



# Stringybark Solar Farm

## Statement of Environmental Effects

Prepared for  
**Stringybark Solar Farm Pty Ltd**

August 2019



## DOCUMENT TRACKING

| Item            | Detail   |
|-----------------|--|
| Project Name    | Stringybark Solar Farm Statement of Environmental Effects                          |
| Project Number  | 19ARM – 13082  |
| Project Manager | Robert Cawley<br>02 8081 2689<br>92 Taylor Street<br>Armidale, NSW 2350            |
| Prepared by     | Robert Cawley, Alex Pursche, Eliza Biggs, Linden Burch, Matt Elsley, Martin Stuart |
| Reviewed by     | Robert Cawley  |
| Approved by     | Robert Cawley  |
| Status          | Final  |
| Version Number  | V3   |
| Last saved on   | 20 August 2019   |
| Cover photos    | Selected images of Stringybark Solar Farm, 14/05/2019 (Matt Elsley)                |

This report should be cited as 'Eco Logical Australia (2019). *Stringybark Solar Farm Statement of Environmental Effects*. Prepared for Stringybark Solar Farm Pty Ltd.'

## ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Stringybark Solar Farm Pty Ltd.

### Disclaimer

*This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Stringybark Solar Farm Pty Ltd. The scope of services was defined in consultation with Stringybark Solar Farm Pty Ltd, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.*

*Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.*

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Introduction .....</b>                     | <b>1</b>  |
| 1.1      | Purpose of this document.....                 | 1         |
| 1.2      | Proposal Overview .....                       | 1         |
| 1.3      | Proposal Setting .....                        | 1         |
| 1.4      | The Proponent.....                            | 2         |
| <b>2</b> | <b>Strategic Justification .....</b>          | <b>4</b>  |
| 2.1      | Climate Change and Renewable Energy .....     | 4         |
| 2.2      | Renewable Energy Commitments and Targets..... | 4         |
| 2.3      | Electricity Generation in NSW .....           | 4         |
| 2.4      | Benefits of the Stringybark Solar Farm .....  | 5         |
| <b>3</b> | <b>Site Selection Process .....</b>           | <b>6</b>  |
| 3.1      | Alternatives considered .....                 | 6         |
| 3.2      | Design Principles .....                       | 7         |
| 3.3      | Site Selection.....                           | 7         |
| 3.4      | Siting and Design Evolution.....              | 8         |
| <b>4</b> | <b>The Proposal .....</b>                     | <b>18</b> |
| 4.1      | Proposal Description .....                    | 18        |
| <b>5</b> | <b>Statutory and Planning Framework.....</b>  | <b>30</b> |
| 5.1      | Permissibility .....                          | 30        |
| 5.2      | Commonwealth Legislation .....                | 30        |
| 5.3      | State Legislation .....                       | 32        |
| 5.4      | Other relevant Policies and Plans .....       | 37        |
| 5.5      | Summary of Licences and Approvals.....        | 39        |
| <b>6</b> | <b>Consultation.....</b>                      | <b>40</b> |
| 6.1      | Consultation Objectives.....                  | 40        |
| 6.2      | Consultation to Date .....                    | 40        |
| <b>7</b> | <b>Environmental Assessment .....</b>         | <b>46</b> |
| 7.1      | Assessment methodology .....                  | 46        |
| 7.2      | Land Use and Soils .....                      | 48        |
| 7.3      | Biodiversity .....                            | 60        |
| 7.4      | Aboriginal Cultural Heritage.....             | 71        |
| 7.5      | Historic Heritage .....                       | 73        |
| 7.6      | Traffic and Transport .....                   | 80        |

|           |  |            |
|-----------|--|------------|
| 7.7       | Visual Impact .....                            | 83         |
| 7.8       | Water .....                                    | 85         |
| 7.9       | Noise.....                                     | 95         |
| 7.10      | Bushfire and Electrical Fire.....              | 100        |
| 7.11      | Electromagnetic Interference.....              | 105        |
| 7.12      | Air Quality .....                              | 108        |
| 7.13      | Waste and resource use.....                    | 111        |
| 7.14      | Socioeconomic Factors .....                    | 115        |
| 7.15      | Cumulative Impacts .....                       | 122        |
| <b>8</b>  | <b>Environmental Management.....</b>           | <b>130</b> |
| 8.1       | Environmental Management Plans .....           | 130        |
| 8.2       | Statement of Commitments .....                 | 130        |
| <b>9</b>  | <b>Project Justification .....</b>             | <b>143</b> |
| 9.1       | Introduction .....                             | 143        |
| 9.2       | Residual environmental risks and impacts ..... | 143        |
| <b>10</b> | <b>Conclusion .....</b>                        | <b>147</b> |
|           | <b>References .....</b>                        | <b>148</b> |
|           | <b>Appendices .....</b>                        | <b>153</b> |

## Appendices

Appendix A: Biodiversity Development Assessment Report (BDAR)

Appendix B: Aboriginal Heritage Due Diligence Assessment

Appendix C: Consultation Letter

Appendix D: Consultation Slides

Appendix E: Landscape and Visual Impact Assessment (LVIA)

Appendix F: Acoustic Assessment

Appendix G: Traffic and Transport Assessment (TTA) including Road Safety Audit



# List of figures

|  |     |
|--|-----|
| Figure 1-1: The location of the Development Envelope and Substation Location Area .....                                  | 3   |
| Figure 3-1: Original Proposed Area .....   | 10  |
| Figure 3-2: The Study Area .....   | 11  |
| Figure 3-3: Initial design presented during early consultations .....  | 11  |
| Figure 3-4: The Site (showing the Development Envelope and Substation Location Area) .....                               | 12  |
| Figure 3-5: Development Envelope.....  | 13  |
| Figure 3-6: Substation Location Area and Site access .....   | 14  |
| Figure 3-7: Known constraints in the wider area .....  | 15  |
| Figure 3-8: Example Array Layout and Design .....  | 17  |
| Figure 4-1: Tracking systems illustrating range of tracker movements and size between systems .....                      | 21  |
| Figure 4-2: Piles for a solar farm in place (image supplied by Infinergy UK) .....                                       | 22  |
| Figure 4-3: Fully assembled tracking array (image courtesy Nextracker Australia, actual tracking system may differ)..... | 22  |
| Figure 4-4: Single inverter container (image courtesy of SMA) .....  | 23  |
| Figure 4-5: Double inverter container (image courtesy of SMA) .....  | 23  |
| Figure 4-6: Typical 11kV cable trench.....   | 25  |
| Figure 4-7: New western landholding access and existing Site access - enlarged .....                                     | 26  |
| Figure 4-8: Typical track cross section.....   | 27  |
| Figure 7-1: Soil landscapes in the Site and surrounds (King, 2009).....  | 51  |
| Figure 7-2: Vegetation communities and BAM vegetation plots .....  | 61  |
| Figure 7-3: Threatened Ecological Communities .....  | 64  |
| Figure 7-4: Heritage search results within a 5 km buffer of the Site .....   | 74  |
| Figure 7-5: Surface water resources within and adjacent to the Site.....   | 86  |
| Figure 7-6: Groundwater resources in proximity of the Site (BoM, 2017; WaterNSW, n.d.).....                              | 88  |
| Figure 7-7: Noise Sensitive Receivers .....  | 96  |
| Figure 7-8: Bushfire Prone Land, Asset Protection Zones and potential emergency exit locations .....                     | 101 |
| Figure 7-9: Location of major and renewable energy projects within 20 km of the Proposal .....                           | 123 |
| Figure 7-10: Nearby projects relative to the local road network.....   | 125 |

# List of tables

|   |     |
|---|-----|
| Table 3-1: Site evolution.....  | 8   |
| Table 4-1: Indicative timeframe for project phases .....  | 20  |
| Table 4-2: Resource requirements and sources for the Proposal .....   | 28  |
| Table 5-1: Impacts on Matters of National Environmental Significance.....   | 31  |
| Table 5-2: Approvals required for the Proposal .....  | 39  |
| Table 6-1: Summary of issues raised through consultation .....  | 42  |
| Table 7-1: Compatibility of the Proposal with the RU1 zone objectives.....  | 49  |
| Table 7-2: Land and soil capability classes within the Site .....   | 50  |
| Table 7-3: Land use conflict risk assessment matrix .....   | 53  |
| Table 7-4: Land use conflict analysis .....   | 53  |
| Table 7-5: Locating the Proposal to avoid and minimise impacts on vegetation and habitat .....                        | 65  |
| Table 7-6: Designing the Proposal to avoid and minimise impacts on vegetation and habitat.....                        | 65  |
| Table 7-7: Direct impacts to native vegetation .....  | 67  |
| Table 7-8: Direct impacts on threatened ecological communities.....   | 67  |
| Table 7-9: Direct impacts on threatened species and threatened species habitat .....                                  | 67  |
| Table 7-10: Change in vegetation integrity .....  | 67  |
| Table 7-11: Measures proposed to mitigate and manage impacts to biodiversity .....                                    | 69  |
| Table 7-12: Heritage search results within 5 km of the Site.....  | 75  |
| Table 7-13: Observed yields and depths of nearby bores .....  | 87  |
| Table 7-14: Likelihood of occurrence of threatened aquatic species .....  | 89  |
| Table 7-15: Average background noise levels for a noise area Category R1 .....  | 95  |
| Table 7-16: Summary of NHMRC's Interim Guidelines on limits of exposure to 50/60 Hz electric and magnetic fields..... | 106 |
| Table 7-17: Potential waste description .....   | 113 |
| Table 7-18: Local workers occupations, all industries (2016 Census) .....   | 117 |
| Table 7-19: Employment Status (2016 Census) .....   | 118 |
| Table 7-20: Total registered businesses by industry (2016 Census).....  | 118 |
| Table 7-21: Nearby major and/or renewable energy projects .....   | 122 |
| Table 7-22: Mitigation measures for cumulative impacts .....  | 129 |
| Table 8-1: Statement of commitments .....   | 131 |
| Table 9-1: Residual environmental risk assessment.....  | 143 |
| Table 9-2: Residual risks for all impacts identified in the environmental assessment .....                            | 144 |

# Abbreviations

| Abbreviation             | Description  |
|--------------------------|--|
| µT                       | Microtesla   |
| AC                       | Alternating Current  |
| ACHA                     | Aboriginal Cultural Heritage Assessment                      |
| AHD                      | Australian Height Datum                                      |
| AHIMS                    | Aboriginal Heritage Information Management System            |
| AHIP                     | Aboriginal Heritage Impact Permit                            |
| Armidale<br>Dumaresq LEP | <i>Armidale Dumaresq Local Environment Plan 2012</i>         |
| BAM                      | Biodiversity Assessment Methodology                          |
| BC Act                   | Biodiversity Conservation Act 2016                           |
| Biosecurity Act          | <i>Biosecurity Act 2015</i>                                  |
| BoM                      | Bureau of Meteorology  |
| BOS                      | Biodiversity Offset Strategy                                 |
| BSAL                     | Biophysical Strategic Agricultural Land                      |
| CCP                      | Community Consultation Plan                                  |
| CCTV                     | closed-circuit television                                    |
| CEEC                     | Critically Endangered Ecological Community                   |
| CEMP                     | Construction Environmental Management Plan                   |
| CIV                      | Capital Investment Value                                     |
| CLM Act                  | <i>Contaminated Land Management Act 1997</i>                 |
| DA                       | Development Application                                      |
| DC                       | Direct Current   |
| DECC                     | Department of Environment and Climate Change                 |
| DMP                      | Decommissioning Management Plan                              |
| DPE                      | Department of Planning and Environment                       |
| EEC                      | Endangered Ecological Community                              |
| ELA                      | Eco Logical Australia Pty Ltd                                |
| EMF                      | Electromagnetic Field  |
| EPA                      | Environmental Protection Agency                              |
| EP&A Act                 | <i>Environmental Planning and Assessment Act 1979</i>        |
| EP&A Regulation          | <i>Environmental Planning and Assessment Regulation 2000</i> |

| Abbreviation   | Description  |
|----------------|--|
| EPBC Act       | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| EPL            | Environment Protection Licence                                       |
| ERP            | Emergency Response Plan  |
| ESD            | Ecologically Sustainable Development                                 |
| FM Act         | <i>Fisheries Management Act 1994</i>                                 |
| GDE            | Groundwater Dependent Ecosystems                                     |
| GWh            | Gigawatt hours   |
| ha             | Hectare  |
| Heritage Act   | <i>Heritage Act 1977</i>   |
| ICNG           | DEEC Interim Construction Noise Guideline                            |
| ISEPP          | <i>Infrastructure State Environmental Planning Policy 2007</i>       |
| JRPP           | Joint Regional Planning Panel  |
| KFH            | Key Fish Habitat   |
| kg             | Kilogram   |
| kV             | Kilovolt   |
| kWh            | Kilowatt hours   |
| LEP            | Local Environment Plan   |
| LGA            | Local Government Area  |
| LLS Act        | Local Land Services Act 2013   |
| mm             | Millimetre   |
| MNES           | Matters of National Environmental Significance                       |
| MW             | Megawatt   |
| NHMRC          | National Health and Medical Research Council                         |
| NPW Act        | <i>National Parks and Wildlife Act 1974</i>                          |
| NSR            | Noise Sensitive Receiver   |
| OEMP           | Operation Environmental Management Plan                              |
| OEH            | Office of Environment and Heritage                                   |
| PCT            | Plant Community Type   |
| POEO Act       | <i>Protection of the Environment Operations Act 1997</i>             |
| Proponent, the | Stringybark Solar Farm Pty Ltd                                       |
| Proposal, the  | Stringybark Solar Farm   |
| PV             | Photovoltaic   |
| RE Act         | <i>Renewable Energy (Electricity) Act 2000</i>                       |

| Abbreviation    | Description   |
|-----------------|---|
| RET             | Renewable Energy Target   |
| RFS             | Rural Fire Service  |
| RMS             | Roads and Maritime Services   |
| Roads Act       | <i>Roads Act 1993</i>   |
| RSD             | Regionally Significant Development                                      |
| RSWMP           | Regional Strategic Weed Management Plans                                |
| RU1             | Primary Production land use zone  |
| RU4             | Primary Production Small Lots land use zone                             |
| Rural Fires Act | <i>Rural Fires Act 1997</i>   |
| SEARs           | Secretary Environmental Assessment Requirements                         |
| SEE             | Statement of Environmental Effects                                      |
| SEPP            | State Environmental Planning Policy                                     |
| SEPP 44         | <i>State Environmental Planning Policy No. 44 (Koala Habitat)</i>       |
| SEPP 55         | <i>State Environmental Planning Policy No. 55 – Remediation of Land</i> |
| SRP             | Spill Response Plan   |
| SSD             | State Significant Development   |
| TEC             | Threatened Ecological Community   |
| TMP             | Traffic Management Plan   |
| TTA             | Traffic and Transport Assessment  |
| WM Act          | <i>Water Management Act</i>   |



# 1 Introduction

## 1.1 Purpose of this document

This Statement of Environmental Effects (SEE) has been prepared on behalf of Stringybark Solar Farm Pty Ltd (the 'Proponent') to support a Development Application (DA) to build and operate a utility-scale photovoltaic (PV) solar farm 14 km east of Armidale, NSW. The solar farm would have a nameplate capacity of no more than 29.9 megawatts (MW), producing enough energy to power the equivalent of 15,000 average NSW households each year (Australian Energy Market Commission, 2018).

The proposed Stringybark Solar Farm ('the Proposal') has an estimated Capital Investment Value (CIV) of more than \$5 million, but less than \$30 million. Under the *State Environmental Planning Policy (State and Regional Development) 2011*, electricity generating works (including solar) that are considered private infrastructure and have a CIV greater than \$5 million, but less than \$30 million, are classified as "Regionally Significant Development" (RSD).

A controlled activity approval under section 91(2) of the *Water Management Act 2000* (WM Act) will be required for cable and vehicular crossings of waterfront land (bed, bank or land within 40 metres (m) of a watercourse). As such, the Proposal is considered to be Integrated Development in accordance with Division 4.8 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This SEE has been prepared to assist the Proponent to gain development approval for the Integrated Development through the Northern Joint Regional Planning Panel (JRPP), with assessment through the Armidale Regional Council.

## 1.2 Proposal Overview

The Proposal will generate electricity through the conversion of solar radiation to electricity using PV panels, laid out across the proposal site in a series of modules, mounted on a single axis tracking system with piled supports. Other infrastructure on site would include electrical invertors, underground electrical cabling, internal access tracks, operational buildings, vehicular access, parking areas, security fencing along with landscape screening.

The Proposal will connect to the national electricity grid via a new substation located offsite, approximately 1.5 km to the north of the Proposal, adjacent to an existing Essential Energy 66 kilovolt (kV) distribution line. An underground cable will connect the Proposal to the proposed Substation.

The Proposal shall likely require permission from Roads and Maritime Services (RMS) under section 138 of the *Roads Act 1993* (Roads Act) for access upgrades at 1060 Waterfall Way and at the intersection of Waterfall Way and Gara Road. Potential impacts associated with these upgrades have been considered during the development of the Proposal and it is anticipated that potential impacts can be mitigated through detailed consultation with the RMS.

A detailed description of the Proposal is provided in Section 3.

## 1.3 Proposal Setting

The Proposal is located in a rural setting approximately 14 km east of Armidale (the Site), within the Armidale Regional Council's Local Government Area (LGA) (Figure 1-1). The Site is accessed from the city of Armidale via Waterfall Way and Gara roads.

The Development Envelope of the Proposal forms part of a greater landholding of 148.5 hectares (ha) that has largely been cleared and sown to improved pastures for grazing livestock (597 Gara Road, Metz - Lot 3 DP 1206469). There are some patches of retained or regenerated woodland that lie along a ridge top which forms the northern boundary of the landholding. The Development Envelope slopes gently in a southerly direction towards Gara Road, which lies along the landholding's southern extent. Two sets of transmission lines transect the area, sited within a cleared easement beneath the northern wooded ridgeline. An onsite residence is located alongside a cluster of mature vegetation just south of the transmission lines. Ephemeral 1<sup>st</sup> and 2<sup>nd</sup> order streams drain the landholding towards Commissioners Waters to the south and Gara River to the east. Farm dams have been constructed to provide water for livestock as there is no permanent water.

The Proposal has been intentionally located in the most disturbed southern section of the landholding, adjacent to Gara Road, where almost all native vegetation has been removed. Other than a few 1<sup>st</sup> and 2<sup>nd</sup> order streams, the site is relatively featureless and as such, is very suitable for solar development.

The Substation has been located offsite on an adjacent landholding (1060 Waterfall Way, Metz - Lot 3 DP786950 and Lot 13 DP822753), which has also been largely cleared for grazing and contains patches of retained and regenerated woodland. The boundary of the landholding extends from Commissioners Waters in the south through to Waterfall Way and is bisected by Gara Road.

The land area associated with the Proposal consists of the approximately 91 ha Development Envelope in conjunction with an additional 2.3 ha accounting for the Substation Location Area and its new access, and the underground connection cable within a 2 m easement (0.4 ha) (Figure 3-4). The Substation is located adjacent to an Essential Energy 66 kV distribution line 1.5 km to the north-west of the Development Envelope. The location of the Substation has been selected in order to minimise potential visual impacts associated with the Proposal (See Section 3.4: Siting and Design Evolution and Section 7.7: Landscape and Visual Impact Assessment) and fine-tuned to minimise impacts to biodiversity and Bush Fire Prone Land.

The Site and adjoining land is zoned "Rural Use 1 – Primary Production" (RU1) and is comprised of previously cleared and improved agricultural land that is currently used for grazing. The land surrounding the Proposal is primarily used for agricultural activities, with associated rural dwellings comprising two involved residences and three non-involved residences within one kilometre of the Site. The new Armidale Landfill is located north of the Development Envelope, however at the time of this assessment, the landfill had not yet been commissioned. The closest non-involved residence is located approximately 368 m from the eastern boundary of the Site and the closest zoned "Rural Use 4 – Primary Production Small Lots" (RU4) land is approximately 700 m south-west from the Site.

## **1.4 The Proponent**

Stringybark Solar Farm Pty Ltd has been set up to develop a solar farm at the Site. The development team (Infinergy Pacific) has over 15 years' experience developing, owning, operating and manufacturing renewable technologies. The company possesses the in-house expertise along with the experience needed to design, develop, build and operate renewable energy schemes. The same team successfully developed the Metz Solar Farm, which also lies in the Armidale Regional Council LGA.

The Proponent believes that solar energy has an important role to play in addressing the combined threats of climate change and decreasing energy security, both of which are identified as key issues facing the electricity sector in Australia. In response to these threats, Australia has committed to reducing emissions by 5% below 2000 levels by 2020 and by 26 to 28% below 2005 levels by 2030 (DEE, 2017). These ambitious targets will require emissions reductions across all sectors of the economy including the electricity sector. The Stringybark Solar Farm will make a measurable contribution towards these targets.

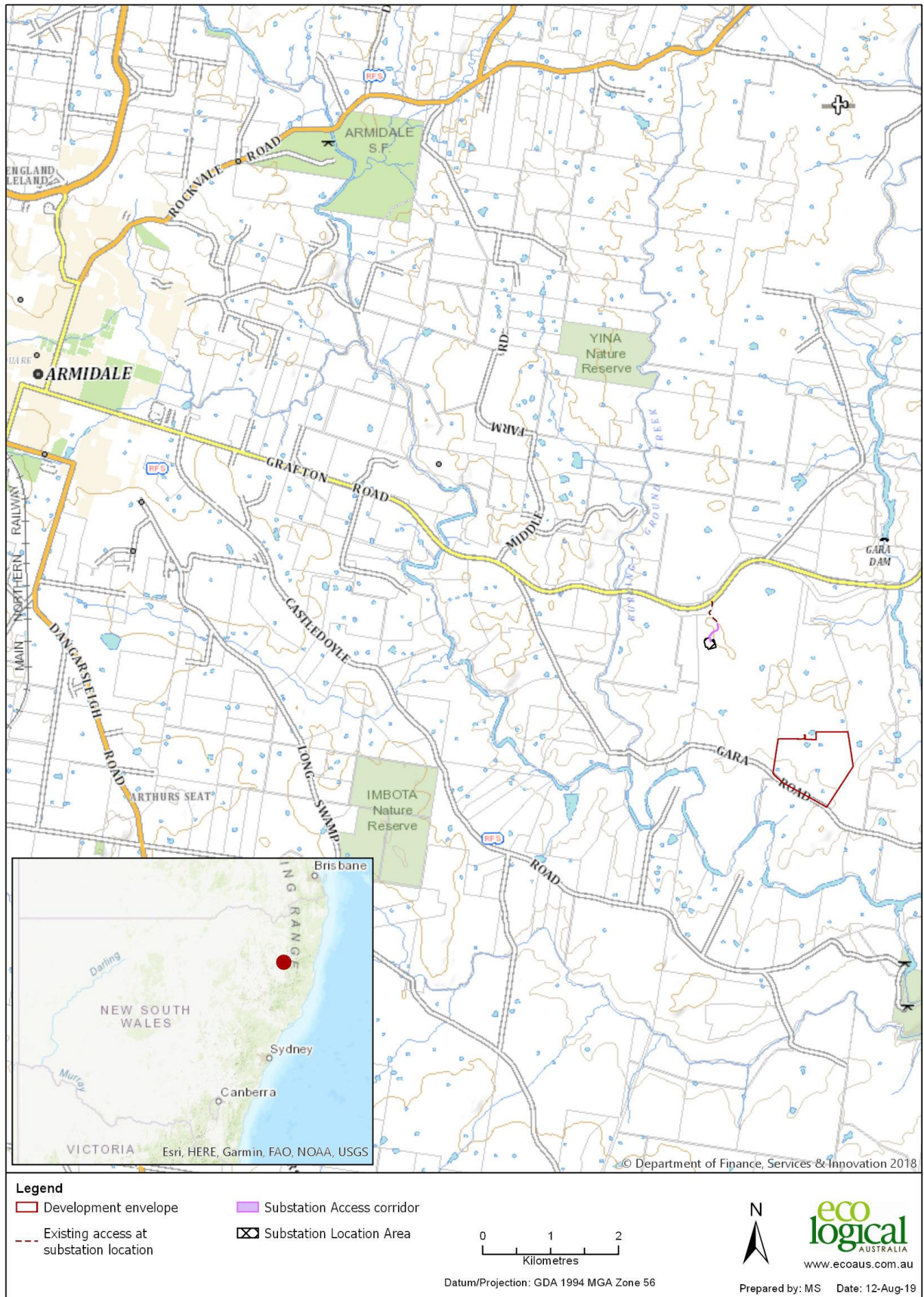


Figure 1-1: The location of the Development Envelope and Substation Location Area

## 2 Strategic Justification

### 2.1 Climate Change and Renewable Energy

There is substantial, scientifically verified, evidence that the Earth's climate is changing in response to both natural and anthropogenic substances and processes (IPCC, 2018). Australia faces significant social, environmental and economic impacts from such climate change, across a number of sectors including water security, agriculture, coastal communities and infrastructure (DEE, n.d.).

A range of responses are required to effectively mitigate climate change. Transitioning to low carbon emission electricity generation technologies, including renewable energy technologies such as solar, is one of the sector transformations required to address climate change (IPCC, 2018).

### 2.2 Renewable Energy Commitments and Targets

Australia is a signatory to a number of international agreements, conventions and protocols regarding climate change and the reduction of greenhouse gas emissions, including the 2015 Paris Agreement to reduce CO<sub>2</sub> emissions to 26 - 28% below 2005 levels by 2030 (DEE, 2017). In addition, NSW has committed to an aspirational target of achieving net-zero emissions by 2050.

Other relevant strategic plans include:

- Australian Large Scale Renewable Energy Target (RET) – renewable energy production target of 33,000 Gigawatt hours (GWh) by 2020 from large scale generators (DEE, 2019);
- NSW Climate Change Policy Framework – to support the National commitments made under the Paris Agreement and to demonstrate positive action in combatting climate change. The Framework outlines the State's long term objectives to achieve net-zero emissions by 2050 and to ensure NSW is more resilient to climate change (NSW OEH, 2016).

Overall, the Proposal is a positive response to Australia's ambitious targets and plans (as summarised above) to increase renewable electricity generation while reducing CO<sub>2</sub> emissions and playing a positive role in the diversification of the energy mix in NSW.

### 2.3 Electricity Generation in NSW

In NSW there is approximately 17,348 MW of generation capacity installed across the State based on a range of energy sources including fossil fuels, such as black coal, natural gas, coal seam methane gas, and to a lesser extent renewable sources including hydro, wind, solar and biomass (AEMO, 2019). Approximately 20.9% of electricity in NSW was generated from renewable sources in 2018. Interconnectors with both Queensland and Victoria provide additional capacity as required.

#### 2.3.1 Demand for products

Access to electricity is essential for the maintenance and improvement of living standards. Demand for clean, renewable energy sources will continue to grow for the foreseeable future as governments and consumers respond to the threat of climate change and act to actively reduce carbon emissions.

## 2.4 Benefits of the Stringybark Solar Farm

The Proposal will increase Australia's renewable energy generating capacity and assist in meeting commitments and obligations under international conventions and agreements to reduce CO<sub>2</sub> emissions.

Fully constructed, the Proposal will generate approximately 64 GWh of clean electricity annually over a 30 year lifespan, enough to supply approximately 15,000 average NSW homes each year (Australian Energy Market Commission, 2018). In addition, the electricity generated by the Proposal would result in significant carbon savings due to the electricity displaced from the current NSW generation supply, which is heavily reliant on coal powered generation. Based on current NSW emission figures of 0.83 kilograms (kg) of CO<sub>2</sub>-equivalent per kilowatt hour (kWh), approximately 53,000 tonnes of CO<sub>2</sub> would be displaced by the Proposal annually (Department of Environment and Energy, 2017).

The Proposal is also aligned with the principles of Ecologically Sustainable Development (ESD), particularly that of inter-generational equity whereby the present generation makes land use decisions, such as the transition of the electricity sector away from a reliance on coal and gas fired power stations to renewable technologies, to ensure the environment is conserved for use by future generations.

The Proposal would also result in significant local social and economic benefits including:

- Direct and indirect employment opportunities during the construction and operation of the solar farm. This would include:
  - Up to 60 jobs during the construction phase, sourcing workers from a wide range of fields and expertise, including engineers, construction workers and labourers;
  - Between 3 and 6 full time jobs during the operational phase; and,
  - Further employment opportunities associated with supply chains and local goods and services.
- Direct business volume benefits for local services, materials and contracting businesses;
- The Proposal will provide income for the region through capital expenditure, the provision of wages and predicted flow-on benefits;
- Diversification of rural income streams; and
- The development preserves the agricultural production values of the Site as there is a commitment to decommission the Proposal at the conclusion of its operational life and return the Site to its current condition, thereby protecting the long term agricultural value of the area.

The environmental benefits of developing renewable energy sources and transitioning to a low carbon future are manifold, providing potential benefits to the entire community and helping to maintain quality of life.



## 3 Site Selection Process

### 3.1 Alternatives considered

#### 3.1.1 Do Nothing Scenario

Under the 'Do Nothing' Scenario the Proposal would not take place, which would negate all potential environmental impacts associated with the Proposal. However, the environmental benefits resulting from the opportunity to generate additional renewable energy and progress towards renewable energy targets and national and international carbon reduction commitments, as well as the local socio economic benefits resulting from the Proposal, would also be forgone.

#### 3.1.2 Alternative Locations

At a regional scale, a multi-criteria site selection process was undertaken to identify the most suitable location for the Proposal. Initial investigations, including consultation with network operators was undertaken. The capacity to export electricity from a development to the National Energy Market is a key factor in selecting a site for large-scale generation in NSW. As such, potential capacity in the transmission and distribution lines in NSW was used as a starting point to identify a suitable site for the Proposal.

The following site selection criteria were considered in the identification of suitable development sites for the Proposal (in no particular order):

- Solar radiation;
- Access to the existing road network;
- Access to the electricity grid;
- Capacity of the local transmission/distribution lines;
- Topography and key landscape features;
- Minimal environmental constraints / impact;
- Existing land uses;
- Access to suppliers and materials;
- Proximity to residential settlement; and
- Landowner support.

The Proponent has reviewed sites within NSW and the local area for the solar farm development and determined that the Proposal location represented a feasible opportunity for PV development. The Site was selected primarily because it is an appropriate site with respect to topography, its proximity to transmission/distribution lines with capacity to export generation, compatible existing land use, and few surrounding environmental receptors.

The site selection process and design optimisation process is fully documented in Section 3.3 and 3.4 and the outcomes of the environmental assessment (Section 7) indicate the suitability of the Site for the Proposal.

The current proposal has been developed through a thorough concept development process aimed at maximising potential benefits while minimising environmental impacts. Alternative land uses would potentially forego this environmentally responsible approach to project development and impact minimisation. Developing an alternative site elsewhere would have similar or greater environmental impacts than the current proposal and would forgo connection to existing capacity within the local electricity network.

### 3.2 Design Principles

The proposed Site was selected due to its suitability for a solar farm and the limited nature of the environmental constraints identified. In designing and assessing the potential impacts of the Proposal, the following design hierarchy was adopted:

- **Avoid** – in the first instance, all efforts have been made to avoid potential environmental impacts;
- **Minimise** – where potential impacts cannot be avoided, design principles seek to minimise environmental impacts, as far as feasibly possible;
- **Mitigate** – mitigation strategies will be identified and implemented to manage the extent and severity of remaining environmental impacts; and
- **Offset** – environmental offsets shall be used only as applicable, following all efforts to first avoid, minimise and mitigate environmental impacts.

In addition, the following specific principles were adopted:

- Minimise vegetation clearing – areas of high conservation value and/or native vegetation have been strategically avoided;
- Protect riparian zones – defined 3<sup>rd</sup> order (Strahler) and higher riparian zones have been excluded from the development area;
- Use previously disturbed land – as much as possible the Proposal has been located on previously cultivated land;
- Protect cultural heritage values – through the identification and evaluation of cultural heritage assets at the site;
- Protect agricultural values – existing agricultural values shall be preserved and a negotiated lease shall offset forgone landholder income while diversifying income streams for the duration of the project life;
- Minimise direct and indirect impacts – as far as possible, infrastructure has been located away from nearby residences; and
- Adopt a flexible approach to design – the final project design responds to identified environmental impacts and constraints.

### 3.3 Site Selection

The Site has been selected based on the site selection criteria outlined in Section 3.1.2 and the design principles outlined in Section 3.2.

The original area considered for the Proposal also incorporated the adjacent landholding at 1060 Waterfall Way, Metz (Figure 3-1). Preliminary investigations at the location revealed:

- A good solar resource;
- Proximity to a range of transmission/distribution infrastructure with potential to connect a development to the national electricity network;
- The area is highly modified and grazed for agricultural purposes reducing the potential for unacceptable environmental effects;
- Suitable topography for solar development; and
- Landowners interested in hosting a solar farm on their land.

Based on these parameters, the Proponent worked on an initial design for a much larger development of approximately 100 MW. The 100 MW development was designed to use most of the two landholdings and the available capacity in one of the two high voltage (132 kV) TransGrid transmission lines that traverse the area.

However, more detailed environmental studies revealed that the location is not suitable for a development at this larger scale, primarily due to the site design principles that seek to avoid or minimise impacts where

possible. Initial topographic and visual assessments indicated that the area was better suited to smaller scale developments that could be contained within local topography while minimising ecological impacts. The results of the initial onsite investigations and the more detailed environmental studies outlined in this SEE have been used to refine the siting and design of the Proposal as described in Section 3.4 below.

### 3.4 Siting and Design Evolution

From the outset, the Proposal has adopted a methodology to, in the first instance, avoid all possible environmental impacts. This design ethic is central to the current proposal and has been adopted at all stages of design. The evolution of the Site is summarised in Table 3-1 below.

**Table 3-1: Site evolution**

| Footprint                     | Area (Ha) | Comments  | Map        |
|-------------------------------|-----------|---|------------|
| <b>Original Proposed Area</b> | 665       | As described in Section 3.3 above, the Proposal was originally part of a greater parcel of land, comprising 597 Gara Road, Metz and 1060 Waterfall Way, Metz, that was initially identified to consider a much larger 100 MW solar farm.  | Figure 3-1 |
| <b>Study Area</b>             | 100       | Preliminary high level constraints analysis, environmental surveys, and technical investigations indicated the Original Proposed Area was not suitable for a 100 MW solar farm as first intended. Rather, a reduced development area within the Original Proposal Area was identified as suitable for a smaller scale solar farm (Study Area).<br><br>The Study Area was limited to the landholding at 597 Gara Road, Metz. The reduced size of the Study Area responds to these early studies which included the identification of areas of continuous native vegetation and Endangered Ecological Communities (EECs), initial visual assessments and the assessment of local transmission infrastructure to identify a suitable connection point for a smaller scale solar farm.  | Figure 3-2 |
| <b>Initial Design</b>         | 87        | As part of the iterative design process, the Proponent identified an unconstrained portion of the Study Area as the initial footprint for the Proposal. This Initial Design was presented to the local community on the 22 <sup>nd</sup> of May, 2019. More detail is provided in Section 6.  | Figure 3-3 |
| <b>The Site</b>               | 94        | The Study Area was further refined to reduce the potential impacts of the Proposal, reflecting findings made during the detailed environmental assessments (outlined in Section 7), design considerations and community consultation.<br><br>Notably, in response to community feedback and the visual assessment, the Development Envelope was modified to decrease the visibility of the Proposal and contain the development within a single vertical band below a tree capped horizon. In addition, strategically located tree lines have been designed to reduce the visibility of the Proposal. The need for new and potentially intrusive overhead power lines has been avoided by burying all electrical cables associated with the Proposal below ground. Further, the Substation to connect the Array Area to the electricity network has been located offsite to screen this infrastructure from neighbouring residences. This iterative design process resulted in the identification of the final extent for the Proposal. | Figure 3-4 |

| Footprint                           | Area (Ha) | Comments  | Map        |
|-------------------------------------|-----------|---|------------|
|                                     |           | <p>The Site represents the final extent of the Proposal; defined by both the area and the maximum vertical dimensions of each of the components (provided in Section 4.1.2). All mitigation strategies, infrastructure, construction and operational activities will be undertaken within the Site.</p> <p>The Site is comprised of the 91 ha Development Envelope, the 2.3 ha Substation Location Area ( including the 0.3 ha new access driveway for the Substation), and the 0.4 ha easement for the underground connection cable options.</p>   |            |
| <b>Underground Connection Cable</b> | 0.4       | The Underground Connection Cable connects the Array Area to the Substation. The cable will be placed within a 2 m easement.   | Figure 3-4 |
| <b>Development Envelope</b>         | 91        | The Development Envelope is defined by the southern area of the Site, in landholding 597 Gara Road, Metz. A solar array of approximately 29.9 MW can be accommodated within this area.  | Figure 3-5 |
| <b>Array Area</b>                   | 81        | <p>The Array Area delineates the extent of the Development Envelope that is suitable for the installation of the PV panels and associated infrastructure (inverters, cables, internal access tracks). All other infrastructure associated with the southern extent of the Proposal will be located outside the Array Area but within the parameters of the Development Envelope.</p> <p>The Array Area along with the potential capacity of the local 66 kV distribution lines to connect the Proposal to the national electricity network have been used to determine the appropriate scale of the Proposal (29.9 MW).</p> | Figure 3-5 |
| <b>Substation Location Area</b>     | 2.3       | <p>The Substation Location Area establishes the area within which the Substation (0.4ha; 45m x 100m) will be located. As substations have very specific requirements for footings and earthing, the Proposal provides for some flexibility within the Substation Location Area to identify the most suitable location for the Substation. The final location will be established post consent, based on final design specifications and detailed onsite geotechnical studies.</p> <p>This area also includes the new access driveway to the Substation.</p>   | Figure 3-6 |

A map of environmental constraints relative to the Proposal is provided as Figure 3-7.

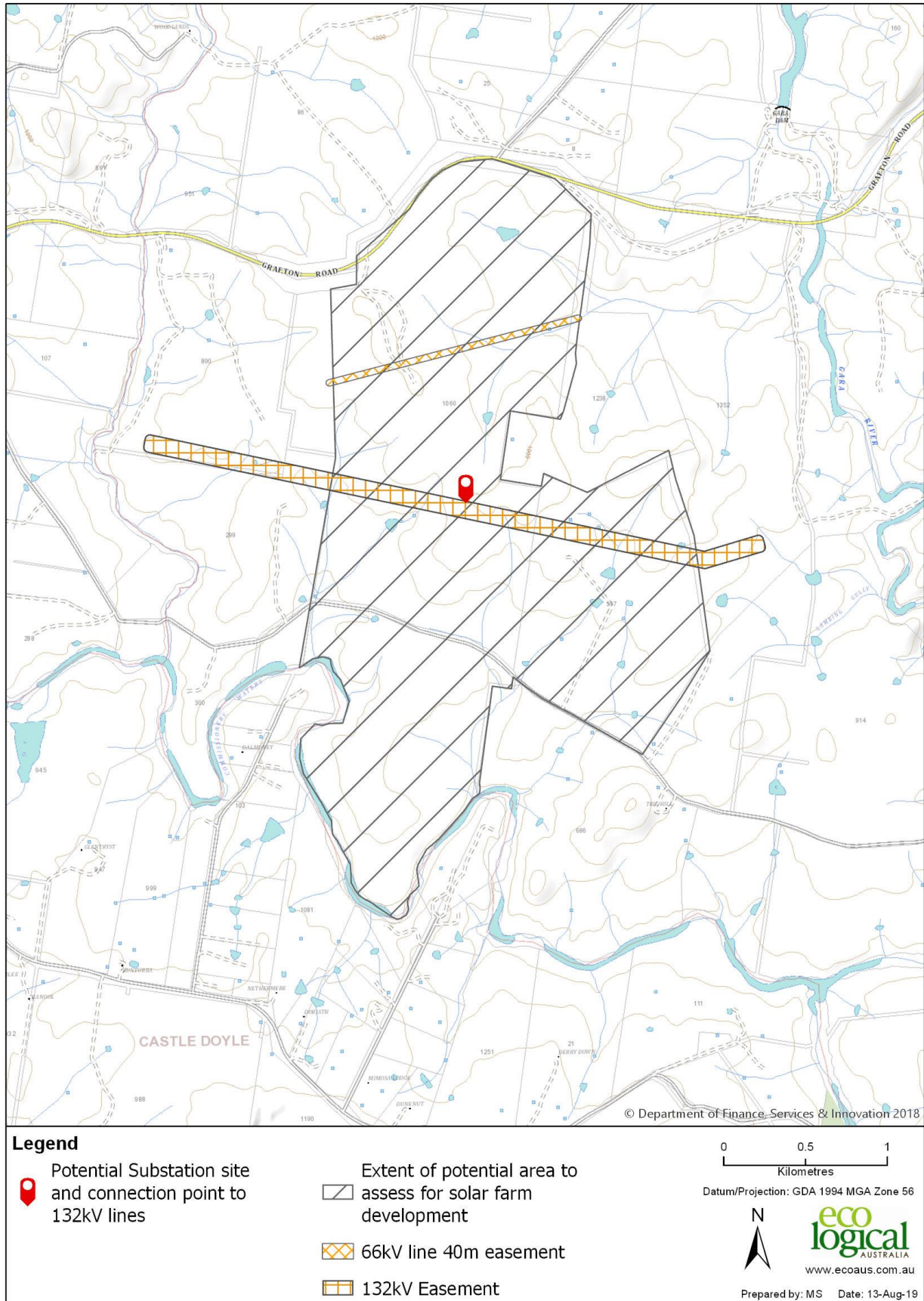


Figure 3-1: Original Proposed Area



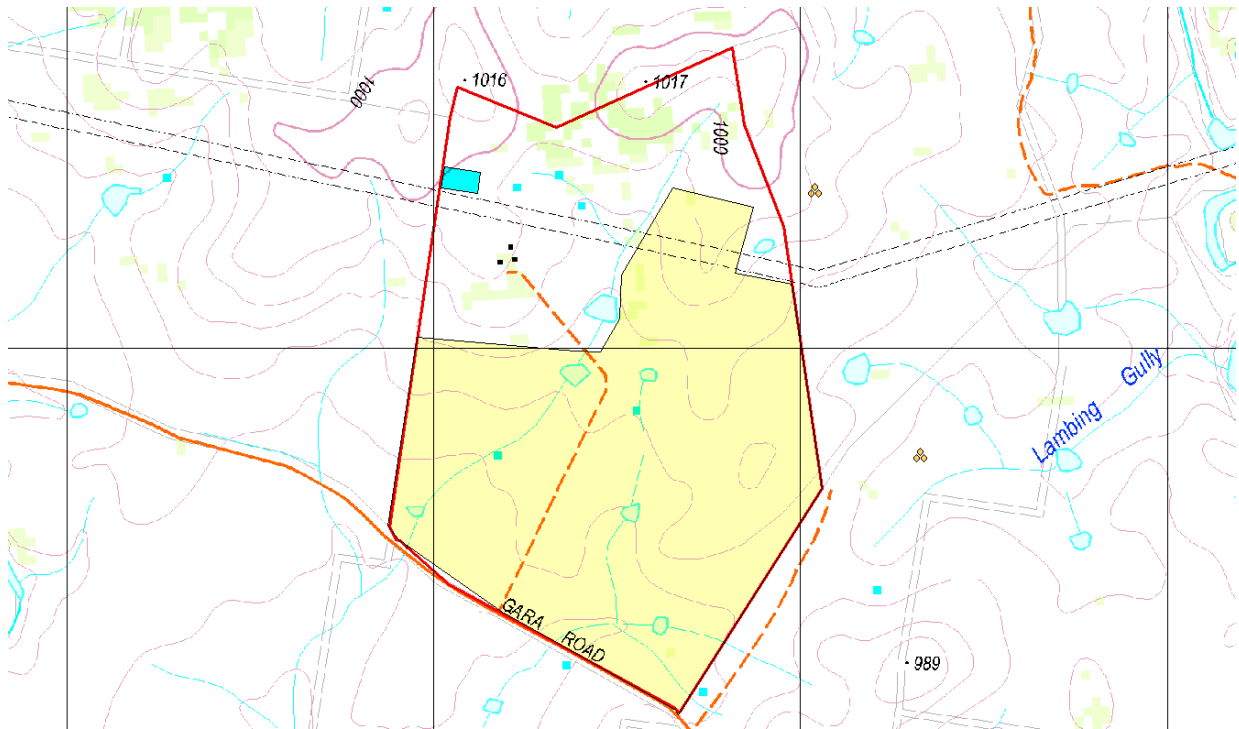


Figure 3-2: The Study Area

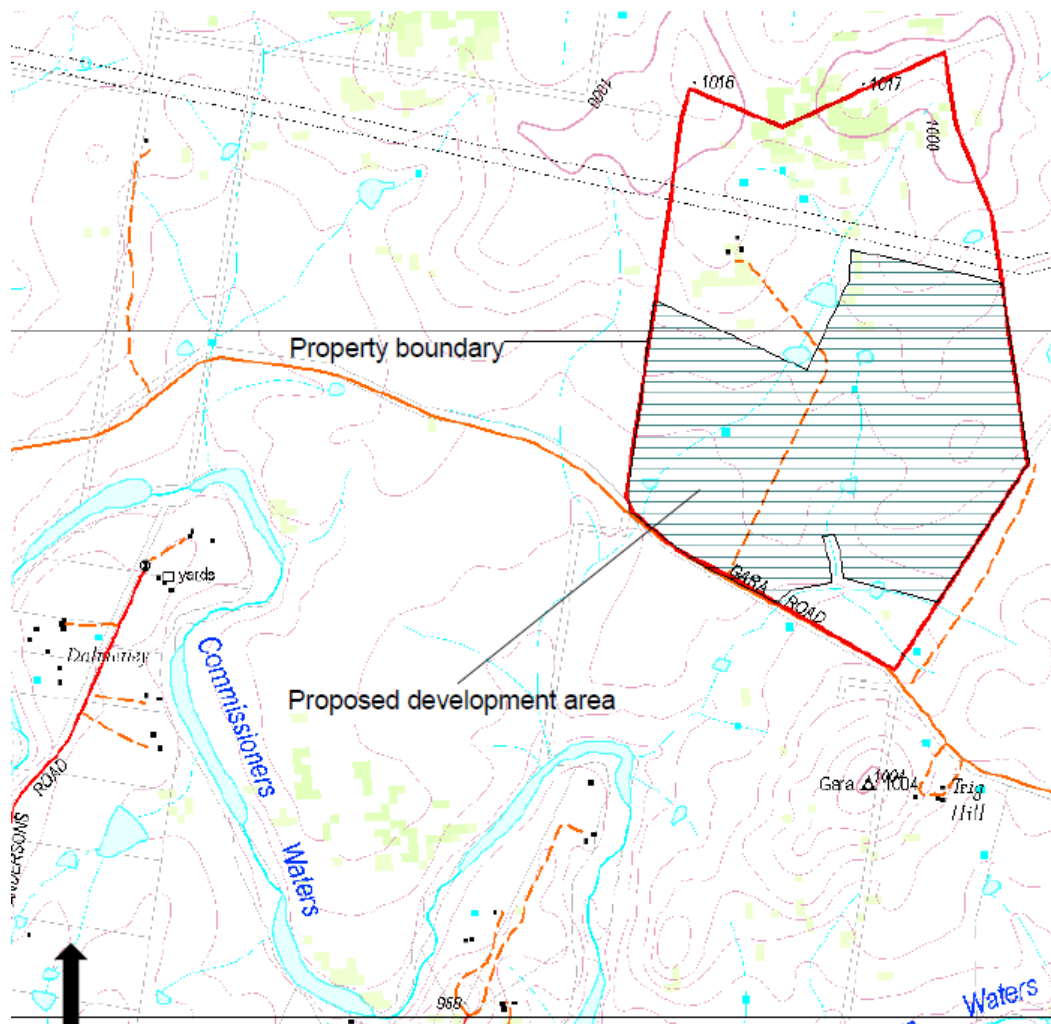


Figure 3-3: Initial design presented during early consultations

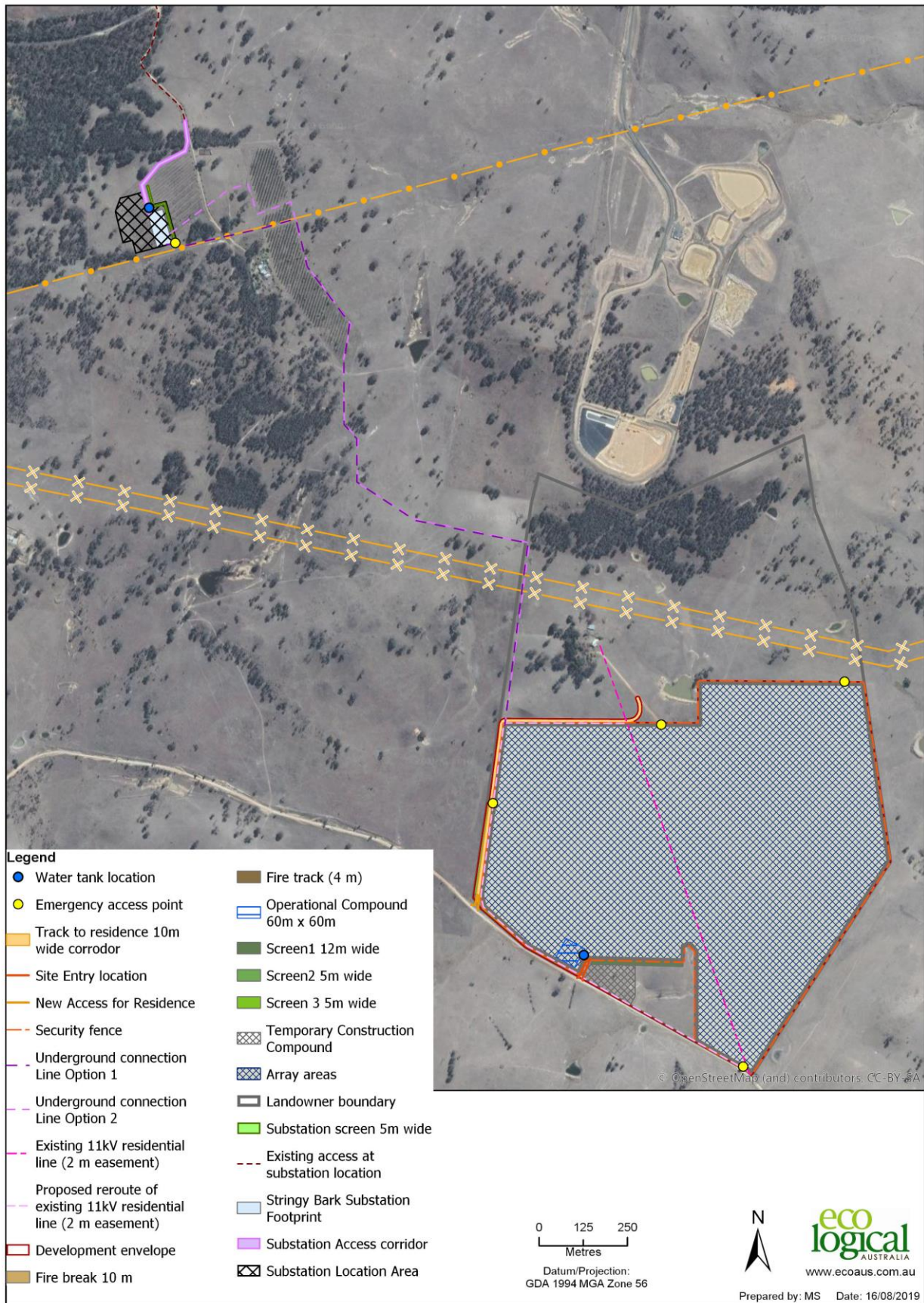


Figure 3-4: The Site (showing the Development Envelope and Substation Location Area)



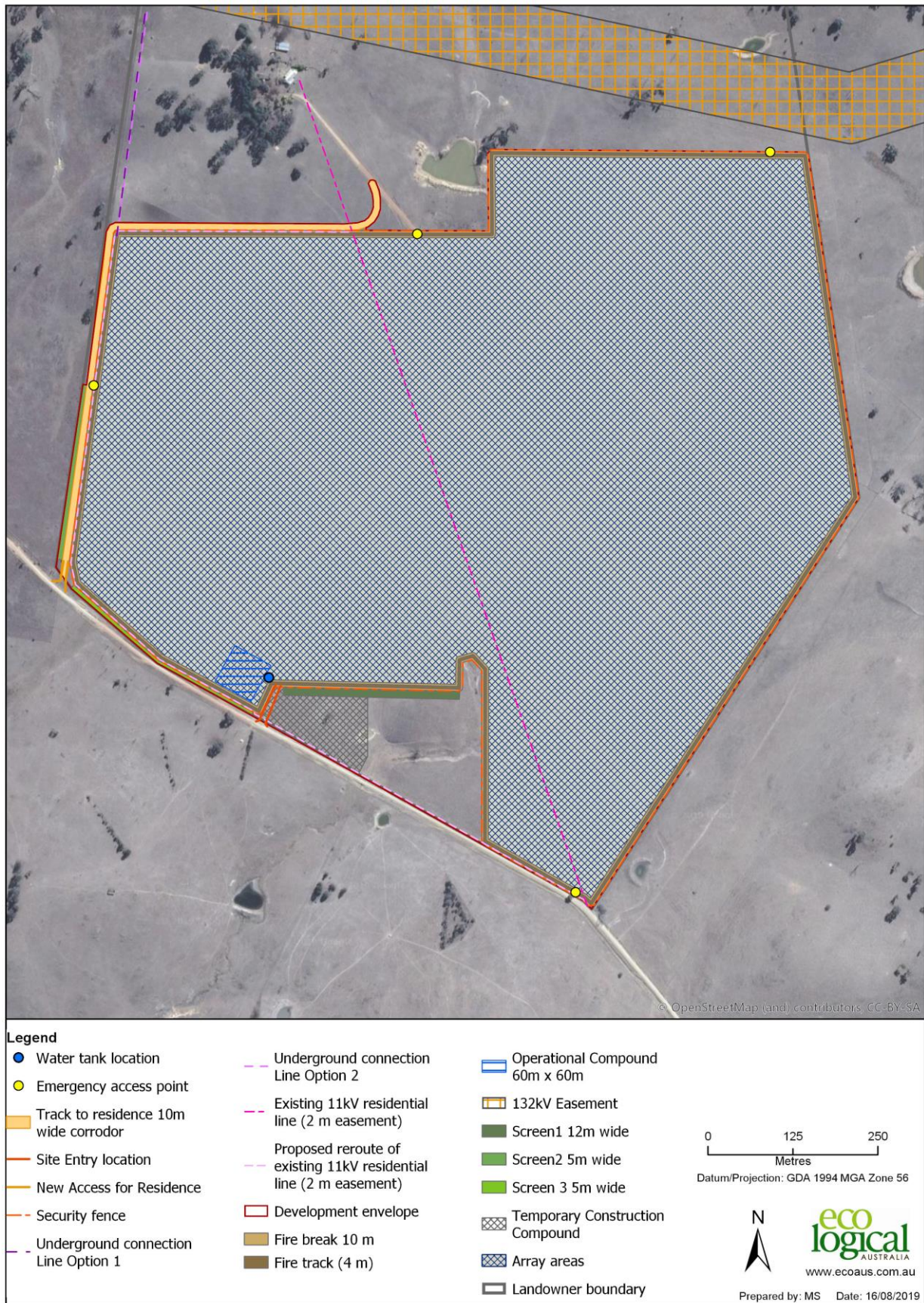


Figure 3-5: Development Envelope



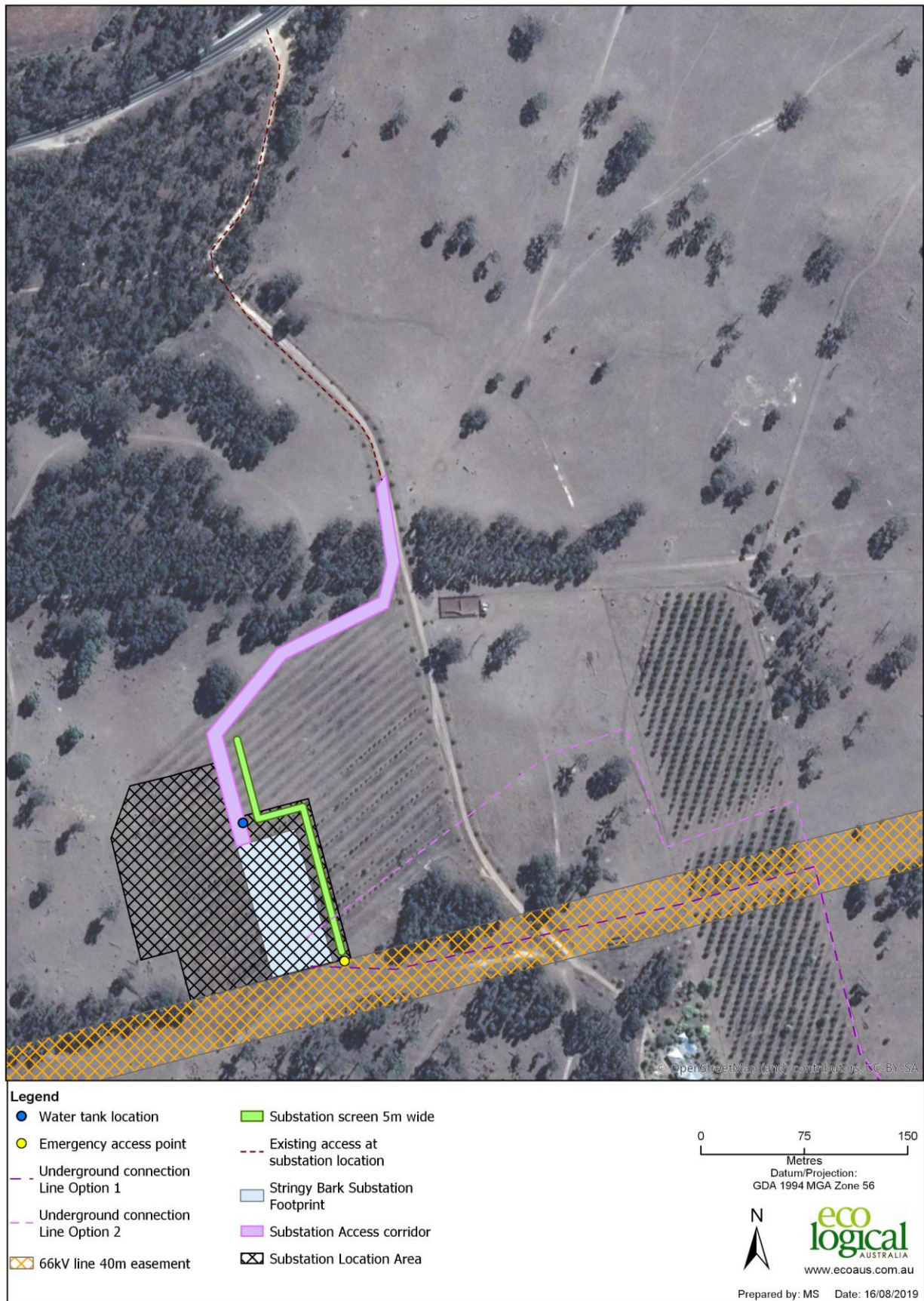


Figure 3-6: Substation Location Area and Site access



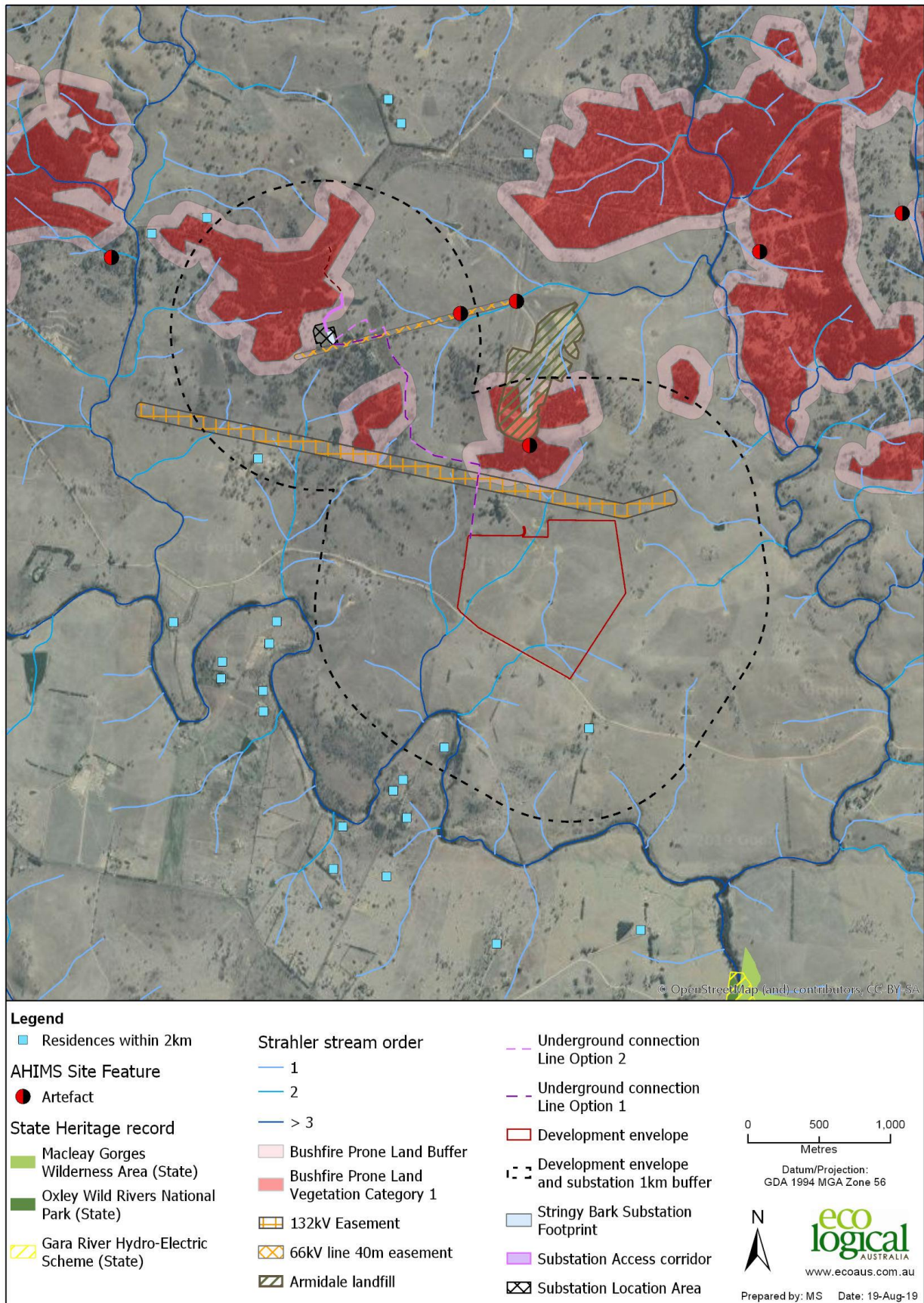


Figure 3-7: Known constraints in the wider area



### 3.4.1 Network Connection

Consultation with the network operator Essential Energy has confirmed that there is an opportunity to connect the Proposal (29.9 MW) to its existing 66 kV distribution network which is located approximately 1.5 km north of the Development Envelope as illustrated in Figure 3-4. As such, the Proponent has negotiated the necessary land rights to locate a Substation offsite adjacent to the Essential Energy line, to bury an underground cable to connect the Proposal to the Substation, and to construct a new internal track to provide access to the Substation via an existing access point at 1060 Waterfall Way (Figure 3-6). The Proponent is currently negotiating a network connection with Essential Energy.

### 3.4.2 Example Array Layout

An Example Array Layout is shown in Figure 3-8. The Example Array Layout provides an illustration of how the PV panels, inverters and internal access tracks could be laid out across the Site. Note, this is **not** a final design for the Array Area. It is provided for illustrative purposes only.

### 3.4.3 Final Design

The Final Design of the solar farm will occur post consent. This is primarily due to the fast moving and dynamic nature of the PV market which the Proponent would like to take advantage of to ensure that the most suitable technology can be utilised at the site to maximise the benefits of the Proposal. However, it should be noted that Final Design would not exceed the environmental or technical parameters as described in this SEE and defined by the Site (Figure 3-4).

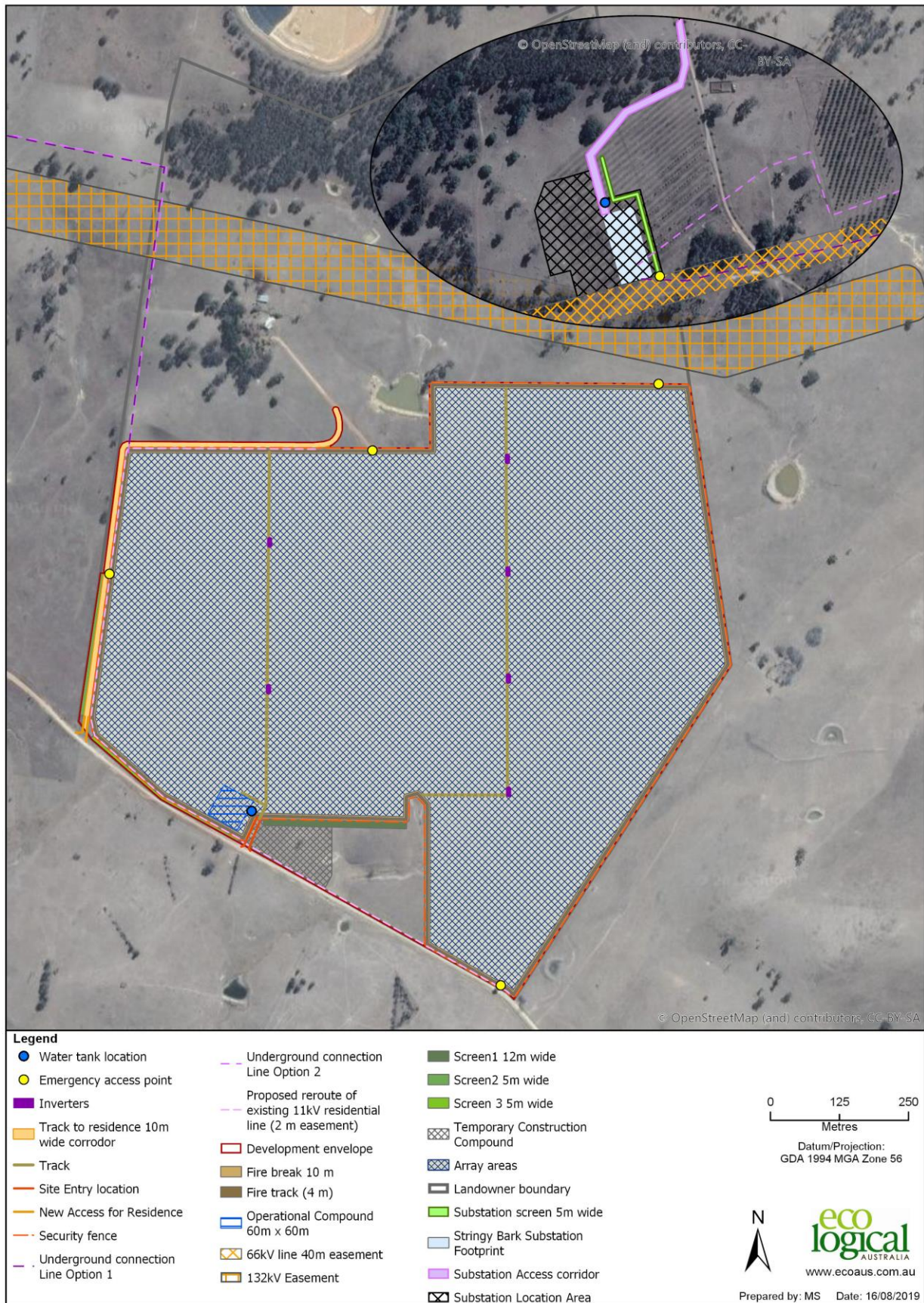


Figure 3-8: Example Array Layout and Design

## 4 The Proposal

### 4.1 Proposal Description

#### 4.1.1 Site Description

The Development Envelope is currently productive agricultural land, but is not mapped as Biophysical Strategic Agricultural Land (BSAL). Neither is the Development Envelope mapped as either Bushfire Prone Land, nor Flood Prone Land.

The entirety of the Development Envelope has been cleared for grazing and sown to improved pastures. There are no remaining paddock trees within the Development Envelope however, there are patches of retained native woodland within the broader boundary of the landholding. The Development Envelope is situated on the side of a tree capped ridge, sloping gently south-east towards Commissioners Waters, which forms a major feature in the local landscape.

The Substation Location Area is located on cleared land on the opposite side of the ridge adjacent to a small olive grove and a 66 kV Essential Energy distribution line, approximately 0.5 km south of Waterfall Way. The Substation Location Area will be accessed from Waterfall Way via an existing access point at 1060 Waterfall Way. The location of the underground cable to connect the Development Envelope to the Substation has been sited to minimise potential environmental impacts identified during the environmental assessment (Section 7). The cable route is shown on Figure 3-4, and is located within highly disturbed land used for grazing sheep and cattle.

The Substation Location Area and the associated underground cable are located on productive agricultural land, but it is not mapped as BSAL or Flood Prone Land.

#### 4.1.2 Key Components of the Proposal

The Proposal involves the installation of a solar farm with a nameplate capacity of 29.9 MW. The Proposal includes the following elements:

Development Envelope (Figure 3-5)

- PV panels located within the Array Area mounted on a single axis tracking system with a maximum height of 4 m above natural ground at maximum tilt;
- Approximately 12 inverters (up to 3 m high) located within the Array Area at least 50 m from any external boundary;
- On or below ground cabling connecting the PV panels to and between inverters;
- Operations compound (area 60 m x 60 m), including buildings with a maximum height of 5 m and car parking for up to eight (8) vehicles;
- A fire track 4 m wide, located within a 10 m defendable firebreak area around the perimeter of the Development Envelope;
- A dedicated water tank for firefighting (4 m high);
- Four (4) emergency access points, the main Gara Road access and a landholder access;
- A perimeter security fence up to 2.5 m high;
- Three (3) vegetation landscape screens, one 12 m wide and two 5 m wide (maintained to be at least 4 m high); and
- Internal access tracks within the Array Area (4 m wide).

Underground Connection Cable (Figure 3-4)

- Underground cabling to connect the development to the Substation set within a 2 m easement.

## Substation (Figure 3-6)

- Substation up to 8 m high connecting the Proposal to the national electricity grid (area 45 m x 100 m);
- A perimeter security fence up to 2.5 m high enclosing the Substation;
- A 10 m defendable firebreak area around the perimeter of the Substation;
- A dedicated water tank for firefighting (4 m high);
- Access from Waterfall Way and one (1) emergency access point at the Substation; and
- One (1) vegetation landscape screen at the substation, 10 m wide (maintained to be at least 4 m high).

In addition to the key components outlined above, there will be a temporary construction compound required to facilitate the construction and decommissioning phases of the Proposal. The construction compound would include:

- Temporary construction offices (up to 5 m high);
- Car and bus parking areas;
- Staff amenity block including portable toilets, showers and a kitchen, designed for peak staff numbers during the construction period; and
- Laydown areas.

Once the development is operational, the construction compound will be decommissioned and restored to its current condition.

The location of the elements of the Proposal listed above are shown in Figure 3-4, Figure 3-5 and Figure 3-6. However, it should be noted that the exact location of the individual solar panel rows, the inverters, associated cabling and the internal access tracks within the Array Area will not be finalised until a post-consent detailed design and tendering process has been conducted. This allows the Proponent to ensure that the most suitable technology can be utilised at the Site.

The reasons for this are threefold:

- The market for solar panels is dynamic with technology changing quickly and it is the intention of the Proponent to take advantage of any advances to ensure that the benefits of the Proposal are maximised;
- While the topography of the site has been assessed as suitable for solar development, detailed geotechnical studies will be required to determine the most suitable location for each of the solar farm components within the Array Area; and
- Essential Energy who own the distribution line into which the Proposal will connect can only provide an estimate in relation to the scale of development that could be accommodated on the line at this stage in the development cycle. Note, the solar farm will not exceed a nameplate capacity of 29.9 MW.

These aspects cannot be resolved until after consent when detailed procurement studies are conducted and grid connection studies are completed. As such, the Proponent has identified a Development Envelope (defined by both area in hectares and maximum dimensions), within which all components of the Array Area will be accommodated. This application has been designed to assess the entire potential Development Envelope which provides a degree of flexibility in which the final design can be optimised to utilise best in class technology, while ensuring that environmental effects are acceptable. By adopting this approach, the assessment represents a worst case scenario in line with environmental assessment principles and reduces the likelihood of needing to seek modification approvals for minor layout changes to the Array Area.

### 4.1.3 Scale of Development

The final scale of the Proposal will not exceed a nameplate capacity of 29.9 MW, and will depend on a combination of the most suitable technology at the time of procurement, results of detailed geotechnical investigations at the Site and grid connection studies. A solar farm of this scale would result in an output of approximately 64 GWh based on the solar resource at the Site.

### 4.1.4 Indicative Timeline

An indicative timeline for the Proposal is provided in Table 4-1 below. It is estimated that the Proposal would take approximately 9 months to construct and would be operational for approximately 28 years. Following the operational period, all above ground infrastructure would be removed from site which would take approximately 6 months. As such, planning consent for the Proposal is sought for 30 years.

**Table 4-1: Indicative timeframe for project phases**

| Phase           | Indicative Start | Indicative Period |
|-----------------|------------------|-------------------|
| Construction    | 2020             | 9 months          |
| Operation       | 2021             | ~28 years         |
| Decommissioning | 2049 / 2050      | 6 months          |

### 4.1.5 Description of the Key Components of the Solar Farm

#### **Array area**

The Array Area is shown on Figure 3-5. It refers to the area of the Development Envelope within which the PV panels will be located, along with the necessary infrastructure to support them; namely the single axis tracking system, inverters, internal track network, and connecting underground cabling. These components and other supporting infrastructure are described in detail below.

#### **Solar panels**

The solar farm will utilise approximately 115,000 individual PV panels. The typical dimensions of a PV panel is approximately 2 m by 1 m. Although they all share a characteristic look, they do differ in both absolute size and output (measured in Watts). These differences are driven by the rapid and continual development in the efficiency of solar panels, which means that the final number of panels required for the Proposal can only be determined post consent during the final design process. Regardless of the size of the individual solar panels selected, when attached to a tracking system, the maximum tilt height above natural ground would not exceed 4 m, as described in the next section.

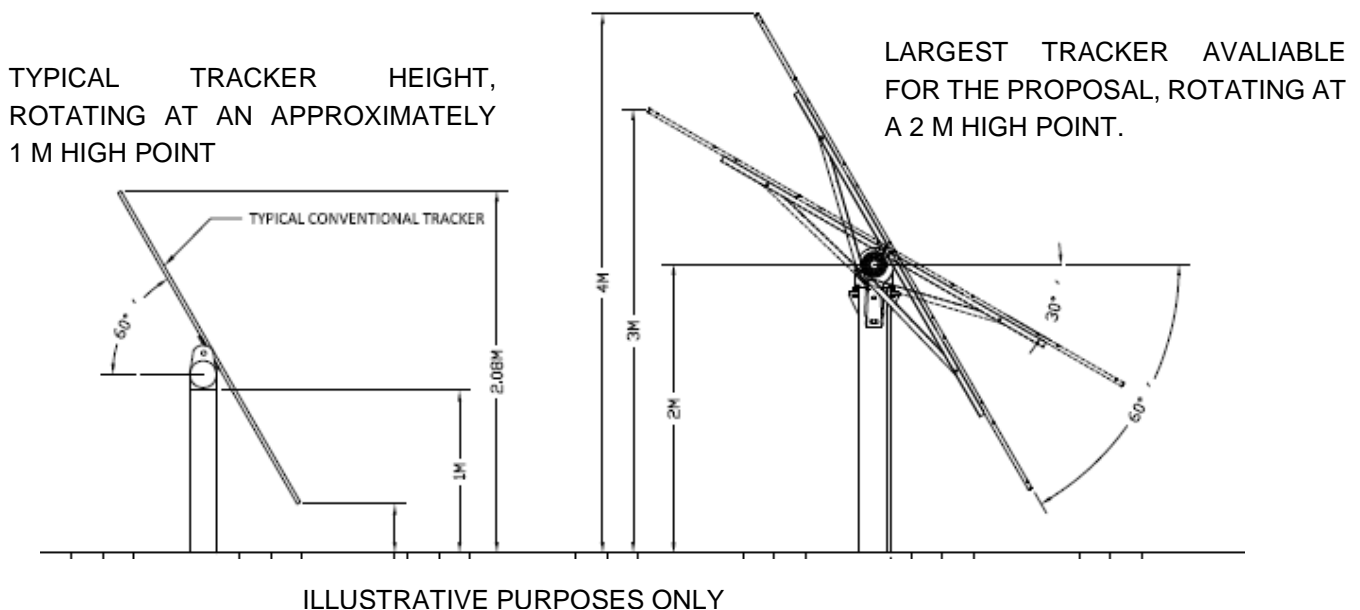
#### **Single Axis tracking system**

The solar panels will be fitted to a single-axis tracking system made up of individual tracking units collectively forming a 'tracking system'. The tracking system allows the PV panels to track the sun as it moves from east to west throughout the day. The tracking system is installed in rows orientated in a north south direction. The tracking system tracks the panels from 60 degrees towards the east in the morning, to face straight upwards at midday (0 degrees) and finally to face 60 degrees towards the west in the afternoon. While there are a number of tracking systems currently available in Australia, the largest system has a maximum height of 4 m when tilted at its maximum angle of 60 degrees. As such, this SEE has used this tracking system to establish the maximum development height of the PV panels installed

on trackers for the Proposal. Note, for the majority of the day, as explained above the PV panels will be below the maximum tilt height of 4 m.

The minimum spacing between each of the rows of trackers would be 5.5 m, this enables vehicles to access the rows for maintenance and the management of vegetation across the Array Area.

Figure 4-1 below illustrates two potential tracking systems (in profile) that could be used for the Proposal. The larger system illustrates the maximum 4 m tilt height that has established the maximum development height for the tracking system and PV panels. Note, this tracking system has been used in the visual impact assessment so the potential maximum visual effect of the Proposal has been assessed.



**Figure 4-1: Tracking systems illustrating range of tracker movements and size between systems**

The tracking system will be supported by piles which would be mechanically driven or screwed into the ground. Figure 4-2 below shows an example of a solar farm during construction. Depending on the tracking system deployed, piles are typically spaced between 5 m to 10 m apart. Figure 4-3 illustrates an operational solar farm utilising a single axis tracking system.

Solar panels are wired together in 'strings' that are connected to inverters positioned throughout the Proposal. Each inverter is approximately 2.5 MW. The inverters will connect to an offsite Substation through an underground 11 kV cable (the cable route is illustrated in Figure 3-4).





**Figure 4-2: Piles for a solar farm in place (image supplied by Infinergy UK)**



**Figure 4-3: Fully assembled tracking array (image courtesy Nextracker Australia, actual tracking system may differ)**

### **Inverters**

PV panels produce Direct Current (DC) electricity which would be converted to Alternating Current (AC) at approximately 12 inverters. The inverters would be approximately 2.5 MW each. Inverters are housed in containers, or located on platforms, either singularly the size of a 20 ft container, measuring approximately 6.1 m (l) x 2.9 m (h) x 2.5 m (w), or in pairs the size of a 40 ft container measuring approximately 12.2 m (l) x 2.9 m (h) x 2.5 m (w). Each inverter would include:

- An 11 kV Medium Voltage transformer;
- Circuit breakers; and
- Communication equipment.

Inverters would be transported to site readymade and either attached to steel or concrete pilings approximately 1.6 m deep depending on ground conditions. The inverters will be located within the Array Area (at least 50 m from the site boundary), and the internal track network will provide access to each inverter location. Figure 4-4 and Figure 4-5 below illustrate a single inverter and a double inverter, respectively.



**Figure 4-4: Single inverter container (image courtesy of SMA)**



**Figure 4-5: Double inverter container (image courtesy of SMA)**



**Substation Location Area**

The offsite Substation would be the point of connection to the existing Essential Energy 66 kV distribution line that runs in an east-west direction approximately 1.5 km to the north of the Development Envelope as detailed in Figure 3-4. The final design specifications of the Substation are subject to agreement with Essential Energy but would contain the following components:

- One 66 kV transformer;
- High Voltage circuit breakers and switch gear;
- Metering equipment;
- Control room;
- Storage shed;
- Low Voltage power connection;
- Overhead cables connecting the Substation to the existing 66 kV line that runs through the Site;
- Parking space for service vehicles;
- Fire break 10 m wide;
- A dedicated water tank for firefighting (4 m high);
- One emergency access point in addition to the main Waterfall Way access;
- Perimeter fencing; and
- Landscape screening along its eastern edge.

The Substation infrastructure as described above will be built within a 100 m x 45 m area within the Substation Location Area, and as close as possible to the existing 66 kV distribution line, as illustrated in Figure 3-6. Component heights will not exceed 8 m. The Substation will be connected to the 66 kV line via an overhead power line.

**Operations Compound**

The operations compound will be located adjacent to the southern Site entrance within an area approximately 60 m by 60 m (illustrated in Figure 4-7). The operational compound would include the following:

- An office and maintenance building, consisting of an office, toilets, showers, staff room and kitchen;
- A storage building/shed;
- A chemical storage shed;
- Parking;
- Water storage;
- A septic tank; and
- A workshop.

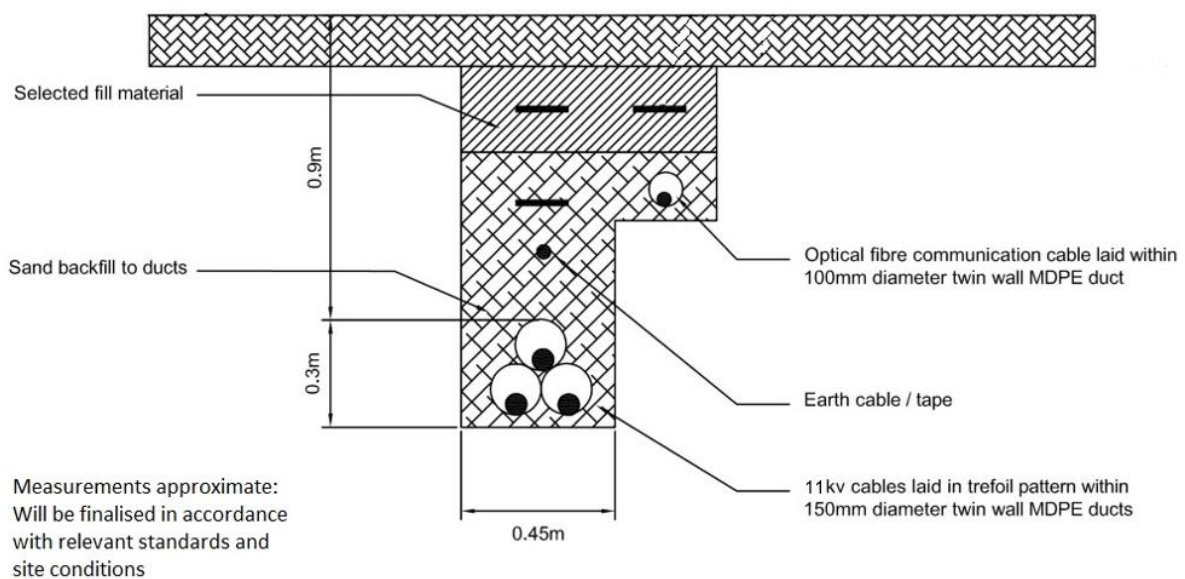
Onsite buildings will comply with all relevant Australian building standards and regulations. They will be designed to accommodate the maximum number of staff that will be required during the operational life of the Proposal (3 – 6 staff). Water for the support buildings will be supplied to site by commercial contactors and stored in an onsite water tank. In addition, there will be a water tank solely for the purposes of fire protection.

### Cables and cable trenching

All cable trenches will be designed based on site conditions in accordance with relevant Australian standards. Subject to final design, cable trenches will contain:

- Below ground warning tapes;
- Below ground Polymeric cover strips;
- Electrical cables to export power;
- Electrical supply cables where necessary;
- Earthing cable;
- Communications and offsite control links; and
- Above ground warning signs.

Where possible, trenches will be located alongside/underneath internal access tracks to minimise ground disturbance (Figure 4-6).



**Figure 4-6: Typical 11kV cable trench**

### Site Access

The Proposal Site will be accessed directly from Gara Road using an existing site access as illustrated in Figure 4-7. Gara Road is an unsealed local road that runs along the southern boundary of the Site.

A new access point for the wider landholding will be constructed west of the existing access point on the western boundary of the landholding (as illustrated in Figure 4-7). This new access point will provide access to the farmhouse and the land at the rear of the landholding.

To ensure safety and security at the Development Envelope, a perimeter fence up to 2.5 m will be installed. In addition to the main entrance, there will be four emergency access points along the permitter fence (Figure 3-5). Once operational, all access points will be gated. Within the Site there will be a closed-circuit television (CCTV) security system to monitor access at the Site.

The Substation Location Area will be accessed from Waterfall Way via an existing access point at 1060 Waterfall Way (Figure 3-6). To ensure safety and security at the Substation Location Area, a perimeter fence up to 2.5 m will be installed with one emergency access point, along with a CCTV security system to monitor access at the Site.



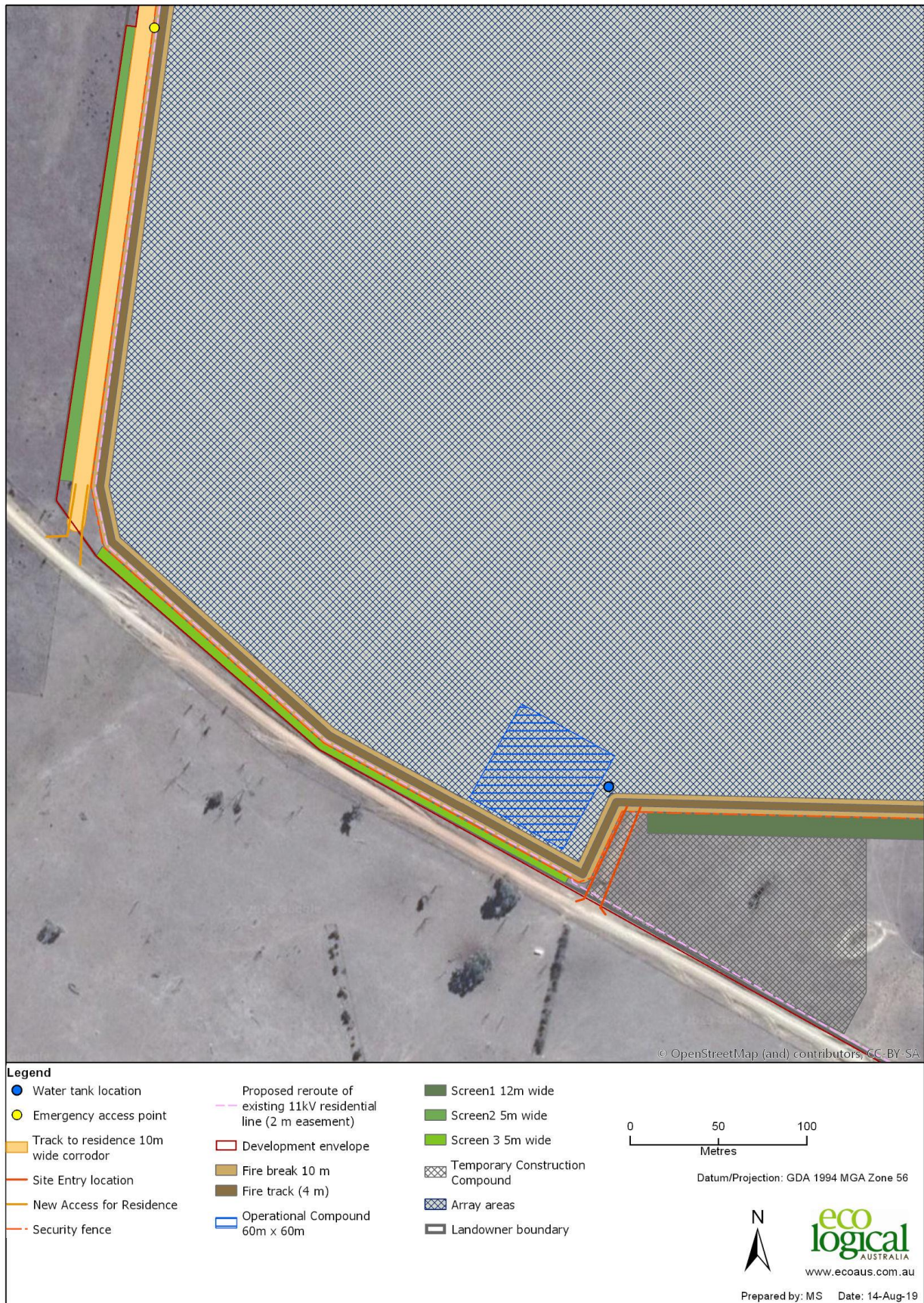


Figure 4-7: New western landholding access and existing Site access - enlarged



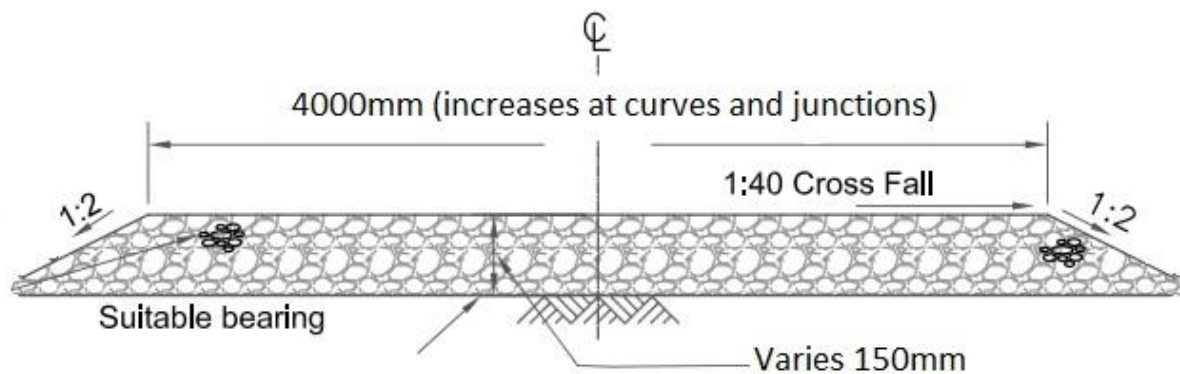
### Internal Tracks

Internal tracks will be constructed of compacted gravel to an approximate depth of 150 millimetres (mm) depending on soil conditions. Internal access tracks will be up to 4 m wide with wider stretches created for passing, parking, and access around corners. The internal access network will consist of a perimeter fire track located within a 10 m firebreak along with a network of tracks within the Array Area that will provide access to the PV panels, inverters and the operations compound. The Example Array Layout (Figure 3-8) provides an example of an internal track layout for the Proposal.

Culverts will be construed if the internal tracks cross any first or second order streams that are located within the Site. The culverts will be designed in line with the following guidance:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2004); and
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).

Figure 4-8 depicts the design of a typical internal track.



**Figure 4-8: Typical track cross section**

### Vegetation Screens

As illustrated in Figure 4-7, there will be three (3) vegetation screens located across the southern and western perimeters of the Development Envelope. The vegetation screens have been designed to help screen the Proposal from nearby residences, and local road users along Gara Road (Section 7.7).

There will also be a vegetation screen along the western edge of the Substation Location Area, mainly to ensure that views of the Substation are completely screened from the onsite residence (Figure 3-6).

To ensure the success of the landscape screens, the Proponent will commit to protocols to maximise the growth of the plantings (Section 7.7.4).

### Firebreak

A 10 m firebreak will be installed around the Array Area inside the perimeter security fence and around the Substation inside the perimeter security fence. The firebreaks will be ploughed, mown or grazed, and maintained in accordance with the relevant NSW Rural Fire Service (RFS) standards. The firebreak is to ensure, as far as possible, that a fire that originates within the Site does not escape offsite or conversely the firebreak should reduce the potential of a fire that originates offsite encroaching onto the Site. Fire protection is discussed in more detail in Section 7.10.

#### 4.1.6 Construction Phase

##### **Primary Construction Activities**

The primary construction activities would be as follows, although, the particular order may change:

- Mobilisation; establishment of temporary construction compound and laydown areas;
- Planting of the vegetation screens;
- Construction of internal tracks and culverts;
- Construction of the perimeter fence and the establishment of the firebreak area;
- Establishment of the Substation and support buildings;
- Preparation of the Array Area;
- Installation of piles and the tracking system;
- Securing panels to the tracking system;
- Installation and connection of inverters;
- Trench digging, cable laying;
- Grid connection;
- Removal of temporary construction compound and facilities;
- Rehabilitation of disturbed areas of the site; and
- Solar Farm Commissioning.

Overall solar developments have a low environmental impact. Ground disturbance is low, and will be principally associated with the installation of piles to support the panels (see Figure 4-2). Other components that would impact directly on the site include access tracks, localised areas of cut and fill, underground cables, the Substation and operational buildings, the temporary construction compound and the perimeter fence (Figure 3-4).

##### **Construction hours**

It is anticipated that the Proposal would take approximately 9 months to construct. Construction work will be undertaken within standard construction hours:

- Monday to Friday, 7am to 6pm; and
- Saturday, 8am to 1pm.

Any construction activities outside these hours would only be undertaken with the permission of relevant authorities and the notification of neighbours.

##### **Construction resource requirements**

Resource requirements and their likely sources are shown in Table 4-2 below. As far as possible local resources will be used for the construction of the Proposal.

**Table 4-2: Resource requirements and sources for the Proposal**

| Resource                | Detail   | Likely Source  |
|-------------------------|--|--|
| Plant and Machinery     | Pile drivers, mobile crane, diesel generators, earth moving and concreting equipment for Substation and support buildings. | Wider NSW for larger equipment; local where possible.  |
| Materials and equipment | Steel, gravel, sand, trees for landscaping, cables, solar panels, inverters, transformers.                                 | Gravel, sand, and landscaping equipment will be sourced locally; some materials and equipment, like solar panels inverters and transformers are manufactured overseas. |
| Labour                  | Variety of positions required depending on construction activity.  | National and local contracting staff.  |
| Accommodation           | Accommodation for workers.   | Armidale and perhaps Guyra and Uralla.   |

#### **4.1.7 Operational Activities**

The operational period is expected to begin in 2021. Operational activities include:

- Monitoring of solar production – analysis of data;
- Export of solar energy to the National Electricity Grid;
- Maintenance of all plant and equipment – visual inspections and/or engineering work as required, analysis of data; replacement of equipment as required;
- Security – remotely and through routine site inspections;
- Vegetation monitoring and management – routine vegetation management and monitoring in panel areas (small live stock may be permitted to graze within panel areas, for example sheep) and within the landscape screens; and
- Erosion monitoring – routine monitoring for scarring beneath the panels and along access tracks and waterways (Section 7.2 and 7.8).

During the operational period there would be approximately 3 to 6 full time staff who may routinely visit the solar farm to carry out activities as listed above. Travel would be in standard 4x4 vehicles. Should there be a requirement for major maintenance work larger trucks and equipment may need to be deployed.

#### **4.1.8 Decommissioning**

During decommissioning all above ground infrastructure would be removed to a level of at least 0.5 m below the surface and the site restored to its pre-development state.

Main activities include:

- Disconnection from the 66 kV offsite Substation;
- Dismantling of the Substation and support buildings;
- Removal of the solar panels, tracking systems, inverters and cables;
- Removal of onsite tracks and fences unless agreed otherwise with the landowner; and
- Reinstatement of all disturbed ground.

It is anticipated that decommissioning would take up to 6 months. Impacts would generally be similar in effect but shorter in duration than those experienced during construction.

## 5 Statutory and Planning Framework

### 5.1 Permissibility

The Proposal is sited on land zoned as RU1 Primary Production under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Dumaresq LEP). Solar energy systems are prohibited in the RU1 Zone. However, pursuant to clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone). Therefore, the Proposal is permissible with consent.

As an activity that is permitted with consent, the Proposal shall be assessed under Division 4.1 of the EP&A Act. The requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) have also been considered during the preparation of this SEE.

Under the *State Environmental Planning Policy (State and Regional Development) 2011* (Schedule 7, section 5), private infrastructure including electricity generating works with a Capital Investment Value (CIV) of more than \$5 million are considered regionally significant development (RSD), while private infrastructure with a CIV of more than \$30 million is considered state significant development (SSD).

Initial plans in November 2018 were for a single, large-scale solar farm that would have been classified as SSD. However, in response to detailed environmental assessments and site constraints analysis, the Development Envelope of the Proposal was significantly reduced in order to minimise potential environmental impacts.

This process identified two physically separate areas for potential solar farm development. These areas are physically distinct from each other; occurring in separate landholdings, hydrological catchments, viewsheds, and with differing road access arrangements and land management practices. As a result of these distinct differences, two separate smaller areas potentially suitable for solar farm development have been identified. This SEE considers Stringybark Solar Farm. Olive Grove Solar Farm shall be the subject of a separate Development Application if future environmental assessments indicate it is viable.

The Stringybark Solar Farm Proposal has an estimated CIV of approximately \$29 million and is categorised as RSD.

The project requires a controlled activity approval under section 91(2) of the WM Act will be required for cable and vehicular crossings of waterfront land, accordingly, Division 4.8 of the EP&A Act categorises the works as Integrated Development.

As such, the Proponent is seeking approval for the Integrated Development through the Northern JRPP with assessment by Armidale Regional Council.

### 5.2 Commonwealth Legislation

#### 5.2.1 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act protects Matters of National Environmental Significance (MNES), such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others).

Any actions that will, or are likely to, have a significant impact on the MNES require referral and approval from the Australian Government's Environment Minister. Significant impacts are defined by the Commonwealth guidelines and policies (DotE, 2013) for MNES. Potential impacts to MNES have been assessed through the preparation of this SEE, and are summarised in Table 5-1.

**Table 5-1: Impacts on Matters of National Environmental Significance**

| Factor   | Likely impact |
|--|---------------|
| <p><i>a. Any impact on a World Heritage property?</i></p> <p>World Heritage areas exist in the Oxley Wild Rivers National Park, located downstream of the Proposal (Figure 3-7). Assessments presented in Section 7.8 of impacts to water resources indicate that the proposal is unlikely impact any World Heritage property.</p> | Unlikely      |
| <p><i>b. Any impact on a National Heritage place?</i></p> <p>The proposal would not impact any National Heritage place.</p>  | Nil           |
| <p><i>c. Any impact on a wetland of international importance?</i></p> <p>The proposal would not impact any wetland of international importance.</p>  | Nil           |
| <p><i>d. Any impact on a listed threatened species or communities?</i></p> <p>Detailed habitat assessments and targeted flora and fauna surveys addressed in Section 7.3 of this SEE and Appendix A, indicate that the Proposal is unlikely to impact on EPBC listed threatened species or communities.</p>                        | Unlikely      |
| <p><i>e. Any impacts on listed migratory species?</i></p> <p>Assessments in Section 7.3 of this SEE and Appendix A, indicate that the Proposal is unlikely to impact on any Commonwealth-listed migratory species.</p>   | Unlikely      |
| <p><i>f. Any impact on a Commonwealth marine area?</i></p> <p>The Proposal would not impact any Commonwealth marine area.</p>  | Nil           |
| <p><i>g. Does the proposal involve a nuclear action (including uranium mining)?</i></p> <p>The Proposal does not involve a nuclear action.</p>   | Nil           |
| <p><i>h. Additionally, any impact (direct or indirect) on Commonwealth land?</i></p> <p>No Commonwealth land would be impacted by the Proposal.</p>  | Nil           |

Based on the assessment included in this SEE, referral to the Commonwealth Department of the Environment and Energy is not recommended.

### 5.2.2 Native Title Act 1993

The *Native Title Act 1993* recognises the rights and interests of Indigenous people to land and aims to provide for the recognition and protection of common law native title rights. Areas of land where native title may exist include public road reserves and other Crown land.

The Proposal is located on freehold land and is not subject to Native Title claims.

### 5.2.3 Renewable Energy (Electricity) Act 2000

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

- (a) to encourage the additional generation of electricity from renewable sources;
- (b) to reduce emissions of greenhouse gases in the electricity sector; and
- (c) to ensure that renewable energy sources are ecologically sustainable.

The objects of the RE Act are achieved through the issuing of certificates for the generation of electricity using eligible renewable energy sources. This requires certain purchasers (called liable entities) to



surrender a specified number of certificates for the electricity that they acquire during a year. Under section 17 of the RE Act solar energy is a renewable energy source eligible under the Commonwealth government's RET. The Proposal will need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

### **5.3 State Legislation**

#### **5.3.1 Environmental Planning and Assessment Act 1979 (EP&A Act)**

The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals.

As an activity that is permitted with consent, the Proposal shall be assessed under Division 4.1 of the EP&A Act. As per Section 5.3.9, the project requires a controlled activity approval under section 91(2) of the WM Act for cable and vehicular crossings of waterfront land. Due to this consent being required, Division 4.8 of the EP&A Act categorises the works as Integrated Development.

#### **5.3.2 State Environmental Planning Policy (State and Regional Development) 2011**

Clause 5(a) of Schedule 7 states that development, including electricity generating works, that has a CIV of more than \$5 million is regionally significant development.

The Proposal has a CIV estimated to be approximately \$29 million, therefore is classified as regionally significant development. A formal quantity surveyor's report confirming the CIV of the Proposal is included as part of the Development Application (DA).

Pursuant to Division 4.2 of the EP&A Act, the responsibility for determining the DA is conferred upon the Northern Joint Regional Planning Panel. The Proposal does not have a CIV greater the \$30 million and is therefore not a state significant development.

#### **5.3.3 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)**

The ISEPP was introduced to facilitate the effective delivery of infrastructure across NSW. In most cases, the ISEPP overrides the provisions of other Environmental Planning Instruments and provides permissibility and development assessment provisions which apply across the State for different infrastructure sectors.

Pursuant to clause 34(7), development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone). Therefore, the Proposal is permissible with consent.

#### **5.3.4 State Environmental Planning Policy (Primary Production and Rural Development) 2019**

The aims of this Policy are as follows:

- (a) to facilitate the orderly economic use and development of lands for primary production,*
- (b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,*
- (c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,*
- (d) to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,*
- (e) to encourage sustainable agriculture, including sustainable aquaculture,*

- (f) *to require consideration of the effects of all proposed development in the State on oyster aquaculture,*
- (g) *to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.*

Pursuant to clause 11 land identified as being State significant agricultural land is listed in Schedule 1. Schedule 1 does not currently identify any land. Given its temporary nature and opportunities for ongoing grazing activities within and adjoining the Development Envelope, the Proposal does not compromise any of the above objectives nor impact any State significant agricultural land.

### **5.3.5 State Environmental Planning Policy No. 44 (Koala Habitat) (SEPP 44)**

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for *Phascolarctos cinereus* (Koala) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. Developers of land with Koala habitat must consider the impact of their proposal on Koalas, and in certain circumstances, prepare individual Koala plans of management for their land.

Armidale Regional Council is listed as one of the Councils in which SEPP 44 applies. Councils are encouraged to prepare LGA-wide Koala plans of management, and once agreed to by the NSW Department of Planning, they may be used by developers to address Koala issues and individual plans of management would no longer be required. Currently, potential and core koala habitat has not been surveyed in the Armidale Regional Council LGA, or included as a special provision in the Armidale Dumaresq LEP, or the *Armidale Dumaresq Development Control Plan 2012*.

Potential koala habitat is defined as areas of native vegetation (>1 ha) where the trees types listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper and lower strata. Core Koala habitat is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population.

The Biodiversity Development Assessment Report (BDAR – Appendix A) found there is no evidence of Koalas on the Site, let alone a breeding population, and did not identify any Koala feed trees on the Site. As such, the Site is determined to be too degraded for Koala breeding habitat and there is no core koala habitat as defined by SEPP 44 within the Site.

### **5.3.6 State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)**

SEPP 55 aims to promote remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

Under clause 7, a consent authority must not consent to the carrying out of any development on land unless:

- (a) *it has considered whether the land is contaminated, and*
- (b) *if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
- (c) *if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

A review of the NSW Environmental Protection Agency (EPA) Contaminated Land Record under section 58 of the *Contaminated Land Management Act 1997* (CLM Act) and the List of NSW contaminated sites

notified to the EPA under section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding the Site.

A review of premises currently regulated by an Environmental Protection Licence (EPL) under the *Protection of the Environment Operations Act 1997* (POEO Act) and premises that are no longer required to be licensed under the POEO Act did not reveal any premises within or surrounding the Site.

Pursuant to clause 7 of SEPP 55 there is no apparent reason to consider that land to be impacted by the Proposal would be contaminated.

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

The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

The BC Act contains provision relating to threatened species and ecological communities listings and assessment, section 1.7 (formerly 5A) of the EP&A Act and repealing the *Threatened Species Conservation Act 1995*.

The BC Act also provides for a biodiversity offsets scheme, a single biodiversity assessment methodology (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and approvals. The BC Act also contains measures for flora and fauna protection, repealing parts of the *National Parks and Wildlife Act 1974* (NPW Act). The *Biodiversity Conservation Regulation 2017* supports the BC Act.

Potential impacts to threatened species and communities listed under the BC Act are addressed in Section 7.3 and in Appendix A of this report.

### **5.3.8 Fisheries Management Act 1994 (FM Act)**

The FM Act provides for the protection, conservation, and recovery of threatened species defined under the Act. It also makes provision for the management of threats to threatened species, populations, and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general.

No Key Fish Habitat (KFH) is mapped within the Development Envelope, though KFH is identified downstream of the Site (NSW DPI, n.d.). KFH is not defined under the FM Act, however the NSW Department of Primary Industries (DPI) provides a definition for KFH as generally including habitats that are crucial to the survival of native fish stock, excluding man-made habitats such as off-stream dams and ponds, and those natural waterways which are dry for the majority of the time or have limited habitat value.

As there is no KFH within the Development Envelope and the Proposal will not harm marine vegetation or block fish passage, permits under sections 205 or 219 of the FM Act and a section 201 permit will not be required for any dredging or reclamation works for the Proposal. Nevertheless, best practice methods for vehicular and cable crossings (as detailed in Section 7.8.4) will be implemented to reduce impacts to drainage lines.

### **5.3.9 Water Management Act 2000 (WM Act)**

The WM Act regulates controlled activities on waterfront land in NSW. Waterfront land is defined as the bed of any river, together with any land lying between the bed of the river and a line parallel to, and the prescribed distance (being 40 m) inland of, the highest bank of the river. Cable and vehicular crossings will cross first and second order streams within the Development Envelope.

A controlled activity, within the meaning of the WM Act, includes the deposition or removal of material (whether or not by extractive material) or vegetation from land, or the carrying out of any other activity

that affects the quality or flow of water in a water source. Installation of underground cables and vehicle crossings are deemed controlled activities when undertaken on waterfront land, regardless of stream classification, therefore a controlled activity approval permit under section 91(2) of the WM Act is required.

#### **5.3.10 Local Land Services Act 2013 (LLS Act)**

The LLS Act provides the framework for clearing of native vegetation that does not require development consent on rural land in NSW. It is an offence under section 60N of the LLS Act for a person to clear native vegetation in a regulated rural area, unless the person establishes any of the following defences:

- (a) that the clearing is for an allowable activity authorised under Division 4 and Schedule 5A,*
- (b) that the clearing is authorised by a land management (native vegetation) code under Division 5,*
- (c) that the clearing is authorised by an approval of the Panel under Division 6,*
- (d) that the clearing is authorised under section 60O (Clearing authorised under other legislation etc.).*

The Proposal, including any vegetation clearing, requires consent and is being assessed under Part 4 of the EP&A Act, and hence does not require assessment and approval under Part 5A of the LLS Act.

#### **5.3.11 National Parks and Wildlife Act 1974 (NPW Act)**

The main aim of the NPW Act is to conserve the natural and cultural heritage of NSW.

*Further works in the form of an Aboriginal Cultural Assessment (ACHA) is not required.*

A due diligence assessment (provided in Appendix B and summarised in Section 7.4) indicates that the proposed works will not impact any known Aboriginal cultural heritage sites. Due to the existing highly disturbed condition of the site and the lack of archaeologically sensitive landscape features there is considered to be a low potential for an intact subsurface archaeological deposit to exist in the study area. The assessment finds that an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act and/or further works in the form of an ACHA is not required.

#### **5.3.12 Heritage Act 1977**

Historic relics, buildings, structures and features are protected under the *Heritage Act 1977* (Heritage Act). The Heritage Act defines “environmental heritage” as those places, buildings, works, relics, moveable objects and precincts of Local or State significance. Identified heritage items are listed in the heritage schedule of the local Council’s LEP or listed on the State Heritage Register, or by an active Interim Heritage Order.

Under section 139 of the Heritage Act a person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit. A relic is any deposit, artefact, object or material that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and is of State or local heritage significance. Section 139 does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Order.

The potential impacts on historic heritage are addressed in Section 7.5 of this SEE. The Proposal is designed to avoid any direct or indirect impacts on any items of historic heritage significance and as such, a section 139 permit is not required as part of this approval.

### 5.3.13 Roads Act 1993

Section 138 of the Roads Act 1993 sets out the requirement for approval to carry out certain works within the vicinity of a road. Under section 138 a person must not, without consent of the appropriate roads authority:

- (a) *Erect a structure or carry out a work in, on or over a public road;*
- (b) *Dig up or disturb the surface of a public road;*
- (c) *Remove or interfere with a structure, work or tree on a public road;*
- (d) *Pump water into a public road from any land adjoining the road; and/or*
- (e) *Connect a road (whether public or private) to a classified road.*

A new access point to the Development Envelope from Gara Road is included within the current application. Therefore, approval from the appropriate roads authority to connect to a public road and to undertake work in, on or over a public road is required under section 138 of the Roads Act. The roads authority for Gara Road is Armidale Regional Council. The authority for the Waterfall Way is the NSW Roads and Maritime Services (RMS).

Strategies shall be negotiated with RMS to manage the intersection of Waterfall Way and Gara Road and any upgrades required are to be conditioned within project consent.

### 5.3.14 Protection of the Environment Operations Act 1997 (POEO Act)

The objectives of the POEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecological sustainable development.

Pursuant to section 48 of the POEO Act, premises-based scheduled activities, as defined in schedule 1, require EPLs from the NSW EPA. Under clause 17 of schedule 1, electricity generation is scheduled activity requiring an EPL, however solar power is not included in this definition. Therefore, the Proposal is not a scheduled activity under the POEO Act, and an EPL is not required.

### 5.3.15 Biosecurity Act 2015 (Biosecurity Act)

The Biosecurity Act repealed the *Noxious Weeds Act 1993* and provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

Part 3 of the Biosecurity Act applies a general biosecurity duty for any person who deals with biosecurity matter or a carrier to prevent, eliminate or minimise any biosecurity risk they may pose. Under section 23 of the Act, a person who fails to discharge a biosecurity duty is guilty of an offence.

Whilst the Act provides for all biosecurity risks, implementation of the Act for weeds is supported by Regional Strategic Weed Management Plans (RSWMP) developed for each region in NSW. Appendix 1 of each RSWMP identifies the priority weeds for control at a regional scale. However, landowners and managers must take appropriate actions to reduce the impact of problem weed species regardless of whether they are listed in Appendix 1 of the RSWMP or not as the general biosecurity duty applies to these species.

A number of weeds were identified within the Site and are detailed in Section 7.3. Weed management responsibilities and actions will be assigned within post-approval Environmental Management Plans to be prepared prior to commencement of the Proposal.

### 5.3.16 Rural Fires Act 1997

The *Rural Fires Act 1997* (Rural Fires Act) provides for the preparation, mitigation and suppression of bush and other fires in local government areas and to provide protection of infrastructure and environment, economic, cultural, agricultural and community assets from damage arising from fire.

The landholding contains Bushfire Prone Land, however all infrastructure, excluding the underground cable between the Development Envelope and the Substation, has been sited outside of these areas. Nevertheless, the Proposal is not a subdivision for residential or rural residential purposes nor is it for a special fire protection purpose, hence issue of a bush fire safety authority under section 100B of the Rural Fires Act is not required. Fire risk is discussed in Section 7.10.

### 5.3.17 Mining Act 1992

The objective of the *Mining Act 1992* is to encourage and facilitate the discovery and development of mineral resources in NSW.

There are no Exploration Licences or Mining Leases within the Site.

## 5.4 Other relevant Policies and Plans

### 5.4.1 Ecologically Sustainable Development (ESD)

ESD integrates social, economic and environmental considerations into the decision-making process. The principles of ESD are defined within the NSW POEO Act and have been incorporated into NSW legislation, including the EP&A Act and the EP&A Regulation.

The Commonwealth of Australia (1992) defines ESD as “*using, conserving and enhancing the community’s resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased*”.

The principle basis for ESD is that current and future generations should leave a natural environment that functions as well or better than the one inherited. Each of the principles of ESD with respect to the Proposal and its environmental impact assessment are considered in the following subsections.

#### ***Precautionary principle***

The precautionary principle means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The environmental consequences of the Proposal have been assessed as accurately as possible, using appropriate specialists in relevant disciplines where required. All predictions, however, contain a degree of variability and uncertainty, which reflects the nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the SEE process, a conservative approach was adopted to ensure the worst-case scenario was predicted in the assessment of impacts.

The Proposal is consistent with the precautionary principle in that where there was uncertainty, conservative over estimates were used, examples include:

- Potential impacts were assessed assuming the largest available tracking system at its maximum tilt height, at which PV panels are at a maximum height of 4 m. However, for most of the day this system is lower than 4 m, and in practice a smaller tracking system with PV panels at a lower maximum tilt height may be installed at the Site;
- Where potential threats to the environment have been identified, mitigation measures have been developed to minimise such impacts; and

- Monitoring will be undertaken, if required, as a precautionary measure to reduce the effect of any uncertainty regarding the potential for environmental damage.

***Social equity in inter-generational equity***

Social equity involves value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the well-being and welfare of the community, population and society. Social equity includes inter-generational equity, which requires that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The Proposal is consistent with the principles of social equity and inter-generational equity through the efficient use of a renewable energy source that provides a number of benefits to society. Increased adoption of renewable energy sources will assist Australia to transition away from traditional carbon intensive energy production which is linked to atmospheric pollution and carbon emissions associated with climate change. Reduced carbon emissions have the potential to slow the effects of climate change, benefitting current and future generations.

Electricity generated from the Proposal would provide a clean electricity source for local and regional consumers in a cost-effective manner, providing improved opportunities and quality of life for all members of the regional community.

The majority of infrastructure used in developing the solar farm will be reused or recycled during operations and decommissioning of the Project.

***Conservation of biological diversity and maintenance of ecological integrity***

Biological diversity refers to the diversity of genes, species, populations, communities and ecosystems, and the linkages between them. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

The commitment from the Proponent to minimise native vegetation disturbance as much as reasonably practical will be implemented to ensure biodiversity integrity. No hollow-bearing trees would be removed. A low level of ground layer vegetation (mainly exotic grasses with very low levels of scattered natives) are likely to be cleared during clearing works. This clearing has been extensively assessed in Section 7.3 and Appendix A and, given its environmental context, it is considered extremely unlikely that this would result in a significant impact on any threatened species, populations or ecological communities or their habitats.

Areas of higher conservation value have been avoided during the evolution of the project design, and where identified impacts are unavoidable these will be managed by the implementation of mitigation measures and ecosystem credits. At the conclusion of the proposed 28 year operational phase, the Proposal shall be decommissioned and rehabilitated, with the objective of returning the Site to its pre-existing agricultural capability.

Therefore, it is concluded that the Proposal would not have a significant negative impact upon the biological diversity or the ongoing ecological integrity in the locality.

***Improved valuation and pricing of environmental resources***

The environment has conventionally been considered a free resource, with the true cost to the environment not factored into cost of production or use of the resource. This principle involves placing a monetary or social value on the environment that ultimately increases its value in order to decrease future exploitation.

The Proposal recognises and makes use of the inherent value in solar energy. This converts an abundant, renewable natural resource (sunlight) into a valuable and valued commodity (electricity). The commitment to offset impacts to native vegetation and to fund future biological conservation activities through the Biodiversity Offset Scheme recognises and places an appropriate monetary value on environmental protection and the maintenance of biodiversity.

#### 5.4.2 New England North West Strategic Regional Land Use Plan

The *New England North West Strategic Regional Land Use Plan* has been developed to help address potential land use conflicts, with a particular focus on managing coal and coal seam gas issues. Of relevance to the Proposal, the plan identifies land that is considered to be Strategic Agricultural Land, i.e. land that is highly productive and has both unique natural resource characteristics and socio-economic values.

Two categories of strategic agricultural land have been identified:

- Biophysical strategic agricultural land (BSAL); and
- Critical industry clusters.

There are no critical industry clusters within the New England North West and the Proposal does not impact upon BSAL. This SEE considers potential impact to land resources in Section 7.2.

### 5.5 Summary of Licences and Approvals

A summary of approvals required for the Proposal prior to construction are outlined in Table 5-2.

**Table 5-2: Approvals required for the Proposal**

| Legislation                      | Approval    |
|----------------------------------|-------------|
| <i>Roads Act 1993</i>            | Section 138 |
| <i>Water Management Act 2000</i> | Section 91  |



## 6 Consultation

Effective consultation is an essential part of the development process. Consultation should provide a clear understanding of a proposal to the community and relevant stakeholders, as well as opportunities to offer feedback that can be considered to improve development outcomes. The Proponent has carried out consultation with the local community and relevant Government Agencies during the design and assessment of the Proposal in order to understand and respond to concerns or suggestions raised by these stakeholders.

### 6.1 Consultation Objectives

Consultation objectives have been designed to ensure that relevant stakeholders are identified and that appropriate communication strategies are employed to ensure effective consultation. They include:

- Identification and direct engagement with neighbours;
- Early and ongoing engagement with the Council and any relevant internal departments;
- Early and ongoing engagement with those that are potentially most effected by the Proposal;
- Engagement with the State Government; and
- Integration of consultation outcomes into the design of the Proposal.

### 6.2 Consultation to Date

In consideration of the consultation objectives and the identification of key stakeholders, the Proponent has carried out a range of activities to ensure that the scope of the Proposal has been communicated to relevant stakeholders.

Activities that have taken place are listed below:

- Identification and consultation with neighbouring residents;
- Identification and consultation with residents in the wider locality;
- Consultation sessions in Armidale providing neighbours and residents an opportunity to meet directly with the development team;
- Local Government consultation;
- State Government consultation. and
- The provision of an email address and phone number through which stakeholders can contact the development team.

#### ***Neighbouring Residences Consultation***

All properties that adjoin the Site have been notified of the Proposal directly. Consultation occurred through a number of avenues including letters, emails and telephone calls. Consultation with this Stakeholder group is ongoing.

#### ***Local Area Consultation***

To initiate consultation in the local community, a letter was sent to all residences within 2 km of the Development Envelope and 1 km of the Substation Location Area (consultation radius). The consultation radius reflects the distance at which a solar farm of the nature and scale proposed has the potential to have effects on local amenity (note, the environmental studies that are included in this SEE support this assumption). The initial letter provided broad details of the Proposal, along with an invitation to a consultation session and contact details should anyone wish to contact the Proponent directly. A copy of the letter delivered to residents is provided in Appendix C. It should be noted, that individuals beyond the consultation radius also contacted the Proponent and while the Proponent was confident that that effects

beyond the consultation radius would be acceptable, these additional residents were included in the consultation process.

An information session for the Proposal was held in Armidale on the 22<sup>nd</sup> of May 2019 (Duval Room, Armidale Bowling Club). Fifteen people attended the session between 4pm and 8pm on the day. Attendees were presented with a series of information boards (Appendix D) that summarised the Proposal, providing details of the proposed design and the assessment process. The project team, were on hand to answer questions, and to listen to feedback and suggestions. At the end of the session, attendees were again provided with contact information should they have any further questions.

To understand the visual concerns that local residents raised during the initial consultation in more detail, the Proponent organised a landscape architect (as part of the Landscape and Visual Impact Assessment), to visit the homes of any of the attendees who wished to be involved. These visits allowed the landscape architect to understand, how the Proposal would be viewed from these residential locations. The findings of the assessment are provided in Appendix E.

A second consultation session was held at the Armidale Bowling Club on Thursday the 25<sup>th</sup> of July. This session was conducted to demonstrate how the Proposal had been refined in response to concerns conveyed at the previous consultation session regarding potential visual impacts associated with the proposal. These changes included:

- A modification of the Array Area to reduce visibility;
- location of the Substation so it is screened from views;
- Ensuring that cabling is installed underground to avoid the installation of any new overhead powerlines (except where the Substation connects to the Essential Energy 66 kV line); and
- The inclusion of strategically placed vegetation screens to minimise the extent of views where possible.

Two members of the development team were also on hand to discuss the updated plans and answer any other project related questions. To complement this, the landscape architect who conducted the Landscape and Visual Impact Assessment (Appendix E), also attended the consultation session to present visualisations of the Proposal. This was to allow attendees to understand more fully how the refined Proposal would sit within the landscape. The visualisations were accompanied with commentary on how they were generated and how they should be interpreted.

Table 6-1 below identifies the general themes of the comments and questions raised during the consultation undertaken to date. The table provides a summary of the responses for context and cross-references to relevant Sections where the topics are discussed in this SEE

**Table 6-1: Summary of issues raised through consultation**

| Main issues/<br>concerns raised                                      | Summary of issue and mitigation response   |
|--|--|
| <i>Concern raised about Visual Impacts</i>                           | <p>The proponent took this concern seriously. Noting, that the scale of the development had already been reduced from 100MW to less than 30MW based on preliminary investigations.</p> <p>To understand the visual concerns of the local residents in more detail, the Proponent organised a landscape architect to visit the homes of any of the attendees of the first consultation session who wished to be involved. These visits allowed the landscape architect to understand in detail, how the Proposal would be viewed from these residential locations. Based on the concerns of the residents and the preliminary results of the landscape assessment, the Proponent decided to modify the Array Area to visually contain the Proposal within a single vertical band. This involved reducing the northern vertical extent of the Proposal while moving the development down to the southern corner boundary, an area that is screened from all residential views and which environmental assessments did not identify any unacceptable effects.</p> <p>In addition, the Substation was located so this infrastructure could be completely screened from views and all electrical cables associated with the Proposal have been designed to go underground to avoid the visual intrusion of additional overhead power lines in the locality. Strategically placed vegetation screens have also been designed to further reduce the visibility of the Proposal. Sections 3.3 and 3.4 explain the evolution of the design in more detail.</p> <p>To ensure that the alterations made to the development in response to the community's concerns were conveyed to the community, the Proponent organised a second consultation session where the landscape architect provided some representative visualisations and was on hand to answer questions regarding the visual assessment process.</p> <p>The landscape and Visual Impact Assessment can be found in Appendix E.</p> |
| <i>Concern raised about whether the solar panels can be recycled</i> | <p>Solar panels are made of valuable materials that can be recycled at recovery rates greater than 90%, with this figure expected to improve as recycling techniques develop over time (IEA, 2017). The recovery, reuse and/or recycling of panels at the end of their life is necessary to avoid unnecessary landfill waste generation and to fulfil obligations set out in the WARR Act which is an obligation fully understood by the Proponent. More information on the recycling of panels and decommissioning of the Proposal can be found in Section 7.13.</p>  |
| <i>Concern about an increase in erosion and runoff</i>               | <p>It should be noted that an erosion and sediment management strategy will be developed as part of the post-approval Environmental Management Plans, considering the construction, operational and decommissioning phases of the development, with the objective of ensuring there are no onsite or offsite impacts due to changed flow volume or velocity of runoff from the site (see Section 7.8.3 and 7.2.4).</p> <p>During construction, work practices will be implemented to avoid the potential for erosion during excavation and earthworks. These would include,</p> <ul style="list-style-type: none"> <li>• limit the extent of excavation activities to the minimum amount required;</li> <li>• stage excavation activities to minimise the total areas of exposed soil;</li> <li>• minimise the number and volume of stockpiles; and</li> <li>• revegetate disturbed areas as soon as possible.</li> </ul> <p>During operation, grass cover will be maintained across the site both between and under the panel rows to provide groundcover. The groundcover will stabilise soils preventing soil erosion and will assist in localised water penetration (for more detail refer to Section 7.2).</p>  |

| Main issues/<br>concerns raised        | Summary of issue and mitigation response  |
|--|---|
| <i>Concern about fire risk.</i>        | Concern that fire risk would increase as a consequence of the Proposal, particularly in relation to fuel load. Managed correctly, solar farms do not present an unacceptable fire risk. As detailed in Section 7.10.  |
| <i>Concern about property values</i>   | <p>Property values are determined by many factors, many of which cannot be controlled by the owner of a landholding. Further, impacts on property values may be subjective.</p> <p>A carefully designed solar farm in a rural area, which includes mitigation measures to neighbouring properties, is not expected to have a major impact on property values in its vicinity.</p> <p>There have not been any published Australian studies into the impact of utility-scale solar on property values; however, of the few international studies available, none indicated negative impacts to property values in proximity to a utility scale solar farm (FutureAnalytics, 2016; McGarr, 2018). Urbis (2016) reviewed the impact of wind farms on property values and found that wind farms are not likely to adversely affect land values in Australia. Wind farms have significantly greater visual and operational noise impacts than solar farms, so the impact of solar farms on land values is considered likely to be substantially lower than that of wind farms.</p> <p>Most lots in the area surrounding the Proposal are zoned RU1 and RU4. Property will therefore mostly be valued by its productivity for agricultural purposes. This will not be affected by the solar farm in any way, therefore an anticipated change in property value cannot be established.</p> <p>A sensitive design and a suite of mitigation measures including screening measures will further mitigate the impact to residences and, as a result, any possible negative impact on values.</p> |
| <i>Site access during an emergency</i> | The Proposal has 7 access points at strategic locations along the perimeter security fence that would surround the Site. Two main access points and then a further 5 emergency access points. All emergency agencies that could be called to respond to an onsite emergency will be briefed and hold access details included within an Emergency Response Plan for the Site. Section 7.10 contains more detail on bushfire and emergency access for the Site.   |

| Main issues/<br>concerns raised                                 | Summary of issue and mitigation response  |
|---|---|
| <p><i>Concern raised about noise and dust generation</i></p>    | <p>The operational noise level of a solar farm is limited. The three main components that generate low levels of noise are the Substation, the trackers and the inverters. Noise from these components have been assessed and there will be no adverse noise impacts at any sensitive noise receptors during the operation of the solar farm.</p> <p>A noise assessment has been conducted for the construction phase of the development. The assessment shows that no receivers will be highly affected. All impacts identified are considered to be of short duration and manageable. Impacts to noise sensitive receiver 1 (NSR1) will occur for a short duration (as is typical with construction projects in proximity to people), when construction works are at the nearest boundary to this residence. However, the construction noise impact can be managed to reduce noise levels through good practice construction noise management procedures, aimed to minimise noise impact to this receptor and the wider community. No other identified receivers are predicted to be impacted by the construction works. See Section 7.9 and the Acoustic Assessment (Appendix F).</p> <p>During construction the Proposal has the potential to generate dust during excavation and earthworks as well as through the movement of trucks and other work vehicles along unsealed access roads. However, the impact of dust is unlikely to be significant if the Proposal implements mitigation measures, such as:</p> <ul style="list-style-type: none"> <li>• the use of a water truck during dust generating activities,</li> <li>• setting up transport protocols to reduce dust generation which could include: <ul style="list-style-type: none"> <li>○ setting speed limits,</li> <li>○ carpooling for construction staff, and</li> <li>○ the coordination of the delivery and removal of materials,</li> </ul> </li> <li>• limit the extent of excavation activities,</li> <li>• stage excavation activities to minimise the total areas of exposed soil, and</li> <li>• minimise the number and volume of stockpiles.</li> </ul> <p>It is unlikely that there will be any significant dust generation activities occurring during the operation of the Proposal as traffic during this period will be low and there will not be any requirement for large scale earthworks at the Site (see Section 7.12).</p> |
| <p><i>Concern about road management during construction</i></p> | <p>The construction of the Proposal will take approximately 9 months. It is anticipated that the Solar Array (and the associated infrastructure) and the Substation would be constructed concurrently. The Substation Location Area will be accessed directly from Waterfall Way, while the rest of the Proposal will be accessed via Gara Road.</p> <p>During the construction phase (9 months) of the Proposal, the majority of workers will travel to site in minibuses minimising the impact of Proposal-related traffic on local traffic.</p> <p>Projected Proposal-related traffic during the construction phase will result in a minor increase to traffic volumes on Waterfall Way, however, it is considered that the road has sufficient capacity to cater for the increase in traffic volumes.</p> <p>The existing daily traffic volumes on Gara Road are low (less than 50 vehicles per day) and remain relatively low taking into consideration the average daily traffic volumes associated with the construction phase of the Proposal (5 heavy vehicles and 11 light vehicles).</p> <p>Impacts on the surrounding road network in terms of school bus services will be minimal and insignificant for pedestrians and cyclists.</p> <p>In summary, the impact to local road uses during the construction of the Proposal will be minimal. See the Traffic and Transport Assessment for a detailed assessment (Appendix G).</p>   |



| Main issues/<br>concerns raised          | Summary of issue and mitigation response   |
|--|--|
| <i>Responsibility of decommissioning</i> | Stringybark Solar Farm Pty Ltd would be responsible for decommissioning the Proposal at the end of its operational life. The Proposal has requested a development approval (DA) for 30 years, after which the Proposal would be required to be removed and the Site returned to agricultural use. Note, it is expected that a requirement to decommission and restore the site to its original state would be included as a condition attached to any DA issued for the Proposal. As such, the determining authority would have the necessary powers to ensure that the Proposal is decommissioned and the site is restored to its pre solar farm condition. |

As outlined in the consultation objectives, the Proponent understands that consultation is an ongoing process that will continue over the life the Proposal. As such, the Proponent has provided contact information in all correspondence to ensure that individuals who were unable to attend the scheduled consultation sessions could contact the development team directly if they had further questions or concerns.

As demonstrated in Table 6-1, the Proponent has addressed the concerns raised through the consultation process in the design of the Proposal presented in this SEE and through the inclusion of mitigation where appropriate.

#### **Local Government Consultation**

Armidale Regional Council has been formally briefed on the Proposal on two separate occasions. A meeting with the Development Manager for Town Planning was conducted on the 3<sup>rd</sup> of April and the 17<sup>th</sup> of July, 2019. The meetings detailed the location and general details of the Proposal and helped to determine the nature and scope of assessments required to support a development application. Since the initial briefing, updates have been provided directly to Armidale Regional Council.

#### **State Government Consultation**

A meeting was held with the Member for Northern Tablelands on the 21<sup>st</sup> May 2019. The Member was briefed on the location, nature and scale of the Proposal.

## 7 Environmental Assessment

### 7.1 Assessment methodology

The **Environmental Assessment** (Section 7) has been undertaken to assess potential environmental impacts for a range of specific issues identified through consultation and site investigations. These are:

| Issues                       | Section |
|------------------------------|---------|
| Land Use and Soils           | 7.2     |
| Biodiversity                 | 7.3     |
| Aboriginal Cultural Heritage | 7.4     |
| Historic Heritage            | 7.5     |
| Traffic and Access           | 7.6     |
| Visual Impact                | 7.7     |
| Water Resources              | 7.8     |
| Noise                        | 7.9     |
| Bushfire and Electrical Fire | 7.10    |
| Electromagnetic Interference | 7.11    |
| Air Quality                  | 7.12    |
| Waste and resource use       | 7.13    |
| Socioeconomic factors        | 7.14    |
| Cumulative Impacts           | 7.15    |

A description of **existing conditions** is provided for each issue, considering existing levels of development, as well as antecedent conditions as relevant. This provides an opportunity to consider both environmental state and function in the absence of the Proposal.

In accordance with the principles of environmental assessment, all **potential impacts** associated with the Proposal are considered across the entire lifespan of the development, considering construction, operational and decommissioning phases. Potential impacts are considered in addition to existing environmental conditions, representing potential cumulative impacts. Furthermore, where known future development is proposed, consideration is given to potential cumulative impacts as relevant.

**Mitigation measures** are proposed to effectively manage all potential environmental impacts. These may include design considerations, monitoring strategies, construction safeguards, consultation, training and awareness programs, modified work practices, management plans or other relevant management strategies. A full list of mitigation and environmental management strategies and commitments is provided in **Environmental Management** (Section 8).

The **Project Justification** (Sections 2 and 9) provides triple-bottom-line (environmental/social/economic) evaluation of the Proposal in order to fully describe potential benefits and impacts to the environment and the local, regional and NSW community.

Potential **residual environmental risks** (Section 9) following mitigation are investigated using likelihood/consequence analysis to describe the potential magnitude of residual impacts. Where the mitigated impact remains high or extreme, further justification is provided to contextualise project risks going forward.

Justification against high level social and economic expectations is then considered against the principles of **Ecologically Sustainable Development**, and more specifically, considering the particular **socio-economic** attributes associated with the Proposal.

**Potential alternatives** are considered to ensure that approval of the Proposal is not detrimental when assessed against potential alternative land uses or development.

The **Conclusion** (Section 10) integrates the relevant **Statutory and Planning Framework** (Section 5) and commitments made through the **Consultation** process (Section 6) with the findings of the **Environmental Assessment** to provide a concise statement regarding the suitability of the Proposal and outlines any key points for consideration as part of the development approval process.

## 7.2 Land Use and Soils

### 7.2.1 Introduction

This section establishes a baseline assessment of current land use, soils and land capability prior to the Proposal.

Potential impacts associated with the Proposal on agricultural land and mineral resources and exploration activities in proximity to the Development Envelope and Substation Location Area are considered to ensure the compatibility of the development with the existing agricultural land use on and adjacent to the Site both during operation and after decommissioning.

### 7.2.2 Existing environment

The Development Envelope is located within an undulating landscape, where elevation ranges between 940 – 980 m Australian Height Datum (AHD). The Substation Location Area is located north-west of the Development Envelope in a similar landscape, where elevation ranges between 980 m – 990 m AHD. The Site has been historically cleared and cultivated for improved pastures and grazed for sheep and cattle production and is typical of farmland in the region. No flood prone land occurs within the Site, however, a number of stock dams have been developed in the Development Envelope. Surrounding land uses include:

- Agriculture;
- Transportation – Waterfall Way is a major road connecting Armidale to the coast;
- Residential – There are two non-involved residences within 1 km of the Proposal; and
- Armidale Regional Council has identified and developed the new Armidale Regional Landfill on the adjoining block immediately to the north of the Development Envelope (Lot 1 DP 1206469). At the time of writing, construction for the landfill is well advanced, however, the landfill is not operational.

#### **Land Use**

Historically, agriculture has been a significant industry in the Armidale region and still plays an important role in both the social and economic wellbeing of the region today. The Northern Tablelands Natural Resource Management Region covers 1,795,059 ha, of which 1,627,359 ha is used mainly for agricultural production (ABS, 2018).

The Site and surrounding land is zoned RU1 - Primary Production. Under the provisions of the Armidale Dumaresq LEP (2012) 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; and*
- *To allow for non-agricultural land uses that will not restrict the use of other land in the locality for agricultural purposes.*

An assessment of the Proposal's compatibility with the objectives of the RU1 zone under the provisions of the Armidale Dumaresq LEP (2012) is provided in Table 7-1.

At the conclusion of the life of the project, the Proposal would be decommissioned in order to permit the resumption of grazing activities or other agricultural uses. Therefore, the Proposal does not conflict with the objectives of the RU1 Zone as described by the Armidale Dumaresq LEP (2012).

**Table 7-1: Compatibility of the Proposal with the RU1 zone objectives**

| Objective  | Proposed Development   |
|--|--|
| To encourage sustainable primary industry production by maintaining and enhancing the natural resource base                    | The Proposal involves a temporary diversification in land use of approximately 94 ha of a larger 665 ha area for the duration of the Proposal (estimated to be 30 years). Impacts of the Proposal on agricultural production at a regional and state level are therefore not significant. This changed land use may temporarily reduce agricultural production within the Site; however, a lease agreement has been established to compensate the landholders for foregone income due to reduced agricultural production. In addition, once constructed limited sheep grazing may continue within the Development Envelope as part of a management plan to control vegetation beneath the solar array. Following decommissioning the land will be rehabilitated back to its current use as a grazing operation.  |
| To encourage diversity in primary industry enterprises and systems appropriate for the area                                    | Sunshine harvesting is a passive land use that can co-exist with agricultural activities. The Proposed Development will support the growth of the renewable energy market, as well as providing for diversification for on-farm income, and more broadly diversification of employment and economic opportunities within the Armidale Regional LGA.  |
| To minimise the fragmentation and alienation of resource lands   | The location and management of the Proposal will not result in the fragmentation of land currently used for primary production. Subdivision is not proposed and land zoning will remain RU1. At the end of the approval the Site will return to an agreed state suitable for ongoing grazing activity.   |
| To minimise conflict between land uses within this zone and land uses within adjoining zones                                   | <p>The Proposal is located on land entirely zoned as RU1, and land adjacent to the Site is also zoned RU1. The Proposal involves a temporary diversification in land use that supports the growth of the renewable energy market, may allow for the continuation of grazing activities and will not restrict the use of any surrounding lands for agricultural purposes, therefore conflicts with the RU1 zones are not anticipated.</p> <p>Land located 700 m south of the Development Envelope on the opposite side of Commissioners Waters, is zoned as RU4 - Primary Production Small Lots. The objectives of the RU4 zone are:</p> <ul style="list-style-type: none"> <li>• <i>To enable sustainable primary industry and other compatible land uses;</i></li> <li>• <i>To encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature; and</i></li> <li>• <i>To minimise conflict between land uses within this zone and land uses within adjoining zones.</i></li> </ul> <p>The Proposal upholds the objectives of the RU4 zone by providing diversification of rural enterprises and employment in the Armidale Regional LGA. Therefore, conflict between RU1 and RU4 land uses are not anticipated.</p> |
| To allow for non-agricultural land uses that will not restrict the use of other land in the locality for agricultural purposes | The Proposal will not restrict the use of other land in the locality for agricultural purposes.  |



### Soil Landscapes

The *Soil Landscapes of the Armidale* mapsheet (King, 2009) covers the Site, and identified the Middle Earth and Argyle soil landscapes occurring under the Site (Figure 7-1). The Middle Earth landscape is mapped as occurring on the undulating plains, rise and footslopes of the Sandon Beds. The Argyle soil landscape is mapped as occurring on the rolling low hills and occasional hills on greywacke/chert and related sediments. Within the Site, Middle Earth is the dominant landscape unit, while the Argyle landscape is restricted to higher elevations in the north of the Development Envelope. These soil landscapes have an erodibility potential ranging from moderate to very high. The Site is dominated by Kurosols, Kandosols. The Site lies within the New England Orogen and is located on the Sandon Beds, and Girrakool Beds underlie parts of the Site.

### Land and Soil Capability

Land capability classes aim to classify land according to its inherent ability and protection from erosion and other forms of land degradation. The classification of any land is based on biophysical features which determine the limitations and hazards of that land. The main hazards and limitations include: water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils, rockiness, and mass movement. The eight class system recognises four types of land uses with land capability decreasing from Class 1 to Class 8 (OEH, 2012):

- Class 1 – 3: land suitable for cultivation;
- Class 4 – 5: land suitable for grazing and restricted cultivation;
- Class 6: land suitable for grazing; and
- Class 7 – 8: land not suitable for agricultural production.

Land and soil capability mapping corresponds to each soil landscape, based on the most limiting factor. The Middle Earth landscape in the majority of the Site has severe limitations (Class 5) for more intensive use other than grazing, but remains suitable for a variety of land uses if careful management to prevent long-term degradation is implemented. The Development Envelope is interspersed with patches of lower capability land (Class 6) associated with the Argyle landscape, and land capability is restricted to low impact land uses. The land and soil capability for each soil landscape is provided in Table 7-2.

**Table 7-2: Land and soil capability classes within the Site**

| Hazard Classification   | Soil Landscape        |            |
|-------------------------|-----------------------|------------|
|                         | Middle Earth          | Argyle     |
| Soil Acidification      | 4                     | 5          |
| Water Erosion           | 5                     | 6          |
| Soil Structure Decline  | 4                     | 4          |
| Wind Erosion            | 2                     | 1          |
| Shallow soils/Rockiness | 2                     | 4          |
| Salinity                | 1                     | 1          |
| Mass Movement           | 1                     | 1          |
| Water-logging           | 3                     | 2          |
| <b>LSC Class</b>        | <b>5</b>              | <b>6</b>   |
| <b>Capability</b>       | <b>Moderate - low</b> | <b>Low</b> |

Source: Land and Soil Capability Mapping for NSW (OEH, 2017)

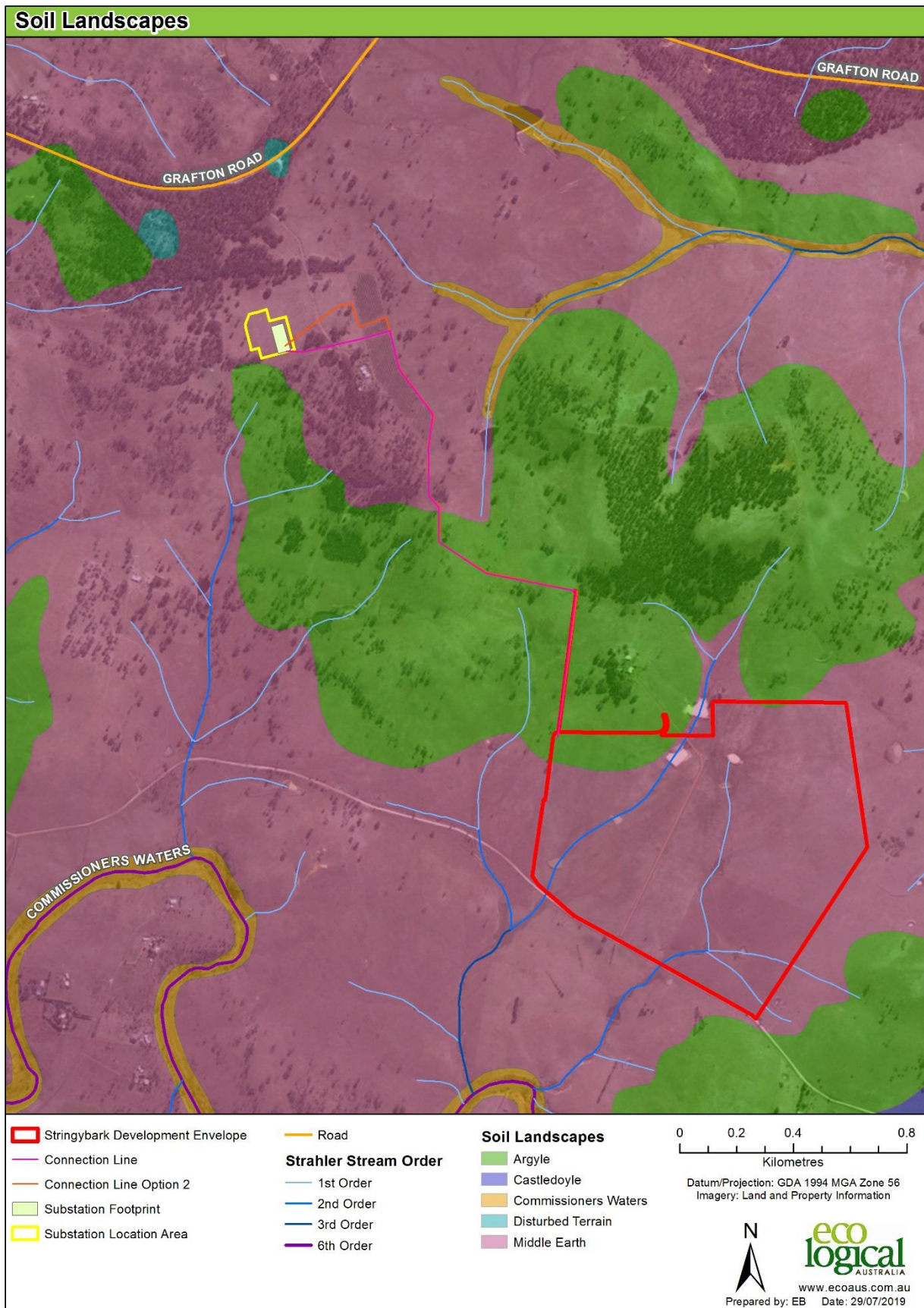


Figure 7-1: Soil landscapes in the Site and surrounds (King, 2009)

### **Biophysical Strategic Agricultural Land**

The Site contains land suitable for grazing, but does not contain any Biophysical Strategic Agricultural Land (BSAL). The closest mapped BSAL is approximately 4 km to the south-west of the Site.

### **Acid Sulfate Soils**

The Australian Soil Resource Information System online data base indicates that there is a low probability of occurrence of acid sulfate soils within the Development Envelope, the Substation Location Area, and in the surrounding area (Fitzpatrick, Powell & Marvanek 2011). The Site is approximately 110 km from the coast at high altitude and as such the potential for acid sulfate soils to occur is negligible. Additionally, based on the soil landscapes, iron sulphide minerals or their oxidation products are not abundant in the soil profile, hence sulfuric acid is unlikely to be produced as a result of ground disturbance.

### **Contaminated Land**

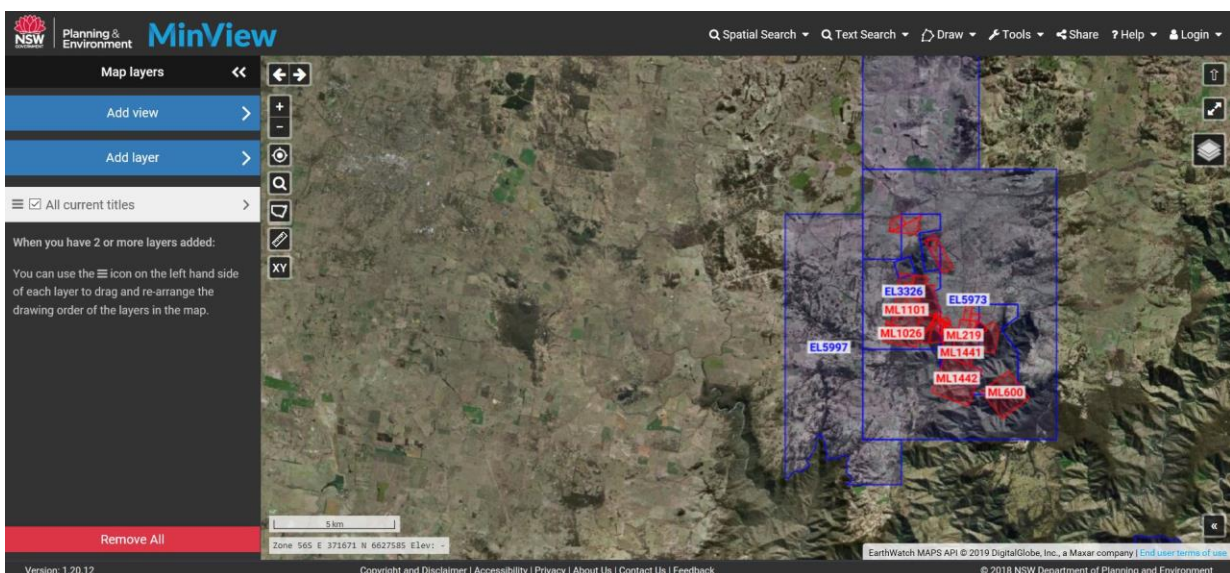
A review of the EPA Contaminated Land Record under section 58 of the CLM Act and the List of NSW contaminated sites notified to the NSW EPA under section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding the Development Envelope or Substation Location Area.

A review of premises currently regulated by an EPL under the POEO Act and premises that are no longer required to be licensed under the POEO Act did not reveal any identified premises within or surrounding the Site. The new Armidale Landfill is located immediately north of the Development Envelope, however at the time of this assessment, the landfill had not yet been commissioned.

Pursuant to clause 7 of the *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land to be utilised by the Proposal would be contaminated.

### **Mineral Resources**

The closest Exploration Licence (EL5997) is located approximately 4 km east of the Site, and held by Hillgrove Mines Pty Ltd (see mineral resources map search below – dated 14/08/19). The Proposal will not impact on exploration activities, nor will EL5997 impact the Proposal.



### 7.2.3 Potential impacts

#### Land use conflicts

The Proposal will have a life span of approximately 30 years and will not involve permanent changes to the landscape. The size of the Site, 94 ha, will not compromise or significantly diminish the availability of land for primary production purposes within the Armidale Regional LGA. Furthermore, due to sunshine harvesting being a passive land use, the Proposal would not have any offsite impacts that would reduce or impact the World Heritage National Park nearby, any BSAL, or the continuation of any of the existing or proposed primary production land uses in surrounding RU1 or RU4 land use zones. Once the Proposal is decommissioned, the land will be returned to a suitable state to permit a return to agricultural use.

#### Land use conflict assessment methodology

A land use conflict analysis based on the DPI's *Living and Working in Rural Areas* handbook (Learmonth, Whitehead, Boyd & Fletcher 2007) is presented in Table 7-3, with the resulting assessment outcomes for issues of land use conflict presented in Table 7-4.

**Table 7-3: Land use conflict risk assessment matrix**

|   |  | Likelihood of a dispute or conflict arising over the land use or activity |        |          |
|---|--|---|--------|----------|
|   |  | Very Likely   | Likely | Unlikely |
| Likely consequences and impacts associated with a dispute or conflict arising over the land use or activity | Major consequences and impacts likely              | High  | High   | Medium   |
|   | Modest or periodic consequences and impacts likely | High  | Medium | Low      |
|   | Minimal consequences and impacts likely            | Medium  | Low    | Low      |

**Table 7-4: Land use conflict analysis**

| Issue                | Assessment | Issue Management  |
|----------------------|------------|---|
| Catchment management | Low        | The Proposal would have no impact on natural resources of surrounding agricultural properties (see Section 7.8).<br>The Developer will not be extracting any surface water within the Development Envelope for construction and/or operational activities. Non-potable water may be sourced off-site and would be only extracted from existing creeks and farm dams under existing Water Sharing Plan licences (Section 7.8). |
| Dogs                 | N/A        |   |
| Drainage             | Low        | Installation of solar panels over the majority of the Development Envelope and the removal of onsite dams would not markedly affect drainage patterns nor have any adverse hydrological or hydraulic effects on neighbouring lands (see Section 7.8).   |



| Issue   | Assessment | Issue Management  |
|---------|------------|---|
| Dust    | Low        | Construction activities could cause short term dust accretion on adjoining trees and pastures, although this risk is limited by mitigation measures proposed (see Section 7.12). There would be nil to minimal impact on production.  |
| Fencing | Low        | <p>The Landholding is already fenced, however a perimeter fence up to 2.5 m high will be constructed around the Proposal.</p> <p>All fences will need to be maintained to avoid the possibility of livestock straying onto the site from the Landholding or any adjoining properties.</p>   |
| Fire    | Medium     | <p>The Development Envelope and Substation Location Area do not contain <i>Bushfire Prone Land</i>, however mapped <i>Bushfire Prone Land</i> exists nearby, through which the underground cable connection passes. The overall nature of the Site in combination with the Proposal poses a low risk, both in terms of fire originating onsite and escaping onto neighbouring land or fire that originates offsite entering the Site (Section 7.10).</p> <p>A suite of mitigation measures are proposed to reduce and manage the risk of fire, and to reduce the impact of any fires within or surrounding the Proposal (Section 7.10.4), including:</p> <ul style="list-style-type: none"> <li>• Design and installation principles and features;</li> <li>• Firebreaks and other design features that will be developed in consultation with relevant fire management agencies (including the NSW RFS);</li> <li>• Fuel load reduction;</li> <li>• Fire management and emergency response strategies will be included in an Emergency Response Plan (ERP) for each phase of the development and will be prepared in consultation with and distributed to NSW RFS and NSW Fire and Rescue; and</li> <li>• Safety protocols.</li> </ul> |
| Lights  | Low        | <p>Construction activities will be undertaken predominantly during daylight hours from 7am – 6pm Monday to Friday, 8am – 1pm on Saturday.</p> <p>During the operational phase, lighting will be restricted to the Substation and the operations compound and will only be used infrequently as required.</p> <p>The low requirement for lighting, the distance from neighbouring properties and the use of vegetation buffers means that potential landholder conflict is assessed as low.</p>  |
| Noise   | Low        | <p>Noise impacts at sensitive receptors during the construction phase (approximately 9 months), are deemed to be acceptable with mitigation measures in place. Construction activities will be limited to standard working hours:</p> <p>Monday to Friday, 7am to 6pm;<br/>Saturday, 8am to 1pm; and</p> <p>No construction work is to take place on Sundays or public holidays.</p> <p>Noise during the operational phase will be low. Noise and associated impacts are discussed in Section 7.9.</p>  |



| Issue               | Assessment | Issue Management   |
|---------------------|------------|--|
| Pesticides          | Low        | <p>Pesticides will be used to control weeds at the site. Good management practices will be implemented to ensure that pesticide use is minimised (including the potential use of sheep to graze between the panel rows to manage vegetation loads).</p> <p>The application of any pesticides will be in accordance with the NSW <i>Pesticides Act 1999</i>, such that only registered pesticides are used based on label instructions that are designed to minimise impacts on surrounding land.</p> <p>The distance from neighbouring properties means the potential conflict is assessed as low.</p>   |
| Pollution           | Low        | <p>Fuels and lubricants will be used on site. These potential contaminants will be managed within bunded areas, according to the CEMP, OEMP and Decommissioning Management Plan (DMP) (see Sections 7.2.4 and 7.8.4).</p>  |
| Roads               | Low        | <p>Potential impacts to road surface conditions and traffic safety are low and will be managed through an upgrade to the intersection of Waterfall Way and Gara Road, as well as the site access point from Waterfall Way to the Substation. Specific details of these works are not currently known and will be developed in consultation with RMS. It is recommended that the completion of these road upgrades be conditioned within the consent of the current DA. Other management strategies to mitigate potential impacts to the local transportation route are detailed in the Traffic and Transport Assessment (see Section 7.6).</p> <p>There are no current Crown roads within the Development Envelope, Substation Location Area, or the proposed connection line route.</p> |
| Straying livestock  | Low        | See fencing.   |
| Theft and vandalism | Low        | <p>The location of the Proposal means that the risk posed by theft/vandalism is considered low.</p> <p>The solar farm would be off limits to the general public, enclosed by an appropriate security fence (approximately 2.5 m high). The Proposal's security system will include CCTV at several locations around the Development Envelope and Substation (Section 4.1.5).</p>   |
| Visual amenity      | Low        | <p>The Proposal has variable levels of visibility, with the greatest visual impact to the south of the Site. Development setback buffers, vegetation screening and site-specific infrastructure arrangements are proposed to minimise these impacts (see Section 7.7).</p>   |
| Weeds and pests     | Low        | <p>Weed and pest control at the Site is the responsibility of the Proponent. The risk from priority weeds and pests is low but would be subject to ongoing monitoring and management (Section 7.2 and 7.3).</p>  |

Most land use conflicts have been assessed as low. Land use conflict analysis indicates that bushfire poses a medium risk. The mitigation measures to reduce this potential conflict are discussed in Section 7.10.

## **Construction**

Duplex soils associated with the Site are characterised by an abrupt change in texture between the sandy surface layer and the underlying clay horizons. Duplex soils present include Kurosols and Kandosols, which make up the majority of soils found. The subsoil of duplex soils has a moderate potential for dispersion and surface crusting. If the topsoil of these soil units is disturbed or removed and the subsoils are exposed, the potential for erosion may be increased.

Large scale bulk earthworks are not anticipated to be required to construct the Proposal. However, general construction activities would include excavation and trenching, and have potential to result in soil erosion (including wind erosion), decreased stability and sedimentation due to the local removal of groundcover and the disturbance of the soil profile.

Within the solar array, soil disturbance would be predominantly limited to the piles driven or screwed into the ground to support and orientate the PV panels, and trenching for cable installation. Some areas of cut and fill may also be required once final designs are established. As such, most of the groundcover will be retained across the Site. Consequently, soil disturbance from localised excavation activities will be relatively small, isolated and temporary. Removal of farm dams is addressed in Section 7.8.

Where the ground surface is disturbed for the Substation and support buildings, inverters, access tracks, the temporary construction compound, laydown and parking areas there is greater potential for increased runoff and/or soil erosion. Footings, access tracks and hardstand areas that would require compaction and/or foundations would reduce soil permeability, leading to increased localised run off and potentially concentrated flows, which could result in soil erosion. Soil compaction from equipment will be small, due to the small and discrete footprint of the lightweight equipment required for panel installation.

Fuels and lubricants will be used on site during construction activities and may pose a potential contamination risk to soils in the event of a spill. These chemicals may alter soil properties and can impact negatively on soil health and consequently plant growth or if absorbed by plants/animals could potentially enter the food chain with adverse impacts. Contaminants in the soil can be mobilised during rainfall events which may potentially spread contamination through the soil profile, or into surface or groundwater potentially impacting aquatic habitats.

As Bushfire Prone Land exists nearby, there is potential for fires. However, the Development Envelope and Substation Location Area have been adjusted to avoid Bushfire Prone Land and it is considered that the physical nature of the Site (cleared land) in combination with the land use and management strategies proposed poses a low risk. Further information is provided in Section 7.10.

## **Operation**

Operational impacts to soil would be minimal as operation and maintenance activities would not result in additional soil disturbance and groundcover would be reinstated and maintained across the site. The potential for concentrated runoff to result in the erosion of the access tracks and localised soil erosion below the panels to occur during significant rainfall events is discussed in Section 7.8.

The potential for wind erosion is considered to be low due to areas of soil disturbance being rehabilitated post construction.

As discussed in the section above, fuels, lubricants and herbicides will be used for maintenance activities, and pose a potential contamination risk to soil, surface and groundwater as a consequence of misuse or a spill event.

The presence of Bushfire Prone Land near the Site poses a potential fire risk that needs to be considered during the operation phase of the development. However, the nature of the Proposal poses a low risk in terms of fire. Further information is provided in Section 7.10.

### ***Decommissioning***

At the end of the 30 year life of the Proposal, the Proposal would be decommissioned, with the objective of returning the land capability to its pre-existing agricultural capacity.

Potential impacts associated with decommissioning will be generally similar to those for construction as there will be a need for some local excavation and the operation of heavy equipment. However, it is anticipated that impacts would be less significant than during construction. Reasons for this include:

- There shall be no need for further vegetation clearing; and
- Subsurface infrastructure below 0.5 m will remain in place.

Following decommissioning, the Site will be returned to agricultural activities, minimising long term land use impacts and mitigating impacts to agriculture capacity.

### **7.2.4 Mitigation measures**

#### ***Land use***

Potential land use conflict management measures, where required, are outlined in Table 7-4.

#### ***Soils and Land Resources***

##### ***Construction***

The construction works are short term and would be managed in accordance with the *Managing Urban Stormwater: Soils and Construction* series, namely:

- Managing Urban stormwater: Soils and Construction, Volume 1, 4th Edition (known as the Blue Book) (Landcom, 2004);
- Volume 2A Installation of Services (DECC, 2008a); and
- Volume 2C Unsealed Roads (DECC, 2008b).

The Construction Environmental Management Plan (CEMP) to be developed following project approval will incorporate an Erosion and Sediment Control Plan in accordance with the above guidelines. The Plan would include a requirement for the establishment of erosion and sedimentation controls at the commencement of works and throughout construction, including the following measures:

Control of sediment and erosion will include the management of exposed soil surfaces and stockpiles to prevent sediment discharge into waterways, and the installation of stormwater management systems, sediment barriers (e.g. silt nets downslope from workings) or sedimentation ponds to control the quality of water released from the Site into the receiving environment.

- Construction and/or installation of erosion and sediment control structures shall be in accordance with the specifications provided in the Blue Book;
- Regular inspection and programmed maintenance of erosion and sedimentation controls will be undertaken and documented in a register of inspections and actions;
- Cable trenches will be constructed in accordance with relevant regulations and ground conditions. Trenches will be excavated and filled progressively to ensure they are left open for the shortest period possible. Surface conditions will be rehabilitated as soon as practicable to prevent the formation of preferential flow pathways;
- Management of erosion generated by traffic shall include a driving code of practice, installation of appropriate drainage controls, inspection and maintenance of unsealed road surfaces and dust management strategies;

- Separation of topsoil and subsoil for stockpiling and correct reinstatement to ensure a suitable growth medium is retained;
- Commence revegetation and vegetation cover maintenance as soon as practicable to minimise the risks of erosion (including scouring under panels during operation) and to minimise area likely to create dust;
- Appropriate stockpile management to ensure air and water erosion is minimised, soil health, organic matter and structure are retained and weed infestation minimised; and
- Account for climatic events during construction;
  - If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and
  - Works methods shall be modified during high wind conditions if excess dust is generated.

To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of off-site in accordance with Department of Environment and Climate Change (DECC) guidelines. Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery. All hazardous materials will be stored in accordance with relevant regulations. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills.

A Spill Response Plan (SRP) will be prepared as part of the CEMP and OEMP. The SRP will outline the procedures to respond to a spill event and the measures required to prevent the spread of spills to adjacent areas. It will also include an emergency response protocol, EPA notification procedures and remediation requirements.

Despite no recorded contaminated sites, the potential remains for unidentified contamination to be encountered during excavation. Should this be the case, works in the area would cease and the relevant authorities would be notified. Protocols for such an event would be included in the CEMP, OEMP and DMP.

All subsurface infrastructure should be placed a minimum of 0.5 m below ground level, or removed when the site is decommissioned, to ensure that no future agricultural activities may possibly be impacted by this infrastructure. Detailed location and identification of any remaining subsurface infrastructure should be provided.

Potential fire hazard mitigation strategies are outlined in Section 7.10.4.

### *Operation*

Limited soil disturbance during the operational phase of the Proposal means that the potential for soil erosion would be limited to the exposed access tracks and areas below the solar array.

An Operational Environmental Management Plan (OEMP) will be prepared to guide operational environmental management following the final design of the Proposal and would be approved by the relevant statutory authority. This will also incorporate an Erosion and Sediment Control Plan.

Maintaining access tracks in good condition and ensuring that associated drains and/or sedimentation traps are monitored and maintained will ensure that the potential erosion associated with the tracks is minimised. Water carts may be used if necessary, to limit wind erosion and dust generation.

The maintenance of vegetation ground cover across the Site will assist in reducing potential erosion across the Development Envelope. This will be especially important below the panels to prevent scouring following significant rainfall events. As such, to minimise the potential for erosion in the areas beneath the panels an inspection program following significant rainfall events would be implemented and stabilisation works would be undertaken as required.

Further to this, any erosion prevention and/or sedimentation traps installed as part of the design of the Proposal will be monitored to ensure effectiveness is maintained.

Weed management strategies to prevent and minimise the spread of weeds to and from, and within the Site are described in Section 7.3.5.

Vegetation management strategies will be included within a Landscape Management Plan in the CEMP OEMP and DMP. Fire management strategies would be included in a Bushfire Management Plan and an Emergency Response Plan (ERP) that would be prepared for the Site and distributed to neighbours and relevant emergency services. To keep fuel levels down over the Site, vegetation can be managed by mechanical methods including mowing or slashing. In addition, sheep may be permitted to graze within the solar array. The Proponent would need to ensure adequate water supplies are located within the Site for the welfare of grazing animals. This would contribute to weed control and fuel load reduction and provides for the potential continuation of agricultural activities at a reduced scale. Further information regarding fire risk mitigation is provided in Section 7.10.

To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of offsite in accordance with DECC guidelines. Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills.

#### *Decommissioning*

At the end of the 30 year life of the Proposal, the Proposal shall be decommissioned as per Section 4.1.8.

A Decommissioning Management Plan (DMP) will be prepared with the objective of returning the land capability to its pre-existing agricultural capacity. The DMP shall include appropriate mitigation strategies to manage potential environmental impacts.



## **7.3 Biodiversity**

### **7.3.1 Introduction**

As the Proposal is RSD, the impacts must be assessed according to the BAM established under section 6.7 of the NSW BC Act, and a BDAR must be prepared. The purpose of the BDAR is to assess the impacts to biodiversity, propose mitigating and ameliorating options, as well as calculate offsets for unavoidable residual impacts.

The current Proposal has considered the biodiversity values known to occur within the Site, and has where possible avoided areas of native vegetation, threatened species, and their habitats. In particular, the Proposal has avoided (as far as practicable) areas of Threatened Ecological Communities (TECs) and known threatened species habitats. The Site has reduced through each iteration of design to provide a final footprint that:

- Co-locates the grid transmission network infrastructure;
- Locates panel arrays within areas of cultivation; and
- As far as practicable avoids drainage lines, high quality vegetation, and known threatened species records.

The full BDAR is included in Appendix A and summarised below.

### **7.3.2 Survey Effort**

The biodiversity assessment was undertaken using a combination of desktop and field surveys. Field surveys were undertaken between 6 November 2018 and 5 April 2019. Detailed survey methods are included in Appendix A.

Preliminary vegetation mapping was undertaken by Alex Pursche on 6 November 2018. The purpose of the initial vegetation mapping survey was to broadly identify the extent and type of PCTs present within the initial investigation area. The preliminary vegetation mapping was used to refine the Site boundary to avoid areas of high biodiversity value within the investigation area (Figure 7-2).

Vegetation integrity surveys were undertaken within the Site by ELA ecologists Alex Pursche and David Allworth from 2 to 5 April 2019. Vegetation surveys were conducted concurrently with the surveys for the nearby proposed Olive Grove Solar Farm, and plot data has been used across both proposals where appropriate. A total of 12 full-floristic vegetation plots were surveyed to identify PCTs and TECs. A total of 12 vegetation integrity plots were undertaken in accordance with the BAM (Figure 7-2; Appendix A).

Targeted surveys were completed by ELA ecologists Ronnie Hill and Eliza Biggs from 25 to 28 February 2019 for species credit species outlined in Appendix A. Target surveys were undertaken primarily for threatened plants.

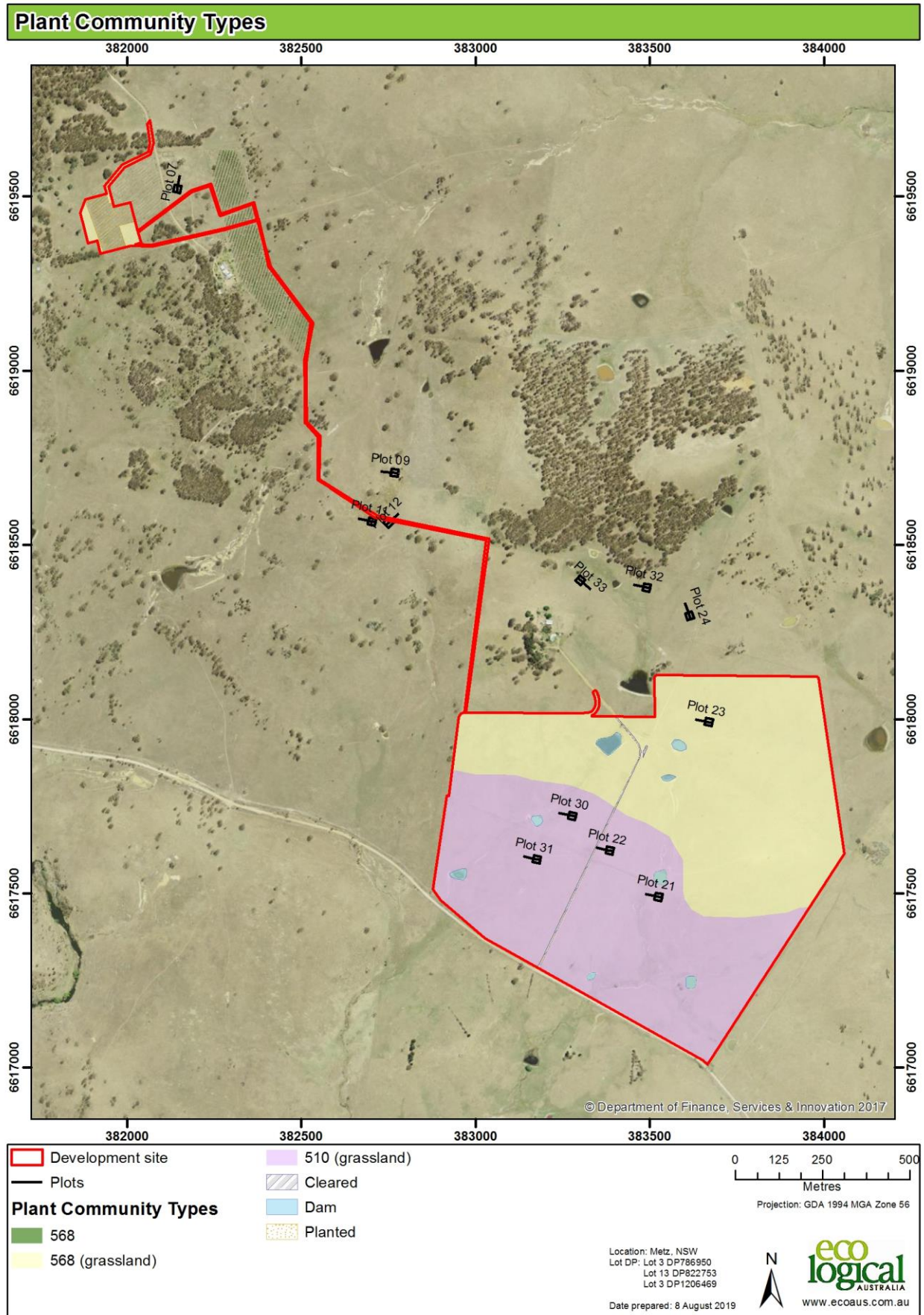


Figure 7-2: Vegetation communities and BAM vegetation plots

### 7.3.3 Existing environment

#### Site Description

The Site occurs wholly within the New England Tablelands Bioregion. The New England Tableland Bioregion has an area of 3,004,202 ha of which 2,860,758 ha (or 95.23%) lies within NSW. This bioregion is one of the smaller bioregions in NSW, occupying 3.57% of the State. The Site located across two private properties, which includes portions of Lot 3 DP1206469, Lot 3 DP786950, and Lot 13 DP822753. The Site is predominately cleared of remnant native vegetation, with only poor condition grasslands remaining. Remaining woodland vegetation consisting of scattered *Eucalyptus calliginosa* (Broad-leaved Stringybark) is present adjacent to, but outside of, the proposed Substation Location Area. The property consists of rolling hills ranging from 900 to 1030 m above sea level with no sharp changes in topography. The majority of the Site is covered in basalt clays, with some emergent granite outcrops along ridgelines. The condition of the Site was relatively poor due to the ongoing lack of rainfall and historic land use, with evidence of erosion in gully areas.

#### Native Vegetation

The Site is almost entirely occupied by native/exotic grasslands. The location of panel array areas is exclusively poor condition grasslands that are dominated by the exotic *Paspalum dilatatum* (Paspalum), *Setaria pumila* (Pale Pigeon Grass), and *Plantago lanceolata* (Lamb's Tongue). Native ground covers present include *Poa siberiana* (Snow Grass), *Sporobolus creber* (Slender Rats Tail Grass), and *Bothriocloa macra* (Red Grass).

Plant community type mapping relied on those woodland and forest PCTs which were present outside the Site. The most common PCT present locally is PCT568 Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion, which occurs on hillslopes and ridges within the Armidale Region. Other PCTs present locally include:

- 510 Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland;
- 734 Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion; and
- 1331 Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion.

Vegetation within the panel array component of the Site is degraded to such a point that it is unlikely to recover into anything resembling any of the above listed PCTs. For the purposes of this assessment, elevation modelling for the Site has been used to differentiate the PCTs present within grasslands areas. At higher elevations above 950 m, it has been allocated to PCT568 for vegetation integrity assessment, which is consistent with remnant vegetation locally. At elevations lower than 950 m, PCT510 has been allocated, which is representative of vegetation occurring in lower lying areas. Due to the degraded condition of the site, there is no 'on-ground' differentiation of the grassland components of these PCTs present.

ELA notes that in accordance with the Vegetation Information System database, neither PCT510 or PCT568 occur as derived communities.

#### Habitat

Fauna habitats within the development site are typical of a predominately cleared grazing farmland, with the available habitat features considerably degraded. The following habitat features are present within the Site:

- Grassland habitats consisting of low condition native and exotic pastures; and
- Farm dams with no emergent vegetation.

### Threatened Ecological Communities

PCT510 can occur as a listed Threatened Ecological Community (TEC) under either the NSW BC Act as White box yellow box Blakely's red gum woodland or the Commonwealth EPBC Act as White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Together these TECs are referred to as 'Box Gum Woodland'.

Under the BC Act, PCT510 is considered an EEC when it contains a portion of the required assemblage of species under Section 3 of the Final Determination for this TEC. Poor condition grasslands within the Site contain several species which are listed as characteristic species including *B. macra*, *Dichelachne micrantha*, *P. siberiana*, and *Rumex brownii*. There are no trees, logs, stumps, or regeneration, and the site is currently heavily grazed by sheep. Under section 10 of the Final Determination, only patches of the TEC that would respond to assisted natural regeneration, where the seed bank is at least partially intact are considered to be the TEC. When considering this limiting component of the TEC listing, it is unlikely that the Site would respond to assisted natural regeneration given the extremely low cover and diversity of characteristic species. As a precautionary measure, vegetation zone 1 has been selected as a TEC in the BAM Calculator, however the assessor notes that this is a conservative decision as the site is sufficiently degraded to not likely meet the minimum requirements (Figure 7-3).

Under the EPBC Act, the Critically Endangered Ecological Community (CEEC) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box – Gum Grassy Woodland and Derived Grassland) is characterised by a species-rich understorey, and the dominance (or prior dominance) of *Eucalyptus albens*, *Eucalyptus melliodora*, or *Eucalyptus blakelyi*. The requirement for listing under the EPBC Act is more defined than the NSW listing, requiring a minimum number of native species, native vegetation cover, or structural elements to be considered. An assessment of the vegetation within the Site was undertaken against the listing for Box – Gum Grassy Woodland and Derived Grassland using the flow chart on Page 5 of the EPBC Act Policy Statement 3.5 White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands (DEH, 2006). Plot data collected within areas of PCT510 indicates that the percentage of native groundcover is patchy and there are isolated patches that contain more than 50% perennial ground cover. Localised areas that do contain sufficient perennial native ground cover, are smaller than 0.1 ha, contain less than 12 native non-grass species, do not have trees or hollows, and do not contain any regeneration. As such the Commonwealth listed TEC is not present.

### Threatened species and populations

Ecosystem credit species predicted to occur at the Site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 11 of Appendix A.

In accordance with Section 3.1.1.3 of the BAM, predicted species have been omitted from vegetation zones with vegetation integrity scores < 15 of EECs, and vegetation scores < 20 for vegetation that is not an EEC.

Targeted threatened flora surveys undertaken for *Dicanthium setosum* obtained populations in the western portion of the Development Envelope in two clumps (approximately 10 and 30 plants respectively – See Figure 9 in Appendix A). No other threatened flora were identified during surveys. No threatened fauna species were sighted during the targeted surveys.



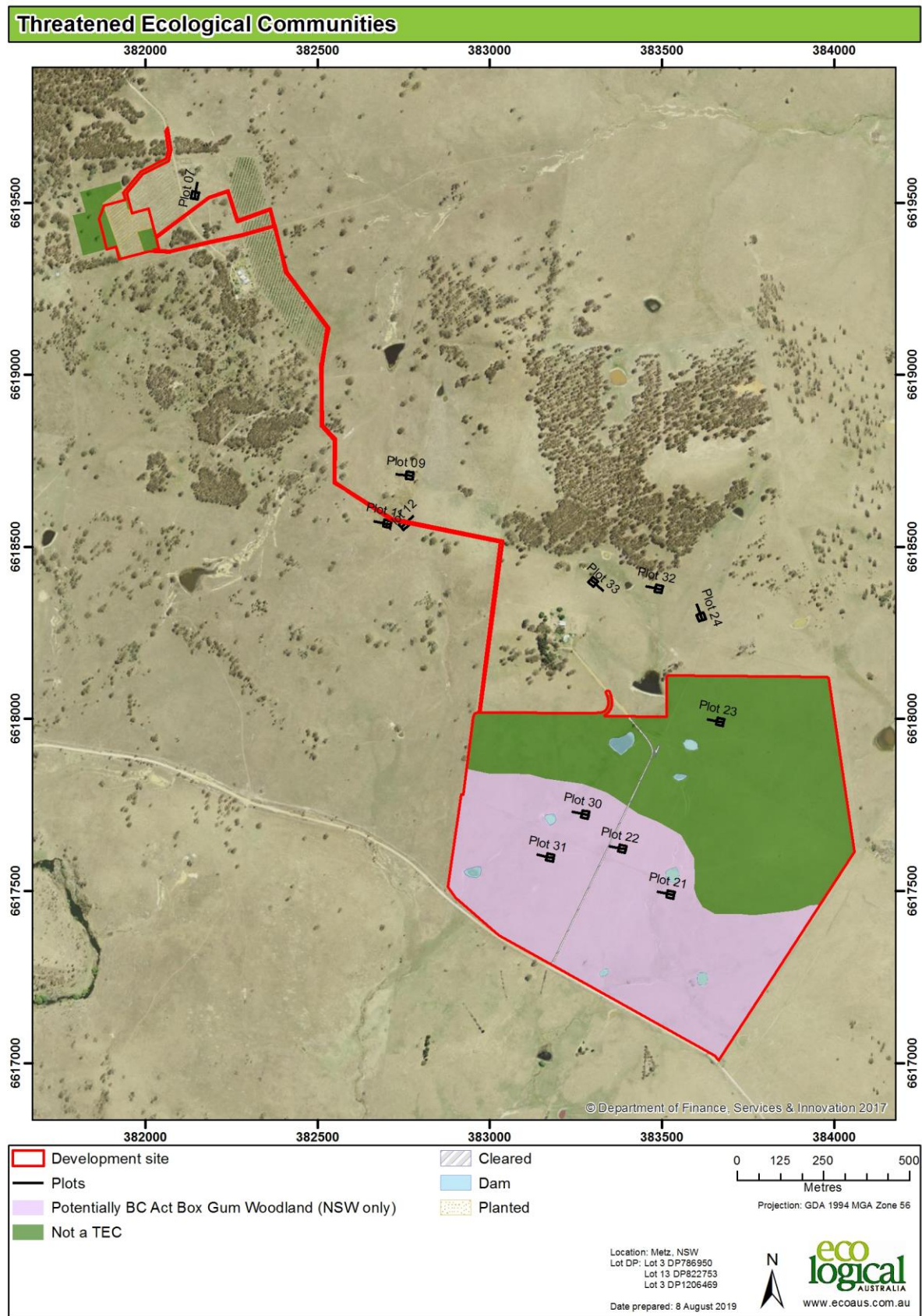


Figure 7-3: Threatened Ecological Communities

### 7.3.4 Potential impacts

#### **Avoidance of impacts**

The Site has been positioned and designed in a way as to avoid and minimise as far as possible impacts to biodiversity (Table 7-5, Table 7-6).

**Table 7-5: Locating the Proposal to avoid and minimise impacts on vegetation and habitat**

| Approach  | How addressed   | Justification  |
|---|---|--|
| Locating the Proposal in areas where there are no biodiversity values.  | All areas of cleared land and low condition vegetation have been utilised.  | The placement of the Site has centred around the areas of lowest biodiversity value within the landholdings, avoiding more established woodland areas.   |
| Locating the Proposal in areas where the native vegetation or threatened species habitat is in the poorest condition.   | All areas of vegetation on the periphery of the cleared land that suffers from edge effects and disturbance from past clearing activities and current grazing pressures have been utilised. | The placement of the Site has centred around the area of lowest biodiversity value (cleared paddock) within the landholdings whilst also encompassing moderate condition periphery vegetation.                                     |
| Locating the Proposal in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species. | The Site has not been able to completely avoid impacts to areas providing species habitat and EEC vegetation.   | The placement of the Site has centred around the area of lowest biodiversity value (cleared paddock) and aimed to minimise impacts to EEC and species habitat by avoiding higher quality remaining vegetation surrounding the Site |
| Locating the Proposal such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.                                 | The Site has been centred around the area of least biodiversity impact with the aim to conserve connectivity values surrounding the Site.   | Connectivity will be retained around the periphery of the Site.  |

**Table 7-6: Designing the Proposal to avoid and minimise impacts on vegetation and habitat**

| Approach   | How addressed   | Justification   |
|--|---|---|
| Reducing the clearing footprint of the Proposal.                               | In designing the Proposal, the aim was to conserve the more intact vegetation whilst centring development in the most cleared portions of the landholdings.         | The design has minimised vegetation clearing through strategic placement.   |
| Locating ancillary facilities in areas where there are no biodiversity values. | The design has endeavoured to locate ancillary facilities within the western cleared/disturbed portion of the Site and along roads designed in the final footprint. | The placement of ancillary facilities has been designed to minimise impacts to biodiversity values by locating them in areas of no biodiversity values (cleared paddock). |



| Approach  | How addressed   | Justification  |
|---|---|--|
| Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score). | The design has endeavoured to locate ancillary facilities in areas of vegetation on the periphery of the cleared land that suffers from edge effects and disturbance from past clearing activities and current disturbance pressures.                       | The placement of ancillary facilities has been designed to minimise impacts to biodiversity values by locating them in areas of lower biodiversity value (cleared paddock) within the landholdings whilst also encompassing moderate condition periphery vegetation. |
| Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC).  | It has not been possible to completely avoid impacts to areas providing species habitat and EEC vegetation. The placement of the Site has minimised impacts as far as practicable to the EEC vegetation whilst maximising extent necessary for development. | The placement of ancillary facilities has been designed to work in and around areas of cleared land. No clearing of species habitat or EEC will occur solely for ancillary facilities.   |
| Providing structures to enable species and genetic material to move across barriers or hostile gaps   | The Proposal will not increase any hostile gaps or barriers.  | Corridor movement will be retained for species around the periphery of the Site.   |
| Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the Site.                              | Proponent to retain all remaining vegetation outside of the Site.   | The proponent will demarcate all areas outside the Site boundary to be retained.   |
| Efforts to avoid and minimise impacts through design must be documented and justified.  | In designing the Proposal, the aim was to conserve the more intact periphery vegetation to the west and south whilst centring development in the most cleared portion of the landholdings.  | The design has minimised vegetation clearing through strategic placement.  |

### **Direct Impacts**

The Proposal does not have any prescribed biodiversity impacts (Table 21 in Appendix A). The assessor has assumed that all vegetation integrity will be lost within the Site as a direct impact of the Proposal. This is unlikely to be the actual impact of the Proposal, as the direct impacts are restricted to removal of vegetation for infrastructure, with indirect shading of the existing low condition ground layer.

The direct impacts of the Proposal on:

- native vegetation are outlined in Table 7-7
- threatened ecological communities are outlined in Table 7-8
- threatened species and threatened species habitat is outlined in Table 7-9
- The change in vegetation integrity Table 7-10

**Table 7-7: Direct impacts to native vegetation**

| PCT ID                         | PCT Name  | Vegetation Class                    | Vegetation Formation                                | Direct impact (ha) |
|--------------------------------|---|-------------------------------------|---|--------------------|
| 510 (Poor condition grassland) | Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland             | New England Grassy Woodlands        | Grassy Woodlands                                    | 45.23              |
| 568 (Poor condition grassland) | Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion | New England Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrub/grass sub-formation) | 48.03              |

**Table 7-8: Direct impacts on threatened ecological communities**

| PCT ID                         | BC Act                         |   |               | EPBC Act                                      |      |               |
|--------------------------------|--------------------------------|---|---------------|---|------|---------------|
|                                | Listing status                 | Name  | Direct impact | Listing status                                | Name | Direct impact |
| 510 (Poor condition grassland) | EEC (precautionary allocation) | White Box Yellow Box Blakely's Red Gum Woodland | 45.23 ha      | Not listed – does not meet condition criteria | n/a  | n/a           |
| 568 (Low condition grassland)  | not listed                     | n/a   | n/a           | not listed                                    | n/a  | n/a           |

**Table 7-9: Direct impacts on threatened species and threatened species habitat**

| Species                    | Common Name | Direct impact number of individuals / habitat (ha) | NSW listing status | EPBC Listing status |
|----------------------------|-------------|--|--------------------|---------------------|
| <i>Dichanthium setosum</i> | Bluegrass   | 0.5 ha   | Vulnerable         | Vulnerable          |

The change in vegetation integrity as a result of the Proposal is outlined in Table 7-10. As indicated at the beginning of this section, the assessor has assumed that all vegetation integrity will be lost within the Site. This is unlikely to be the actual impacts of the Proposal, as the only direct impacts will be from the installation of the panels and Substation infrastructure. Whilst areas under the panels will be subject to shading, there is unlikely to be a total loss of biodiversity.

**Table 7-10: Change in vegetation integrity**

| Veg Zone | PCT ID | Condition                | Area (ha) | Current vegetation integrity score | Future vegetation integrity score | Change in vegetation integrity |
|----------|--------|--------------------------|-----------|------------------------------------|-----------------------------------|--------------------------------|
| 1        | 510    | Poor condition grassland | 45.23     | 13.3                               | 0                                 | -13.3                          |
| 2        | 568    | Poor condition grassland | 48.03     | 8.5                                | 0                                 | -8.5                           |

**Indirect Impacts**

The construction and operational phases of the Proposal have the potential to impact biodiversity values within the Site that cannot be avoided. Indirect impacts that may occur during the construction phase of the Proposal are detail in depth within the BDAR (Appendix A) and include:

- Sedimentation and contamination and/or nutrient rich run-off;
- noise, dust or light spill;
- inadvertent impacts on adjacent habitat or vegetation;
- vehicle strike;
- transport of weeds and pathogens from the site to adjacent vegetation;
- rubbish dumping;
- wood collection;
- bush rock removal and disturbance;
- increase in predatory species populations;
- increased risk of fire; and
- disturbance to specialist breeding and foraging habitat.

Indirect impacts that may occur during the operational phase of the Proposal are detailed in depth within the BDAR (Appendix A) and include:

- Vehicle strike;
- Rubbish dumping;
- Wood collection;
- Bush rock removal and disturbance;
- Increase in predatory species populations;
- Increase in pest animal populations;
- Increased risk of fire; and
- Disturbance to specialist breeding and foraging habitat.

**Serious and Irreversible Impacts (SAILs)**

One threatened ecological community will be potentially impacted by the Proposal that is listed as a potential SAIL entity in the Guidance to assist a decision-maker to determine a serious and irreversible impact. This is the Box-Gum Woodland EEC. Considering the degraded nature of Box-Gum Woodland in the Site, the TEC is prevalent in the New England Tablelands, the Proposal is likely to remove less than 0.2% of the woodland remaining within 5,000 m of the Site and the Proposal will shade/indirectly impact less than 0.09% of the grassland TEC remaining within 5,000 m of the Site. It is therefore unlikely that the Proposal would have a SAIL.

**Matters of National Environmental Significance**

Two MNES were considered as having the potential to occur based on a desktop review, including NSW BioNet Records, Atlas of Living Australia records, aerial imagery and the BAMC. These MNES include:

- Box-Gum Woodland; and
- *Dicanthium setosum*.

Detailed descriptions and assessments for Box-Gum Woodland and *Dicanthium setosum* have been included within the BDAR (Appendix A) and all have concluded that the Proposal is not likely to significantly impact any MNES.

### 7.3.5 Mitigation Measures

Measures proposed to mitigate and manage direct and indirect impacts from the Proposal to biodiversity during the construction and operational phases will be included in the Environmental Management Plans and are outlined in Table 7-11.

**Table 7-11: Measures proposed to mitigate and manage impacts to biodiversity**

| Measure  | Timing                                       |
|--|--|
| A qualified ecologist/licensed wildlife handler will be present to supervise during clearing of identified fauna roosting or nesting habitat, in accordance with best practice methods to relocate fauna in a sensitive manner. Any fauna utilising habitat within the Site will be identified and managed to ensure clearing works minimise the likelihood of injuring fauna.   | Prior to and during removal of habitat trees |
| If possible in considering the Proposal construction schedule, construction activities should be programmed to avoid impacts; for example, timing construction activities for when migratory species are absent from the Site, or when particular species known to or likely to use the habitat on the Site are not breeding or nesting. Where possible, timing of vegetation clearance should be planned to occur outside of the period between August and March, during the breeding/nesting/nursing time for the majority of avian and micro-bat species, to avoid impacts to fauna during these critical life cycle events.  | During clearing works                        |
| Clearing of vegetation will be undertaken via a two-stage clearing process. Clearing will not be undertaken until pre-clearance survey of trees to be removed and identification of habitat trees are conducted by a qualified ecologist. Stage 1 of the clearing process involved marking of habitat features, and removal of all vegetation except habitat features. Stage 2 involves removal of habitat features under the supervision of a qualified ecologist/licensed wildlife handler to relocate resident fauna. Vegetation that is to be removed nearby to retained vegetation will be removed using a chain-saw rather than heavy machinery to avoid any additional impacts on adjacent vegetation. All clearing staff will be briefed about the two-stage clearing process, and their responsibilities to minimise impacts to biodiversity. | During clearing works                        |
| Construction works are to occur during standard construction hours to maximise daylight hours. Any request for an out of hours works protocol should consider construction activities during non-daylight hours as having potential fauna impacts.   | For the duration of construction works       |
| Control of sediment and erosion in accordance with an Erosion and Sediment Control Plan incorporated in the CEMP OEMP and DMP (as per Section 7.2.2) will include the management of exposed soil surfaces and stockpiles to prevent sediment discharge into waterways, and the installation of stormwater management systems, sediment barriers (e.g. silt nets downslope from workings) or sedimentation ponds to control the quality of water released from the Site into the receiving environment. The Landscape Management Plan includes a requirement to commence revegetation as soon as practicable to minimise the risks of erosion and to minimise area likely to create dust  | Duration of the Proposal                     |
| Weed management strategies will be included within a Landscape Management Plan in the CEMP OEMP and DMP for the Site that aim at preventing and minimising the spread of weeds to and from, and within the Site. Weed management strategies that will be implemented, include: <ul style="list-style-type: none"> <li>• Protocols for weed hygiene in relation to the cleaning and inspection of vehicles, mobile plant and machinery prior to entering and leaving the Site, and for the importation of fill; and</li> </ul>  | Duration of the Proposal                     |

| Measure  | Timing   |
|--|--|
| <ul style="list-style-type: none"> <li>While there are currently no weeds on the Site listed under the <i>NSW Biosecurity Act 2015</i>, management and removal strategies for any future pathogen or declared priority weed infestations should be implemented by a qualified bush regenerator according to the stipulations of the <i>Biosecurity Act</i>.</li> </ul>   |  |
| <p>All staff working on the development will undertake an environmental induction to communicate environmental features to be protected and measures to be implemented as part of their Site familiarisation. Site briefings should be updated based on phase of the work. This induction will include items such as:</p> <ul style="list-style-type: none"> <li>Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and weeds);</li> <li>What to do in case of environmental emergency (chemical spills, fire, injured fauna);</li> <li>Key contacts in case of environmental emergency.</li> </ul>   | For all staff entering / working at the Site and when environmental issues become apparent |
| <p>Development control measures to regulate activity in vegetation and habitat adjacent to development should be implemented to protect flora and fauna surrounding the Site. These measures should include installation of signage to indicate no go zones, rubbish disposal guidance, prohibition of wood collection, prohibition from lighting fires, prohibition of disturbance to vegetation outside of the Site, and pest &amp; disease management to advise contractors and responsibilities and prevent any accidental construction damage.</p> <p>Temporary fencing to be installed prior to works, to delineate work zones and clearing boundaries, to protect retained vegetation and to prevent rubbish dumping by contractors. Trees for retention within open areas will be marked. Appropriate security measures will also be in place to reduce illegal dumping.</p> | Duration of the Proposal   |
| A monitoring program will be considered within the management plans to measure infrequent and cumulative impacts of the Proposal such as erosion and dust.   | Duration of the Proposal   |

## 7.4 Aboriginal Cultural Heritage

As the Proposal complies with the definition of RSD, legislation requires that a Due Diligence Assessment is required, advancing to an Aboriginal Cultural Heritage Assessment (ACHA) only if the Due Diligence triggers the requirements for an Aboriginal Heritage Impact Permit (AHIP). As per section 2.4 of the Armidale LEP, consultation with Aboriginal Stakeholders is not a requirement under the Due Diligence process, unless there is the potential to harm items of cultural heritage (thus triggering an AHIP).

ELA conducted an Aboriginal Heritage Due Diligence Assessment for the Proposal, in order to determine if there are any registered Aboriginal sites, artefacts or archaeologically sensitive landscape features that require further assessment. The full report is provided in Appendix B and is summarised below.

The Due Diligence process aims to determine whether Aboriginal objects will be harmed by the Proposed Development, as required under Part 6 of the NSW NPW Act. The assessment follows the Due Diligence Code of Practice as set out in the Office of Environment and Heritage's (OEH) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (NSW DECCW 2010). The Due Diligence Code of Practice sets out the reasonable and practicable steps which individuals and organisations need to take in order to:

- Identify whether or not Aboriginal objects are, or are likely to be, present in an area;
- Determine whether or not their activities are likely to harm Aboriginal objects (if present); and
- Determine whether an AHIP or further assessment is required.

### 7.4.1 Existing Environment

#### ***Previously Recorded Aboriginal sites***

##### *Heritage Database Searches*

Searches of the Australian Heritage Database, the State Heritage Inventory and Armidale LEP were conducted on 8 May 2019 to determine if any places of Aboriginal significance are located within proximity to the Site.

These searches found no places of Aboriginal heritage significance within the Site.

##### *AHIMS Search*

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) database was conducted on 8 May 2019 within the following coordinates covering an area of approximately 20 km<sup>2</sup>: GDA Zone 56, Eastings: 372950 – 392950, Northings: 6608770 – 6628770 (Appendix B, Figure 2).

There are no registered AHIMS sites located within the Site.

A total of 108 Aboriginal sites and zero Aboriginal Places were identified during this search. Three items of Aboriginal cultural heritage (21-4-0095, 21-4-0096, 21-4-0026) were found within 1 km of the Site.

#### ***Site Visit and Inspection***

A site inspection undertaken by ELA Archaeologist Andrew Crisp and Matt Elsley on May 13 and 14, 2019 and again by Matt Elsley on July 15, 2019 observed high surface visibility across the Site due to extensive agricultural disturbance and drought conditions preventing excessive groundcover, with subsurface features exposed by erosional drainage lines and dam excavation works.

Following an analysis of the desktop assessment and observations made during the archaeological field survey, the Development Envelope, Substation Location Area (including the new access track) and proposed transmission line routes were considered to represent an area of low archaeological potential



as a result of physical impacts caused by pastoral activities including vegetation clearing, ploughing, vehicle movement and dam/fence construction.

No archaeological items or landscapes of significance were found within the Development Envelope, proposed underground transmission line easement or Substation Location Area.

One isolated artefact was found on the northern aspect of a ridgeline approximately 80 m north of the boundary of Lot 3 DP 1206469 (597 Gara Road, Metz). Part of the ridgeline, where vegetation persists and disturbance is minimal, may have PADs present as indicated by the isolated find and the prominence of this landscape feature in the local area. The Proposal avoids this part of the ridgeline.

No archaeological items or landscapes of significance were found within the proposed access point areas, one on Waterfall Way and one on Gara Road, which are highly disturbed and modified due to associated road infrastructure and drainage. The area of road directly outside the south-western corner of the Site – proposed for an additional entrance - was also found to be highly disturbed and deeply excavated as evidenced from the road verges and is not archaeologically significant.

#### **7.4.2 Potential Impacts**

The Due Diligence process has revealed no Aboriginal cultural items that will be affected by the Proposal and therefore does not require either an AHIP or further works in the form of an ACHA to continue development. No recorded Aboriginal objects or sites are located within the Site or were discovered during the detailed site survey, in a highly disturbed local setting. It has been concluded that the Proposal will not have any direct or indirect impacts on known Aboriginal heritage items and that the area of proposed works exhibits low archaeological potential, does not contain indigenous archaeological materials and it is unlikely that an intact subsurface archaeological deposit will be present within the Site.

#### **7.4.3 Mitigation Measures**

The OEH aims to ensure impacts to Aboriginal objects and places are avoided or reduced and that where possible Aboriginal sites should be conserved. The guiding principle is that, wherever possible, avoidance should be the primary management option, but if avoidance is not feasible, measures shall be taken to mitigate against impacts to Aboriginal items and/or places.

Based on the findings of the Due Diligence and the requirements of the NP&W Act the following measures shall be implemented to remove impacts to potential aboriginal heritage items:

- Due to the low potential for any intact archaeological deposits and the highly disturbed setting, further works in the form of an ACHA is not required;
- Aboriginal objects are protected under the NPW Act regardless of whether or not they are registered on AHIMS. If suspected Aboriginal objects, such as stone artefacts are located during future works, works must cease in the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, the OEH shall be notified under section 89A of the NPW Act. Appropriate management and avoidance or approval under a section 90 AHIP should then be sought if Aboriginal objects are to be moved or harmed.
- In the extremely unlikely event that human remains are found, works should immediately cease and the NSW Police should be contacted. If the remains are suspected to be Aboriginal, the OEH may also be contacted at this time to assist in determining appropriate management.

## 7.5 Historic Heritage

The historic heritage assessment was undertaken in accordance with the *NSW Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996), specifically the guidelines *Assessing Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch Department of Planning, 2009), and with reference to the Burra Charter (the Australian ICOMOS Charter for Places of Cultural Significance) (Australia ICOMOS, 2013).

The primary objectives of the historical heritage assessment were:

- To identify, through heritage register searches, historical research and targeted archaeological investigations, the historical heritage values of the land within the study area;
- To assess the significance of potentially impacted historic heritage items in accordance with the NSW Heritage Branch guidelines: *Assessing Heritage Significance* (NSW Heritage Office, 2001); and
- To provide, on the basis of significance and impact assessments against the Proposal, appropriate management and mitigation strategies for all identified and potential historic heritage items.

This involved the following key tasks:

- A search of relevant historic heritage registers, databases and lists, including:
  - World Heritage List;
  - National Heritage List;
  - Commonwealth Heritage List;
  - Register of the National Estate (non-statutory archive);
  - National Trust of Australia NSW Heritage Database (non-statutory);
  - NSW State Heritage Register;
  - NSW State Heritage Inventory; and
  - Schedule 5 of the *Armidale Dumaresq Local Environmental Plan 2012*;
- Background research concerning land within, and in the vicinity of, the Site in order to identify historic heritage items;
- Comprehensive field survey of the Site to identify potential historic items;
- Identify potential direct and indirect impacts to historic items; and
- Undertake a significance assessment for potentially impacted items in accordance with the guidelines *Assessing Heritage Significance* (NSW Heritage Office, 2001) to establish why a particular site or item is of significance and, if necessary, to enable appropriate mitigation strategies to be developed.

### 7.5.1 Existing environment

The Proposal sits within an area that has been cleared and has historically been used for agricultural purposes.

#### **Database searches and background research**

No known items of heritage significance were identified within the Site or in the vicinity of the proposed new access point during the database searches.

The closest recorded non-Aboriginal heritage item is the Gara River Hydro-Electric Scheme, approximately 2.83 km to the south-east of the Site. It is recorded on multiple registers.

Items of significance that were identified within 5 km of the Site are listed in Table 7-12 and presented in Figure 7-4.

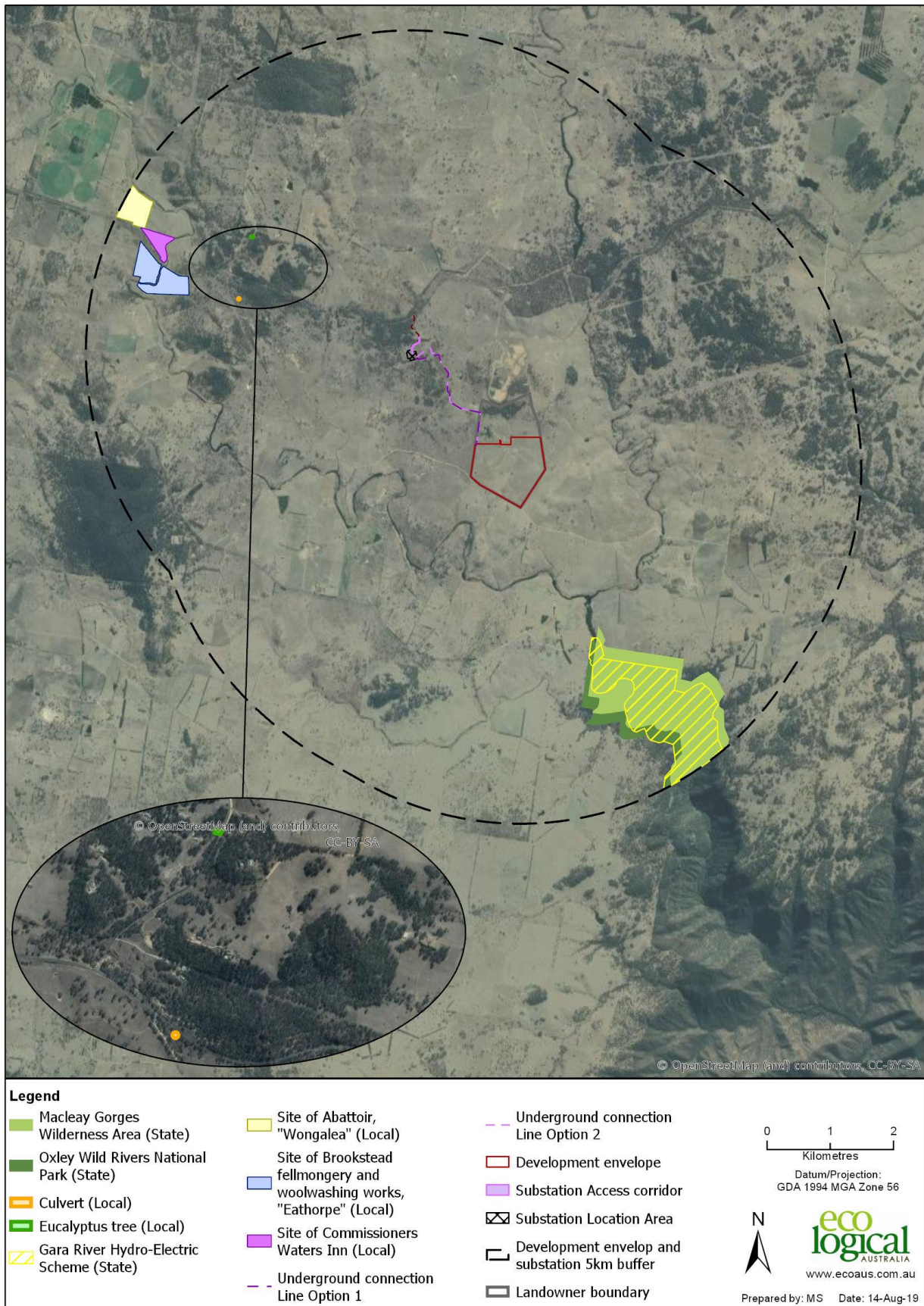


Figure 7-4: Heritage search results within a 5 km buffer of the Site

**Table 7-12: Heritage search results within 5 km of the Site**

| Register   | Item Name   | Item ID | Significance   | Item Location  | Distance to Site |
|--|---|---------|----------------|--|------------------|
| World Heritage List                                | Oxley Wild Rivers National Park                                   | 368-BIS | World Heritage | Approx. 11 km south-east of Armidale                       | 2.9 km           |
| Commonwealth Heritage List                         | None identified   | N/A     | N/A            | N/A  | N/A              |
| National Heritage List                             | None identified   | N/A     | N/A            | N/A  | N/A              |
| NSW State Heritage Register                        | Gara River Hydro-Electricity Scheme                               | 00986   | State          | 10km south-east of Armidale, on Blue Hole Road, Gara Gorge | 2.83 km          |
| Section 170 Registers                              | Gara River Hydro-Electricity Scheme                               | 3902003 | State          | 10km south-east of Armidale, on Blue Hole Road, Gara Gorge | 2.83 km          |
| Armidale Dumaresq LEP 2012                         | Gara River Hydro-Electric Scheme                                  | I002    | State          | 10km south-east of Armidale, on Blue Hole Road, Gara Gorge | 2.83 km          |
|  | Culvert   | I222    | Local          | Gara Road, south-east of intersection with Waterfall Way.  | 2.96 km          |
|  | Site of Brookstead fellmongery and wool washing works, 'Eathorpe' | A039    | Local          | 650 Waterfall Way  | 3.7 km           |
|  | Site of Commissioners Waters Inn                                  | A037    | Local          | Waterfall Way (west of Commissioners Waters)               | 4.3 km           |
|  | Site of Abattoir, 'Wongalea'                                      | A038    | Local          | 475 Waterfall Way  | 4.8 km           |
|  | Eucalyptus Tree   | I149    | Local          | Corner of Middle-Farm Road and Somerset Lane               | 3.18 km          |
| Register of the National Estate (Indicative Place) | Oxley Wild Rivers National Park                                   | 382     | Archive        | Oxley Highway and Waterfall Way, Wollomombi                | 2.83 km          |
|  | Macleay Gorges Wilderness Area                                    | 311     | Archive        | Kunderang Trail, Kempsey Road Armidale                     | 2.84 km          |
| National Trust                                     | None identified   | N/A     | N/A            | N/A  | N/A              |

**Field survey results**

The field surveys (13<sup>th</sup> and 14<sup>th</sup> of May, and 15<sup>th</sup> of July 2019) did not identify any historic heritage items within the Site.

Several features were identified near the Waterfall Way – Gara Road intersection that have been assessed to be associated with the previously recorded 'Culvert' item I222 (Table 7-12) and therefore have a similar local heritage significance to that item's significance. One of these features is located directly below the intersection. These heritage items are discussed below in Section 7.5.2.

### 7.5.2 Potential impacts

The Proposal will not have any direct impacts on any known historic heritage items within the Site.

It is considered highly unlikely any items of historic significance remain unidentified within the Site. The Proposal is therefore unlikely to directly impact on any unknown items of historic significance.

The proposed works to construct the new site access off Gara Road, at 597 Gara Road, Metz will also not result in any direct impacts on any known historic heritage items.

It is considered very unlikely that any items of historic significance remain unidentified within the road verge where the new site access will be constructed due to the highly disturbed nature of the local environment in this location (site survey July, 2019). The proposed road works are therefore unlikely to directly impact on any unknown items of historic significance.

Potential direct and indirect impacts have been considered for all registered heritage items located within 5 km of the Site (as listed in Table 7-12). Due to the nature of the Proposal, potential indirect impacts beyond 5 km are considered to be insignificant.

The following items of historic heritage significance will not be impacted, either directly or indirectly, by the Proposal:

- Site of Brookstead fellmongery and wool washing works, 'Eathorpe' (item A039);
- Site of Commissioners Waters Inn (item A037);
- Site of Abattoir, 'Wongalea' (item A038); and
- Eucalyptus Tree (item I149).

Each of these items is located more than 3 km from the Site. Studies undertaken for each of the potential impacts (visual amenity, noise, traffic and air quality) conclude insignificant direct or indirect impacts at these locations.

Further consideration is given to the following items due to their closer proximity to the site and potentially more sensitive nature:

- Oxley Wild Rivers National Park;
- Gara River Hydro-Electricity Scheme;
- Culvert (Item I222); and
- The features identified during the field surveys.

In order to understand and appropriately manage the potential impacts of the Proposal on a heritage item, it is necessary to understand why the item is considered to be of historic heritage significance. A significance assessment has been undertaken in accordance with the guidelines *Assessing Heritage Significance* (NSW Heritage Office 2001) to establish why a particular site or item is of significance and, if necessary, to enable appropriate mitigation strategies to be developed.

#### ***Oxley Wild Rivers National Park***

The Oxley Wild Rivers National Park is an extensive dry eucalypt rainforest gorge wilderness area, encompassing the Apsley Macleay Gorge system which is one of Australia's largest landscape features of this type (NSW NPWS, 2019). The park is listed under the UNESCO World Heritage Register as part of the Gondwana Rainforests of Australia heritage item and maintains very high values for conservation due to its rich biodiversity, landform significance and ecological value – as well as heritage items located within it, notably the Gara River hydro-electric scheme.

#### ***Statement of Significance***

*The Gondwana Rainforests of Australia is a serial property comprising the major remaining areas of rainforest in southeast Queensland and northeast New South Wales. It represents outstanding examples*

*of major stages of the Earth's evolutionary history, ongoing geological and biological processes, and exceptional biological diversity. A wide range of plant and animal lineages and communities with ancient origins in Gondwana, many of which are restricted largely or entirely to the Gondwana Rainforests, survive in this collection of reserves. The Gondwana Rainforests also provides the principal habitat for many threatened species of plants and animals" (UNESCO, 2000).*

#### *Statement of Impact*

The Oxley Wild Rivers National Park is located approximately 2.83 km from the Proposal at its closest point. The Proposal will have no direct impacts; however there is the potential for indirect effects as the watercourses surrounding the site eventually flow into the Park. The main watercourse that flows into the closest point of the Park is Gara River, which is located 1.3 km from the eastern side of the Proposal. Commissioners Waters (located 0.64 km west of the site) also makes confluence with Gara River before entering into the Park. Potential impacts include the possibility of runoff and erosion which may have effects on the rivers downstream through increased sedimentation – particularly given the high erosion potential of the soil landscapes the site is based on. The potential for this impact is assessed in Section 7.8.3 to be very low given the dilution of any major effect due to distance between the Proposal and the Park. Section 7.8.4 provides mitigation measures to be included in the CEMP that reduce potential impacts to negligible. Additionally, given the land use change during the time of life for the Proposal, it is likely that a reduction in agricultural product use and resultant runoff will occur – potentially offsetting impact that may already be occurring.

Accordingly, it is concluded that no direct or indirect impacts are considered likely to impact the heritage values of the Oxley Wild Rivers National Park.

#### ***The Gara River Hydro-Electric Scheme***

The Gara River hydro-electric scheme was constructed between 1893 and 1895 and it was the first commercial hydro-electric scheme to be constructed in the world. The scheme consisted of a rubble and earth dam of which only two ends survive. Below the dam location, is a low intact concrete weir which spans a narrow location across the Gara River. The eastern end of the weir was designed to divert water from the river into a 500 m flume that splits in two with one half running on wooden trestles (none of which survive in tact), and the other following the fall of the land. At the end of the flume runs, a steep slope leads down to a PowerStation which is in various stages of decay (Gojack et.al. 1988). The scheme was a functioning enterprise in 1907 but after this its history is unclear. Today, the site is located within the Oxley Wild Rivers National Park, under the management of the NSW National Parks and Wildlife Service.

#### *Statement of Significance*

*"The Gara River hydro-electric scheme is of state and national significance because it was the first hydro-electric scheme to light a township in Australia (Hillgrove) and the first to offer its power for commercial sale. As designed by Richard Threlfall, Professor of Physics at the University of Sydney, it incorporated technological innovations which made it one of the most advanced schemes of its time in the world. It provides direct physical evidence of the changing economic fortunes of Hillgrove in the face of the 1890s depression, the drop in antimony prices and the drought. For modern Australian society, it provides a time depth for the environmental debates of hydro versus environment (Gojak et.al. 1988: 32)" (NSW OEH, 2009; inclusive of internal references).*

#### *Statement of Impact*

The Gara River hydro-electric scheme lies approximately 2.8 km to the south-east of the Proposal at its closest point. The Proposal presents no direct impact to the scheme. Studies for visual amenity indicate that the Proposal will not be visible from the scheme, and that noise, traffic or air quality impacts are not significant. As mentioned above for the item 'Oxley Wild Rivers National Park', there is the potential for



indirect impacts regarding runoff and erosion and the resultant affect that the sedimentation has on downstream watercourses – particularly the Gara River, on which the Scheme is based. As above, this impact is managed by the distance between the Scheme and the Proposal, the CEMP and could potentially result in improvements due to reductions in contaminants from fertilizers and other agricultural products.

Accordingly, it is concluded that no direct or indirect impacts are considered likely to impact the heritage values of the Gara River hydro-electric scheme.

### ***Culvert (item I222)***

The culvert is a 19<sup>th</sup> century arched bridge feature that was previously part of the old Armidale – Waterfall Way alignment and is located approximately 45 m south-east from the Waterfall Way-Gara Road intersection. Its location was confirmed during the field surveys. It features a basalt/concrete stone wall construction with a steel support (presumed to be from an old boiler) and pipe, and a metal railing along one edge. The feature is in good archaeological condition and is the larger component of a group of archaeologically associated (non-listed) constructions in the immediate area identified during the field assessments which are discussed further below.

### ***Statement of Significance***

*“The culvert has historic significance as evidence of the alignment of the old Armidale - Waterfall Way”* (NSW OEH, 2010) Additionally, the arched bridge culvert has significance associatively with previous road constructions in the vicinity, is an exemplar of 19th century road construction techniques, has archaeological potential for study and is rare within the Armidale – Dumaresq area (NSW OEH, 2010).

### ***Statement of Impact***

Pending the outcomes of consultation with RMS, the Waterfall Way - Gara Road intersection may require works to support increased traffic volumes during the construction of the Proposal (Section 7.6). It is expected that the arched bridge culvert (item I222) will not be impacted by the proposed intersection works as it is located away from the intersection itself.

It is unlikely that the culvert (item I222), nor any part of its surveyed archaeological association, will be indirectly impacted by other areas of the Proposal (the solar panel array area, underground transmission cable easement corridor or Substation), given the distance (2.96 km) and lack of landscape connectivity that would enable factors such as erosion and runoff to impact the area. Indirect impacts associated with increased traffic flow down Gara Road are also unlikely to occur given the already good design (already avoiding/mitigating historical items) and width of the road which will not be affected by increased traffic flow.

Accordingly, this assessment concludes that no direct or indirect impacts are likely to impact the heritage values of the arched bridge culvert (item I222) and mitigation measures are not necessary.

### ***Field Survey Identified Features***

During the field survey in which the arched bridge culvert (item I222) was located, several other related, but non-listed, features within the area were identified, including:

- A visually similar, but more modern, culvert construction underlying the current Waterfall Way - Gara Road intersection;
- A smaller culvert underlying Gara Road approximately 40 m from the intersection partially constructed with similar materials to item I222, and;
- remnants of road base from the previous alignment.

These areas are considered contextual in association, but not part of, the listed culvert (item I222) and thus contribute to the assessed historical significance of item I222.

It is expected that the smaller culvert item underlying Gara Road will not be impacted by the proposed intersection works as it is located away from the intersection itself; however the culvert item underlying the Waterfall Way - Gara Road intersection does have the potential to be directly impacted if works are required to upgrade the existing intersection.

The potential for impact will depend on the nature of works to be undertaken. Given this, mitigation measures should be followed to avoid impacting the historic heritage within this area when the final design of the intersection is agreed with the relevant authority (RMS) post consent.

It is unlikely that any part of this archaeological association will be indirectly impacted by other areas of the Proposal (the solar panel array area, underground cable easement or Substation Location Area), given the distance (2.96 km) and lack of landscape connectivity that would enable factors such as erosion and runoff to impact the area. Indirect impacts associated with increased traffic flow down Gara Road are also unlikely to occur given the already good design (already avoiding/mitigating historical items) and width of the road which will not be affected by increased traffic flow.

Accordingly, this assessment concludes that no indirect impacts are likely to impact the heritage values of the features, though a direct impact may be caused depending on the nature of works. Mitigation measures are provided below to assist in avoiding impact to the identified heritage item underlying the Waterfall Way - Gara Road intersection.

### 7.5.3 Mitigation measures

#### ***Oxley Wild Rivers National Park and the Gara River Hydro-Electric Scheme***

The low potential for indirect impacts regarding runoff to the downstream Oxley Wild Rivers National Park and the Gara River hydro-electric scheme will be mitigated by the measures outlined in Section 7.2 (Land use and Soils) and Section 7.8 (Water) that will be included in the CEMP and the OEMP.

#### ***Field Survey Identified Culvert underlying the current Waterfall Way - Gara Road intersection***

As a feature of contextual association with the listed culvert (item I222), mitigation measures may be necessary to assist in avoiding unnecessary impact on these features. The mitigation measures should be complimentary with the management recommendations for the associated culvert (item I222). The management recommendations for culvert (item I222) are as follows;

*“The culvert should be retained and conserved. A Heritage Assessment and Heritage Impact Statement should be prepared for the culvert prior to any major works being undertaken. There shall be no alterations to the culvert other than to reinstate original features.”* (NSW OEH, 2010)

The culvert underlying the Waterfall Way - Gara Road intersection (the feature with the potential to be directly impacted) is recommended to be mitigated by avoidance. The associated feature is close to the surface on the southern side of Waterfall Way and follows the natural depression of the landscape, emerging approximately 3 m below Waterfall Way on its northern side. Should works be undertaken at this access point, the eastern bound lane (northern side of Waterfall Way) would require modification, as such, it is expected that works will be able to avoid the areas where this feature is present. This assessment will continue through approval of the works and in conjunction with the assessed requirements for the modifications of the intersection when they are available.

## 7.6 Traffic and Transport

A Traffic and Transport Assessment (TTA) that considers traffic and transport related impacts of the Proposal on the surrounding road network has been undertaken by Constructive Solutions Pty Ltd. The full TTA can be found in Appendix G.

The TTA assesses the traffic and transport related impacts of the Proposal on the surrounding road network and has been prepared with reference to the following guidelines:

- RMS (RTA) *Guide to Traffic Generating Developments Version 2.2* (2002);
- RMS (RTA) *Road Design Guide* (as amended) and relevant Austroads Guides; and
- Austroads *Guide to Traffic Management Part 12: Traffic Impacts of Development*.

As part of the assessment a Road Safety Audit was conducted along the Gara Road and forms an appendix to the TTA.

### 7.6.1 Existing Environment

The Development Envelope, located approximately 14 km east of the Armidale Town Centre at 597 Gara Road in Armidale NSW, shall be accessed off Gara Road for the construction and operational phases of the Proposal. Traffic associated with the construction and operation of the offsite Substation will use an existing access from Waterfall Way.

Based on the requirements of the Proposal, the study area for the TTA includes:

- Waterfall Way from approximately 2 km west of the Gara Road intersection to approximately 2 km east of the Silverton Road intersection;
- Gara Road between Waterfall Way and the proposed Site access; and
- The access from the Waterfall Way for the Substation Location Area which will facilitate vehicles associated with the Substation.

#### **Gara Road**

Gara Road is a local road providing access to rural properties between Waterfall Way and Silverton Road with the Armidale Regional Council as the road authority. The road effectively runs parallel to Waterfall Way to the south.

Gara Road is unsealed, other than a 100 m section of bitumen at the Waterfall Way intersection. The width of gravel pavement varies but is generally between 5 m and 6 m. The horizontal and vertical alignment consists of several curves, crests and single lane causeways. The overall condition of the unsealed pavement is considered to be good, however there are some sections where corrugations are present.

There is no traffic count data available for Gara Road, based on observations during inspections it was concluded that the average annual daily traffic would be less than 50 vehicles per day.

#### *Site Access for the Proposal*

The proposed Site access for the Proposal uses an existing access point at 597 Gara Road. The access point is unsealed and is located on the northern side of Gara Road. Sight distance to the east is greater than 300 m however, the sight distance to the west is restricted to approximately 200 m due to a crest in the road.

## **Intersections**

### *Waterfall Way and Gara Road*

The intersection of Waterfall Way and Gara Road is a basic T-intersection configuration with Waterfall Way as the priority road. There are no auxiliary turn lanes on Waterfall Way. Sight distance in both directions is greater than 300 m along Waterfall Way and signage consists of a Give Way sign and sight board located opposite the intersection. The pavement is sealed and considered to be in reasonable condition at the mouth of the intersection.

### *Waterfall Way and Proposed Substation Access*

The existing access point for the Substation Location Area is at 1060 Waterfall Way approximately 3 km east of the Gara Road intersection. The access point is unsealed and is located on the southern side of Waterfall Way. The existing access is positioned on the outside of a curve and the sight distance to the east and west along the Waterfall Way is approximately 300 m and 260 m respectively.

## **Bus Services, Pedestrian and Cycling Activity**

There are two school bus services operated by Edwards Coaches. The operator advised that these services travel along Waterfall Way, one to Wollomombi and one to Hillgrove. Both services commence pick-ups at approximately 7:30 am in the morning with students arriving in Armidale at approximately 8:15 am. The afternoon runs commence at approximately 3:45 pm from Armidale and end at approximately 4:30 pm. The school buses stop at informal locations along the Waterfall Way to pick up and drop off passengers (i.e.: side road intersections and property entrances).

No pedestrians or cyclist were observed during the inspections along Waterfall Way within the study area. As the surrounding area is rural, there are no dedicated on-road cycleways or off-road shared paths (for cyclists and pedestrians) along the surrounding road network.

### **7.6.2 Potential Impacts**

The construction phase for the Proposal is anticipated to be approximately 9 months and the concurrent construction phase for the Substation is anticipated to be approximately 7 months. The majority of workers during the construction phase of the solar farm will travel to the Site in mini buses therefore minimising the impact of Proposal related traffic on the surrounding road network.

Proposal related traffic during the construction and operational phase over the 10 year horizon will result in a minor increase to traffic volumes on Waterfall Way however, it is considered that the road has sufficient capacity to cater for the combined background traffic.

The existing daily traffic volumes on Gara Road are low (less than 50 vehicles per day) and remain relatively low taking into consideration the average daily traffic volumes associated with the construction phase (5 heavy vehicles and 11 light vehicles) and the operational phase (7 light vehicles) beyond the 10 year horizon following the commencement of operations.

Impacts on the surrounding road network in terms of school bus services will be minimal and insignificant for pedestrians and cyclists.

### **7.6.3 Mitigation measures**

To facilitate construction traffic safely, the assessment recommends shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment as well as the provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the Gara Road intersection, during the construction phase.

At the intersection of Waterfall Way to the Substation Location Area (1060 Waterfall Way), the assessment also recommends the provision of shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment. Both intersection upgrades are to be completed to a level that satisfies the requirements for a rural property access as per Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General*.

Existing road safety issues along Gara Road between the Waterfall Way and the Site access have been identified. Interim measures, such as the provision of give way signage in one direction at the locations where the road has a narrow formation and tight radius bends, could be implemented during the construction phase to ensure that Heavy Vehicle passing maneuvers at these locations are mitigated.

The proposed Site access is currently the main access to the landholding at 597 Gara Road, as a result of the Proposal, a new access for the landowner will be required. It is proposed that this new access be located further west along Gara Road and be constructed to satisfy the requirements for a rural property access as per Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General*.

A Traffic Management Plan (TMP) and driver code of conduct will be prepared and included in the CEMP for implementation during the construction phase. This will assist with the control of Proposal-related traffic movements (including the use of mini buses), and ensure that driver behaviour within the Site and on the surrounding road network is maintained to a safe level that accounts for local conditions given the deficiencies along Gara Road identified from the Road Safety Audit.

The TTA concludes that, subject to the recommended roadworks being implemented, there are no Proposal-related traffic and transport issues which would prevent the Proposal from proceeding.

## **7.7 Visual Impact**

### **7.7.1 Introduction**

A Landscape and Visual Impact Assessment (LVIA) was undertaken by Jacobs Pty Ltd. The LVIA report (Appendix E) assesses the landscape and visual impacts of the Proposal, including any potential for solar glare, from publicly accessible locations along the surrounding road network and from residential dwellings where access permission was granted for this purpose. The LVIA report is summarised below.

### **7.7.2 Existing Environment**

The Site is located approximately 14 km east of the Armidale. Access to the Site for construction and operations will be from Gara Road and Waterfall Way.

The Site and the majority of the surrounding area is within the Rural Use 1 – Primary Production (RU1) land use zone. Areas to the west of Burying Ground Creek nearer to Armidale and south of Commissioners Waters are zoned Rural Use 4– Primary Production Small Lots (RU4). These zones are set aside for the protection and continued use of these areas for farming and agricultural purposes; uses that are not sensitive to visual change and are recognised as having the potential for offsite amenity impacts.

### **7.7.3 Potential Impacts**

Photomontages prepared for the Proposal demonstrate vegetation, topography and built form will screen or filter views from most locations. Where there are clear open views to the Proposal, the proposed solar array would not be a dominant feature.

Views from and visual impacts to the surrounding road network are limited to short section of Gara Road, which is a local gravel road with few road users. Views from Castledoye Road and Blue Hole Road further to the south, are limited to locations where a break in topography, vegetation and buildings permits views across the landscape to the north and towards the Site. These roads carry relatively low traffic numbers and therefore limit the potential number of people who may view the Proposal. The visual impact to the local road network will be negligible.

The Proposal will be visible from residential dwellings in the farming areas to the south of Site. These dwellings are within an area that is zoned RU4, a zone which contemplates some amenity impacts from nearby RU1 farming areas.

The visual impact to residential dwellings has been assessed as negligible to low. This assessment is due in part to the views from the majority of the residential dwellings being partially screened or filtered by either topography, vegetation or both, and where the Proposal is visible, dwellings are at a such a distance that the Proposal would not be a dominant feature in views.

Over time, the proposed landscape mitigation (Section 7.7.4) would further assist to reduce visibility of the solar array, further reducing the visual impact of the Proposal.

The solar glare assessment reviewed the potential for glare impacts to 32 sensitive receptor locations in the area where the Seen Area Analysis demonstrated theatrical visibility of the proposed solar array. There were no locations where solar glare of any magnitude was predicted.

### **7.7.4 Mitigation measures**

Through the extensive assessment process and ongoing consultation, the Proponent has refined the design of the Proposal and identified commitments to reduce potential impacts on amenity. There are several key ways in which to mitigate the visual impact of a project. Regarding visual impacts, these include:



- 1) *Avoiding impacts wherever practicable by locating project infrastructure in areas that are not visible or where there are few sensitive receptors.* This principle has influenced the location of the proposed Substation Location Area and the undergrounding of the transmission cable connecting the Solar Array to the Substation.
- 2) *Minimising the potential visual impacts of a project by modifying the project footprint or other visible components of the project.* This has influenced the retention of existing vegetation around the periphery of the Site and a reduction of the northern extent of the solar array area to reduce the overall elevation of the Proposal, reducing its visual prominence from areas to the south.
- 3) *Exploring locations where mitigation may assist in reducing any visual or glare impacts identified.* The photomontages produced for the LVIA demonstrate that landscape mitigation (including vegetation screens) can and will be an effective measure in managing potential visual impacts that might be brought about by the Proposal from sensitive viewing locations. As such, a draft landscaping plan has been developed for the Proposal.

### **Draft Landscaping Plan**

The landscaping plan has been developed in response to the findings of the LVIA, with the objective of further minimising visual impacts at sensitive receptors. Landscape mitigation measures, including vegetation screens, are an effective and accepted measure to assist with reducing visual and glare impacts of solar farm projects.

Three locations along the southern and western edge of the Site have been identified where the establishment of landscape screening would be of benefit to views from the surrounding area (see Figure 11-1 in Appendix E, these are also illustrated in Figure 3-4).

The vegetation screens are intended to grow densely and to a height taller than the panel array. It is proposed to install a range of local indigenous species that were observed in recent plantings near the Proposal. Suggested species include:

- *Eucalyptus leucoxylon rosea*
- *Eucalyptus blakelyi*
- *Eucalyptus boliviana*
- *Eucalyptus stricta*
- *Banksia integrifolia*

These species are a guide only and would be selected based on guidance from local nurserymen or Landcare groups and agreed performance criteria to provide complementary biodiversity outcomes. To ensure the success of the landscape screening, a Landscape Management Plan would be developed for the establishment and maintenance of the proposed landscaping in consultation with the Armidale Tree Group and included in the CEMP and OEMP.

## 7.8 Water

### 7.8.1 Introduction

This section considers potential impacts associated with the Proposal on water resources, having regard to surface water and groundwater resources, riparian land, groundwater dependent ecosystems (GDEs), adjacent licensed water users and basic landholder rights. The assessment included the following steps:

- Consideration of existing environmental conditions through desktop and field assessments;
- Impact assessment; and
- Identification of mitigation and management measures.

### 7.8.2 Existing Environment

The Site lies within the upper reaches of the Macleay River Catchment. This catchment occupies 11,450 km<sup>2</sup>, and incorporates extensive areas of the Northern Tablelands, a sparsely populated escarpment area of the Great Dividing Range and a coastal area ranging from foothills to coastal floodplains. Many of the rivers in the Macleay catchment are unregulated, and most water users rely on small structures for their water supplies. Flows are most affected during dry periods where water availability is low, and demand is high.

#### **Surface Water**

The (91 ha) Development Envelope has a catchment area of approximately 171.24 ha and contains 1<sup>st</sup> and 2<sup>nd</sup> order (Strahler, 1952) drainage lines and five farm dams which retain small quantities of water following periods of rainfall (Figure 7-5). These drainage lines mostly flow to the south-west, joining Commissioners Waters approximately 1 km downstream of the Development Envelope, while small portions drain east to Lambing Gully and then Gara River. The Substation Location Area has no drainage lines or farm dams (Figure 7-5). Commissioners Waters meets Gara River which flows into Gara Gorge, part of the World Heritage Listed Oxley Wild Rivers National Park, before joining Salisbury Waters to eventually join the Macleay River which then flows to the Pacific Ocean near South West Rocks. The onsite drainage lines were dry during field investigations and appear to be highly ephemeral with minimal bank delineation, limited riparian vegetation and with evidence of rill and gully erosion in places. As such, they resemble broader drainage lines in grazed paddocks, rather than streams with a defined bed and banks. Additionally the small size of the farm dams indicates that their presence in the gently sloping landscape would have minimal influence on flow rates and water levels, including during rainfall events.

A search of relevant databases did not identify any existing hydrological or water quality data relating to the drainage lines within the Site or the downstream Commissioners Waters and Gara River. Accordingly, information provided below is based on the findings of Site reconnaissance, results for nearby streams, and expert knowledge.

Water access rules at the Site is in accordance with the *Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources* (NSW DPI - Water, 2016). The Report Card for the Gara River Surface Water Source indicates an 80<sup>th</sup> percentile flow volume of 0 ML/day, indicating the highly ephemeral nature of the water source. Water quality objectives for the Macleay (NSW DECCW, 2006) include those for:

- Aquatic ecosystems;
- Visual amenity;
- Primary and secondary contact recreation;
- Livestock, Irrigation and Homestead water supply;
- Drinking water (Disinfection only/clarification and disinfection/groundwater);
- Aquatic foods; and
- Industrial water supplies.

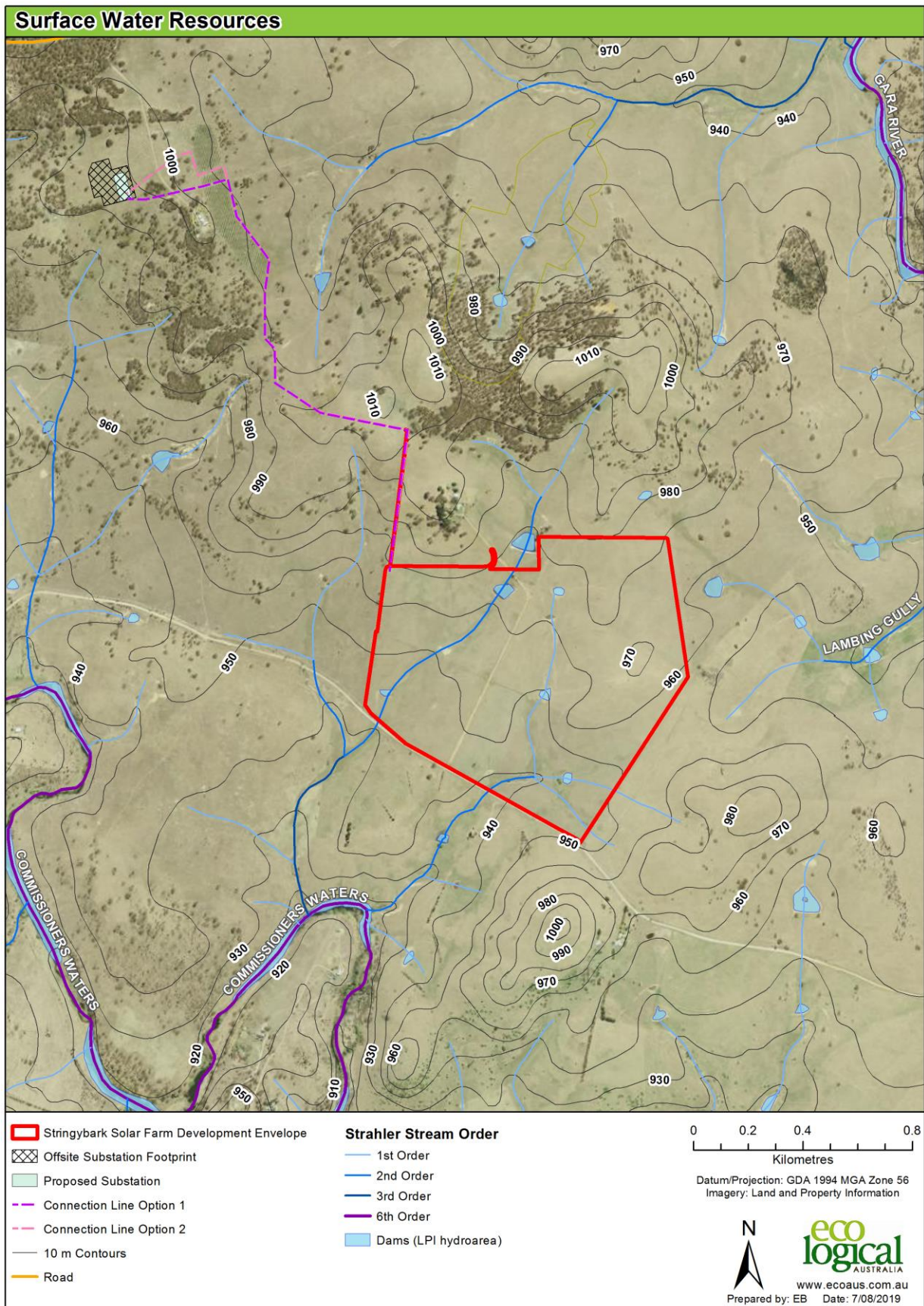


Figure 7-5: Surface water resources within and adjacent to the Site

## Groundwater

The Site does not contain any groundwater bores, however a review of the WaterNSW (n.d.) online *All Groundwater Map* and the BoM (2018) *Groundwater Explorer database* identifies two bores within a 2 km radius of the Site, both used for stock and domestic purposes (Figure 7-6; WaterNSW, n.d.). Data for these bores (GW305317 and GW307568) indicate relatively deep groundwater levels, with standing water level (SWL) depths of 31.4 metres below ground level (mbgl) and 19 mbgl, respectively (Table 7-13).

**Table 7-13: Observed yields and depths of nearby bores**

| Bore ID  | Latitude   | Longitude  | Registered use | Total depth (m) | SWL (mbgl) | Yield (L/s) | Salinity |
|----------|------------|------------|----------------|-----------------|------------|-------------|----------|
| GW305317 | -30.552745 | 151.781245 | Stock/Domestic | 38.72           | 31.4       | 0.76        | potable  |
| GW307568 | -30.561664 | 151.765009 | Stock          | 61              | 19         | 0.3         | potable  |

Available groundwater yield records suggest the fractured rock aquifer has low productivity with reported groundwater yields of < 1 L/s. Limited baseline groundwater quality data is available, with the salinity of the bores merely being described as “potable”. The use of groundwater for stock and domestic purposes, although limited, implies “fitness for purpose”.

## Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that have their species composition and natural ecological processes wholly or partially determined by groundwater (Geoscience Australia, 2017). Types of ecosystems that can rely upon groundwater include:

- Terrestrial vegetation that show seasonal or episodic reliance on groundwater;
- River base flow systems which are aquatic and riparian ecosystems in or adjacent to streams/rivers dependent on the input of ground water for base flows;
- Aquifer and cave ecosystems;
- Wetlands;
- Estuarine and near-shore marine discharge ecosystems; and
- Fauna which directly depend on groundwater as a source of drinking water of that live within water which provide a source.

A search of the Bureau of Meteorology’s (BoM) *Groundwater Dependent Ecosystem Atlas* (BoM 2017) indicates there are areas in the vicinity of the Site that have low potential for GDEs reliant on subsurface groundwater (vegetation) (Figure 7-6). There are no mapped potential GDEs within the Development Envelope; however, the Substation Location Area and connection line would be partially located within mapped low to moderate potential GDE areas. It is noted that the BoM assessment is based on national and regional studies involving remote sensing, vegetation community mapping and groundwater level data. The *Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources* identified no high priority GDEs within the Site.



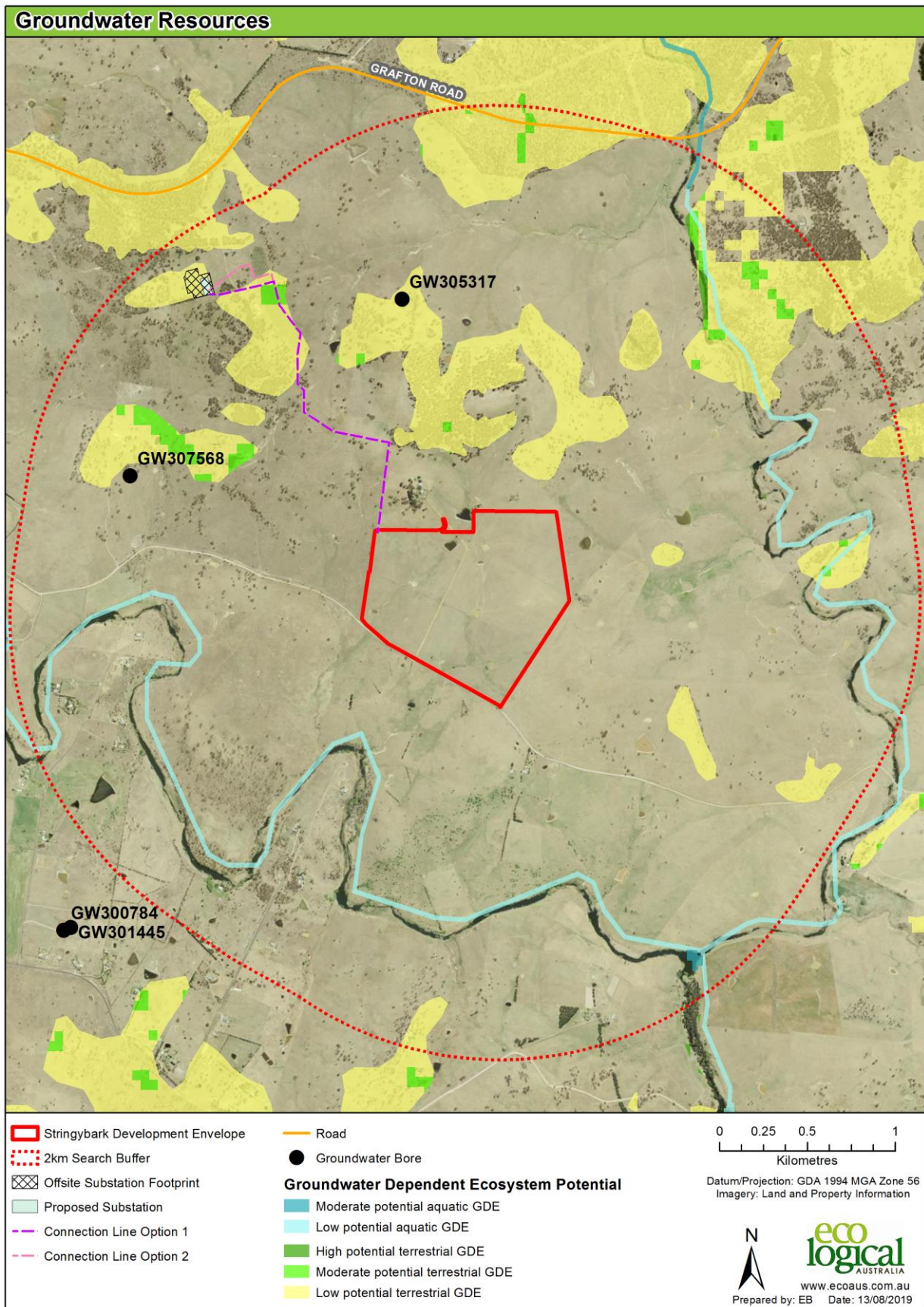


Figure 7-6: Groundwater resources in proximity of the Site (BoM, 2017; WaterNSW, n.d.)

### Aquatic Ecosystems

Riparian vegetation and riparian zones throughout the Site are highly degraded, having been cleared, grazed, sown and modified to support agricultural activities and comprise mostly exotic grass species (Appendix A). No native trees occur within the riparian zones in the Development Envelope, and the remainder of the Site does not contain riparian zones. Eroded tracks and cattle pads leading into the water remaining in dams indicate unregulated livestock access within the area.

Downstream of the Site, the Gara River and Commissioners Waters are classified as Key Fish Habitat under the FM Act (NSW DPI, n.d.). Within the Development Envelope, the unnamed watercourses are classified as *unlikely fish habitat* (Class 4 waterway - Fairfull, 2013).

A desktop constraints analysis identified three threatened aquatic species with potential to occur within the Site and its vicinity (Table 7-14). While areas downstream of the Development Envelope have potential to be habitat for these species, the highly ephemeral nature of the channels, lack of a natural riparian zone and extensive agricultural activity along the creek make it highly unlikely that these species would occur at the Development Envelope.

**Table 7-14: Likelihood of occurrence of threatened aquatic species**

| Species                  | Common Name                     | Status     |          | Source     | Habitat Potential   |
|--------------------------|---------------------------------|------------|----------|------------|---|
|                          |                                 | NSW BC Act | EPBC Act |            |   |
| <i>Litoria castanea</i>  | Yellow-spotted Tree / Bell Frog | CE         | E        | DoE, 2019a | <b>Unlikely.</b><br>There are no permanent ponds, swamps, lagoons, slow-moving streams or still backwaters of rivers. The few permanent farm dams on-site are degraded and lack tall reeds and overhanging grassy banks<br>No NSW BioNet Atlas records within 10 km of Site.    |
| <i>Litoria piperata</i>  | Peppered Tree Frog              | CE         | V        | DoE, 2019b | <b>Unlikely.</b><br>Occupies rocky streams in open forest and wet sclerophyll forest. Adults are active in bushes or on rocks at the edge of creeks. There are no permanent creeks with rocky substrate on-site.<br>One NSW BioNet Atlas record 4.5 km south of Site from 1984. |
| <i>Wollumbinia belli</i> | Bells Turtle                    | E          | V        | DoE, 2019c | <b>Unlikely.</b><br>There are no permanent pools deeper than 2 m with complex underwater habitat. There are no permanently-flowing rivers on-site.<br>No NSW BioNet Atlas records within 10 km of Site.   |

V = Vulnerable; E = Endangered; CE = Critically Endangered.

Assessment of terrestrial habitat for threatened species is given in Section 7.3 and Appendix A.



### 7.8.3 Potential impacts

The Proposal has been assessed as unlikely to have significant impacts on water resources. There is low potential for indirect impacts to occur during the construction, operation and decommissioning stages through the process of erosion and sedimentation. The Site has been designed to minimise potential impacts to water resources. Potential impacts to water quality, quantity and aquatic ecosystems for both surface and groundwater resources during construction (including decommissioning) and operational phases are considered in the following sections.

#### ***Hydrology Impacts***

The installed solar panels will be raised above the ground on piles and therefore not an obstruction to the flow of water across the Development Envelope. Cook and McCuen (2013) found that there was little influence of solar panels on runoff volumes, peak flows or the time to peak flows, when the groundcover under the solar array was unchanged.

Due to the decommissioning of small stock dams and the more impervious nature of proposed permanent access tracks inverters, operations compound (buildings and hardstand) and the Substation areas, a slight increase in localised runoff from these features is likely. However, the results of previous studies on similar projects, including nearby Metz Solar Farm and Sapphire Solar Farm (ELA, 2017; ELA, 2018; ELA, 2019; Jempson, 2019), indicate these localised effects would be very minor and therefore no adverse hydrological or hydraulic effects on neighbouring lands are anticipated.

Additionally, as the farm dam immediately north of the Development Envelope will remain in place and continue to catch runoff from the drainage lines originating from the steeper ridgeline and as the farm dams to be decommissioned are small and on a relatively gentle slope, the hydrology of the onsite 1<sup>st</sup> and 2<sup>nd</sup> order streams is unlikely to be substantially altered to where it would have a negative hydrological impact that could potentially increase erosion.

#### ***Surface Water Quality***

##### *Construction and Future Decommissioning*

The proposed construction and decommissioning works involve a range of activities that disturb soils and could potentially lead to sediment laden runoff, affecting local waterways during rainfall events. These activities include:

- Excavations for the construction of internal roads, support buildings, construction laydown and parking areas;
- Ground preparations including some localised areas of cut and fill associated with the installation of PV panels and inverters;
- Ground preparations for overhead cable installation between the Substation and the 66 kV line;
- Trenching for below ground cable installation;
- Dewatering and decommissioning existing surface water dams within the Development Envelope; and
- Soil compaction and reduced permeability in areas of hardstand and access tracks.

Surface water runoff, waste or debris created during construction works could pollute surrounding waterways, for example via strong winds or runoff to Gara River during unforeseen extreme weather events. As the removal of the small farm dams within the Development Envelope is unlikely to significantly affect runoff or increase erosion in the onsite 1<sup>st</sup> and 2<sup>nd</sup> order streams, the potential for increased sedimentation downstream as a result of the absence of these farm dams is negligible.

The use of fuels, lubricants, herbicides and other chemicals during construction and operation pose a risk of surface and groundwater contamination in the event of a spill, this is also discussed in Section 7.2. Chemicals commonly used onsite would include fuels, lubricants and herbicides.

### *Operation*

Operational impacts to surface water resources are considered negligible. The operational land use as a solar farm would likely reduce the potential for impacts to water quality, compared to current agricultural land use practices. Potential water quality benefits would include a decrease in soil disturbance compared to the current land use (grazing and potential pasture improvement activities). The elimination of grazing or at the very least a reduction in stocking rates would reduce erosion, sedimentation and riparian disturbance at the Site and hence impacts on surface water quality. In addition, a decrease in fertiliser use and stocking rates would reduce the potential for nutrients to enter surface waters.

Although the installation of PV panels presents a large impervious surface standing above the ground at approximately 2.0 m, the flat nature of the panels, and the separation distance between rows (approximately 5.5 – 12 m) will quickly return rainfall as runoff to the natural ground to allow surface penetration and/or run-off to occur in a typical manner. Disturbed areas would be revegetated in order to stabilise the ground surface. This should prevent soil erosion and, thus, sedimentation impacts to surface water. The installation of tracking rather than a fixed panel system allows water to drip onto different areas of the ground as the panels track east to west daily, instead of continually being focussed on the same dripline. However, it is acknowledged that some soil scarring could occur under the panels resulting from sudden and intense rainfall events which may, if left untreated, result in soil erosion and potential impacts to surface water. Sedimentation may also occur from increased runoff due to the more impervious nature of small areas of permanent access track, inverters, operations compound (buildings and hardstand) and the Substation.

### **Surface Water Quantity**

#### *Construction and Future Decommissioning*

The Proposal will require non-potable water for dust suppression and cleaning purposes during the construction phase. This water would be sourced from existing farm dams as part of the dewatering process, and offsite without the need for an application for a water licence, therefore not impacting upon the quantity of water available to surrounding water users or upon water related infrastructure. If a licence is required, the regulator is to determine the potential impact as part of the application process. Surface water access and use is authorised under the WM Act, in accordance with the provisions of the *Water Sharing Plan for the Macleay River*. Mitigation measures are provided in Section 7.8.4.

Water required for staff amenities shall be sourced from on-site rainwater tanks or delivered to Site as potable water.

### *Operation*

Panel cleaning requirements depend on prevailing weather conditions at the Site. Some solar plants are never cleaned, while others require multiple cleanings per year. Given the vegetated landscape and climate associated with the Site (117 days of rain average per annum; BoM, 2018), resulting in generally low levels of dust (Section 7.12 for further detail), it is anticipated that the Proposal will require infrequent cleaning. If required, it is anticipated that water requirements for panel cleaning would be secured through commercial arrangements with a local water supply company and trucked to Site. The volumes of water used for individual panel cleaning shall be insufficient to pose an erosion threat, given the proposed erosion and sedimentation mitigation discussed below.

### **Impacts to Groundwater Quality and Quantity**

No groundwater is proposed to be sourced during construction, operation or decommissioning of the Proposal. Therefore, the Proposal is unlikely to influence groundwater systems or the water balance of the Site, nor would an aquifer interference approval as per the *NSW Aquifer Interference Policy* be required. Accordingly, groundwater monitoring is neither warranted, nor proposed.

No operational activities at the Site would affect groundwater. Subsurface disturbances would be limited to trenching, shallow excavation, and piling activities during the construction phase of the development. Interference of the groundwater resource during construction is considered to be negligible because construction activities at a maximum depth of 2 m would not intersect groundwater at the Site (Table 7-13). Potential groundwater quality impacts will be managed through the surface water quality mitigation measures described in Section 7.8.4.

### ***Impacts to Riparian, Aquatic and Groundwater Dependent Ecosystems***

The solar farm is not likely to have a significant impact on aquatic ecology as the drainage lines and riparian zone is already degraded by past clearing and cattle access. Impacts downstream of the Site to Commissioners Waters and the Gara River from the proposed solar farm will be negligible.

Background searches of threatened species that may occur in the locality has indicated potential occurrence of three threatened aquatic species. However, field survey has concluded that it is unlikely that these species occur in the area and that their preferred habitats do not occur onsite, so the potential for impact to either species is negligible.

As described above, the Proposal will not impact groundwater. Small areas of terrestrial vegetation mapped as moderate to low potential as GDE, may be cleared in the area of the Substation Location Area and the underground connection cable. Impacts to terrestrial vegetation are assessed and offset in accordance with the BDAR (Appendix A) prepared for the Proposal. All other potential GDEs are unlikely to be directly or indirectly impacted by the Proposal.

### ***Construction and Future Decommissioning***

Construction and decommissioning activities have the potential to cause direct physical disturbance associated with constructing crossings over drainage lines, and the laying of electrical cables to small areas of riparian, aquatic and (in the Substation Location Area) potential GDEs. Additionally, impacts to surface water quality have the potential to indirectly impact these ecosystems.

These impacts are considered to be minor and it is concluded that indirect impacts do not pose a threat to the aquatic environment. Nevertheless, mitigation measures to reduce risk of runoff induced sedimentation to existing riparian, aquatic and ground water dependent ecosystems, as well as to reduce impacts from potential chemical spills are proposed in Section 7.8.4.

### ***Operations***

Operational activities will have negligible direct impacts on riparian, aquatic and groundwater dependent ecosystems. Compared to current land use, reduced agricultural pressure would reduce erosion and improve the ecology of riparian and aquatic habitats relative to current conditions.

As there would be no significant change in the overall hydrology of the Site during the operational period of the Proposal, operational activities would have negligible indirect impacts on riparian, aquatic and ground water dependent ecosystems.

#### 7.8.4 Mitigation measures

The Proposal has been designed to minimise potential impacts to water resources and aquatic ecosystems. As a result of a design philosophy that, in the first instance seeks to avoid impacts, the following environmental protections apply:

- Exclusion of higher order streams from the Site;
- Avoidance of footings and pilings, where practicable, from 1<sup>st</sup> and 2<sup>nd</sup> order drainage line riparian zones;
- Minimisation of drainage line crossings for internal access and electrical cabling, and in accordance with permit conditions where necessary;
- Avoidance or offsetting of existing vegetation within the potential GDEs mapped in the Site, where appropriate;
- Sourcing of non-potable water from rainwater tanks, and/or existing licenced water sources offsite; and
- Sourcing all potable water requirements offsite.

All works undertaken in and around watercourses should be carried out in accordance with DPI Water *Guidelines for Controlled Activities* (2012). A CEMP and OEMP shall be developed in consultation with DPI Water ([water.referrals@dpi.nsw.gov.au](mailto:water.referrals@dpi.nsw.gov.au)), prior to the commencement of activities, to assess and identify appropriate construction and operational protocols to ensure the protection of surface and groundwater quality, maintenance of water supplies and rights of access, and, where relevant, the appropriate protection of riparian and aquatic ecosystems, and the potential GDEs. A similar plan would be developed within the DMP to guide decommissioning activities in accordance with relevant requirements at the time. Specific mitigations to potential impacts by topic are outlined below.

##### *Water Quality*

Erosion and sedimentation impacts associated with soil disturbance from construction activities will be minimised by undertaking works in accordance with provisions of the *Managing Urban Stormwater: Soils and Construction* series, in particular:

- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom, 2004), known as ‘the Blue Book’;
- Volume 2A Installation of Services (DECC, 2008a); and
- Volume 2C Unsealed Roads (DECC, 2008b).

Procedures shall be adopted to minimise the risk of water quality impacts associated with sedimentation and contamination of surface water resources (Section 7.2 provides detail on contamination mitigation measures and an Erosion and Sediment Control Plan to be incorporated in the CEMP OEMP and DMP).

Water quality protocols include establishing and maintaining ground vegetation cover across the Site to minimise potential for erosion (including erosion associated with scouring beneath the panels following significant rainfall events during operation), and consequently, to therefore minimise potential sedimentation impacts to water quality. Groundcover species selection and management will be undertaken in continued consultation with local agronomists (GrazAg) and seek to balance between maintaining groundcover at the Site, future agricultural land uses, and bushfire management objectives to avoid a build-up in combustible vegetation. Protocols for the management and reinstatement of groundcover will be compiled in a Landscape Management Plan to make sure groundcover is reinstated after disturbance during construction and preserved and managed during the operational life of the solar farm. GrazAg advice indicates that the establishment of groundcover within the array area would not be problematic; however, the Landscape Management Plan will also include alternative measures to protect

soils in the unlikely event that pasture establishment is unsuccessful in producing adequate cover to protect soils.

Access tracks shall be maintained in good condition, ensuring that associated drains and/or sedimentation traps are monitored and maintained so that potential erosion associated with the tracks, which could lead to impacts on water quality, is minimised.

Management of construction waste and sewage would be detailed in the CEMP. Waste produced from toilets shall be stored in a septic tank until it is trucked off site and disposed of in accordance with EPA (2016) requirements. All hazardous materials will be classified and appropriately stored to prevent contamination of drainage lines. All hazardous materials (fuels, lubricants, construction chemicals, herbicides, etc.) will be transported and disposed offsite in accordance with EPA (2016) guidelines to avoid release to the environment, and contamination of water systems (see also Section 7.13 which details commitments for responsible disposal of this material under the POEO regulations and the WARR Act). Onsite refuelling shall occur within designated areas located more than 100 m from the nearest drainage line and within an impervious bund. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from engines or hydraulic systems. All contractors and staff will participate in toolbox talks to prevent, minimise and manage accidental spills.

A Spill Response Plan (SRP) will be developed and included as part of the Environmental Management Plans. All contractors and staff will be trained regarding appropriate spill response strategies. Should a spill occur, incident management procedures provided in the SRP will be implemented and the EPA will be notified of any incidents that cause harm to the environment, pursuant to sections 147 – 153 of the POEO Act.

#### *Water Quantity*

Non-potable water required for the Proposal would be sourced offsite under agreement with existing water access licences. Accordingly, a water access licence from DPI Water would not be required for construction activities.

Potable water required for the construction, maintenance and decommissioning phases of the Proposal will be sourced from local water cartage services in the surrounding area, along with ensuring appropriate DPI water licences are held.

#### *Riparian, aquatic, and groundwater dependent ecosystems*

Construction and decommissioning activities will avoid impacts to riparian and aquatic ecology, avoiding direct impacts where possible and adopting best practice where necessary.

To minimise direct impacts to riparian, aquatic and groundwater dependent ecosystems, excavation activities will be located away from drainage lines where possible. However, vehicular culvert crossings and cables required for the Proposal will cross 1<sup>st</sup> and 2<sup>nd</sup> order drainage lines. Approval under the WM Act is required as installation of vehicular and cable crossings on waterfront land is a controlled activity. Accordingly, relevant design considerations will be followed as per the NSW Office of Water's *Controlled Activities: Guidelines for laying pipes and cables in watercourses*, and where vehicular crossings are required, a culvert would be used in line with the requirements of Class 4 waterway recommendations under the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI, 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003). These measures will avoid negative impacts to riparian, aquatic and groundwater dependent ecosystems.

## 7.9 Noise

### 7.9.1 Introduction

A construction and operational noise assessment was prepared for the Proposal by TTM Consulting Pty Ltd. The full acoustic assessment report can be found in Appendix F. This section provides a summary of the existing environment, methods, results and discussion of the noise impact assessment and steps to be taken to mitigate potential impacts to nearby sensitive receptors and the environment. The noise impact assessment includes the following:

Construction noise assessment:

- Identification of construction stages and associated activities including, specialised machinery and equipment used during the works;
- Assessment in accordance with *NSW Interim Construction Noise Guideline* (DECC, 2009); and
- The identification of appropriate mitigation and management measures.

Operation noise impact assessment:

- Assessment of the Substation, inverters, transformers and other noise generating equipment in accordance with the *NSW Noise for Industry Policy* (EPA, 2017); and
- The identification of appropriate mitigation and management measures.

### 7.9.2 Existing Environment

The Site is located in a rural area with an acoustic environment that is dominated in most parts by natural sounds, generally characterised as low background levels.

The background noise levels of the area have therefore been estimated by refereeing to Appendix A of the Australian Standard AS 1055.2<sup>3</sup>. The standard provides estimated average background noise levels for different areas in Australia, which may be used as a guideline.

In accordance with Appendix A of AS 1055.2 (extract attached in Appendix F), the noise area category R1 (with the lowest background noise levels) is relevant to the site and has been used for this assessment. The corresponding average background noise levels for Category R1 are summarised in Table 7-15.

**Table 7-15: Average background noise levels for a noise area Category R1**

| Time Period | Hours  | Average background noise Level, L <sub>90</sub> , in dB(A) |
|-------------|--|--|
| Day         | from 0700 to 1800 (Monday to Saturday) and<br>0900 to 1800 (Sundays and Public Holidays) | 40   |
| Evening     | from 1800 to 2200  | 35   |
| Night       | from 2200 to 0700 (Monday to Saturday) and<br>2200 to 0900 (Sundays and Public Holidays) | 20   |

#### *Noise Sensitive Receivers*

The four closest non-involved residential dwellings have been identified as noise sensitive receivers for the noise assessment as shown on Figure 7-7. These are referred to as noise sensitive receivers (NSRs) and have been the subject of the noise impact assessment to determine whether, and analyse how, they may potentially be adversely impacted by noise from the construction and operation of the Proposal. Noise impacts at receivers further away than the assessed NSRs will be significantly less due to increased distance attenuation. As such, if noise impacts are found to be acceptable at the four NSRs, it can be inferred that noise impacts are acceptable at all sensitive receivers in the wider area.





Figure 7-7: Noise Sensitive Receivers

### 7.9.3 Potential Impacts

The Proposal has been assessed as unlikely to have significant impacts on the identified NSRs.

#### **Construction Noise**

The noise impact of construction activities for each applicable construction phase has been predicted for a worst-case scenario. The noise prediction has been based on the following:

- All plant and equipment for each construction phase are operating simultaneously at the same location;
- Plant and equipment sound power level information for construction processes including;
  - Site preparation works;
  - Track construction;
  - Civil construction of benches ;
  - Construction/ installation activities including:
    - Site fencing
    - Piling works
    - Tracking and PV panel and inverter installation; and
    - Cable trenching.
    - OHL construction
    - Construction of the operational compound
    - foundations
  - Deliveries; and
  - Waste collection.
- Distance attenuation - assessing the maximum impact worst-case scenario of construction works occurring at the closest boundary of the Site to each respective receiver. This ensures the right mitigation methods are implemented. Maximum impact will, however, be for a short duration until the activities move to a different location; and
- Atmospheric, meteorological and ground noise attenuation using the CONCAWE method, where applicable.

Based on criteria set out in the Acoustic Impact Assessment (Appendix F), a predicted approximate noise impact radius was derived for each construction process above. This information was then used to understand the potential noise impacts associated with the Proposal at the four NSRs.

The predicted noise levels have then been compared to the following *NSW Interim Construction Noise Guideline* (ICNG) noise targets, during recommended standard hours for construction of Monday to Friday 7am to 6pm and Saturdays 8am to 1pm with no work on Sundays or public holidays:

- ICNG noise management level of 50 dB(A), and
- ICNG highly noise affected limit of 75 dB(A).

The assessment found that no NSRs are predicted to be highly noise affected as a consequence of the construction phase of the Proposal.

Based on the predicted approximate noise impact radius, receivers located within 550 metres of the noisiest construction tasks (conservative prediction CONCAWE attenuation) will exceed the ICNG Noise Management Level of 50 dB(A).

The only receiver located within this radius is NSR1. The assessment found NSR1 will be noise affected for short periods of time during construction work in the Development Envelope only. Although the construction noise is expected to be noticeable, as is typical with construction projects in proximity to people, the degree of adverse impact is expected to be low. By incorporating noise control measures (Section 7.9.4), the noise impact to NSR1 and land surrounding the site can be significantly reduced.

**Construction traffic**

During the construction period of 9 months, there will be approximately 11 Light Vehicles (including 3 mini busses), and up to 5 Heavy Vehicles required to service the Development Envelope via Gara Road daily (Section 7.6). On the Substation Location Area, an average of five light vehicles and one Heavy Vehicle are forecast daily. There is potential for peak hour movements at the beginning and end of the day as Site workers move on and off site.

The closest receivers along the proposed access routes are the houses located approximately 25 m from the road boundary of the access route, close to the centre of Armidale.

Typical light vehicles, mini busses and semi-trailers have a maximum pass-by noise level of 78 dB  $L_{Amax}$  at 10 metres (DEFRA Database, Table 4, Ref. 91 Unit Trailer). This translates to a maximum noise level incident at the façade of that closest receiver (25m) of 70 dB  $L_{Amax}$ .

As all traffic movements associated with the Proposal will occur during daylight hours, sleep disturbance is not expected.

With an average of 12 heavy vehicle movements (6 in and 6 out), occurring during a 12 hour construction period (peak hour 6 pass-by events), it follows that the impact will be noticeable but relatively minor and momentary (vehicle pass-by events last only a matter of seconds), at the closest receivers to the access road. Therefore, the risk of adverse noise impact being caused by construction traffic to residences along the access route is considered low. Other construction traffic is not expected to result in adverse noise impacts to residents.

**Operational Noise**

The solar infrastructure at the Site will operate during daylight hours, seven days a week, 365 days a year, for a period of approximately 28 years. The main infrastructure that has the potential to generate noise at the Site include:

- Inverters;
- Substation (Transformer); and
- The motors which drive the tracking systems.

Equipment required for operational activities including solar module washing and vegetation, weed, and pest management also have the potential to generate noise.

Based on criteria set out in the Acoustic Impact Assessment (Appendix F), a predicted noise impact radius was derived for each noise generating component. This information was then used to assess the potential noise impacts associated with the operational phase of the Proposal at the three NSRs.

Noise generated from the operation of the solar farm is predicted to have negligible impacts at all identified NSRs. Therefore, no additional noise mitigation measures are recommended during the operational phase of the Proposal.

**7.9.4 Mitigation measures**

As the Acoustic Assessment predicted minimal exceedances of the ICNG noise management level at NSR1 for short periods of time during construction, it is recommended that a Construction Noise and Vibration Management Plan is produced by the contractor and incorporated in the CEMP and DMP to provide a framework for construction noise management on-site. This should include all pertinent information regarding the control and management of noise and vibration, and would be used as a working

document on-site by contractors and sub-contractors so that everyone is aware of their responsibilities. The following management measures will be employed to minimise construction noise:

- Informing potentially effected residences regarding impending or current construction activities that may cause high levels of noise along with an estimation of the duration of these works. This could take the form of letter drops, an email or a message on a community notice board;
- Provide a complaints telephone number prominently displayed at the Site, and on any community information material;
- Respite hours can be agreed with residents when noisy works will not take place, if necessary;
- Investigate complaints when received to establish the cause, and where possible implement corrective action such as providing a respite period or other practical measure;
- Minimising the operational noise of machinery brought to site;
- Where appropriate obtain acoustic test certificates for machinery brought on to the Site;
- Ensure that plant is not left idling when not in use;
- Ensure plant is well maintained; and
- All access hatches for plant to be kept closed.

Due to the relatively low traffic volumes associated with the construction phase of the development, no additional mitigation measures have been recommended for the TMP.

Based on the results of the assessment no additional noise mitigation measures are recommended during the operational phase of the Proposal.

## 7.10 Bushfire and Electrical Fire

### 7.10.1 Introduction

This section provides an assessment of potential hazards associated with bushfire and electrical fire. It first considers relevant guidance within NSW, then presents an overview of the existing environment. Next it considers potential fire hazards associated with the Site, throughout the lifecycle of the Proposal. Finally, in line with the appropriate standards, it provides a coordinated response to fire risks.

Fire presents a threat to human life, property, infrastructure and ecology. Risk can be considered in terms of environmental hazards that increase the likelihood or severity of fire (vegetation, topography and weather patterns), as well as activities and infrastructure that increase combustion or ignition risks.

The Proposal is classified as Integrated Development, is not a subdivision for residential or rural residential purposes, nor is it a development for a special fire protection purpose, hence the issue of a Bush Fire Safety Authority from the Commissioner of the NSW Rural Fire Service (NSW RFS) under section 100B of the Rural Fires Act is not formally required. Nonetheless, the Rural Fires Act places a duty of care on land owners/managers to prevent fire spreading on and from their land, which is a principle that will be adhered to through all phases of the Proposal. As the Proposal could be exposed to bushfire risk from grasslands or nearby areas of vegetation, and carries the risk of a potential fire starting from within its boundary, a bushfire assessment has been conducted in accordance with *Planning for Bush Fire Protection (PBP), A guide for councils, planners, fire authorities and developers 2006* (RFS, 2006) and with reference to the Draft PBP 2018.

### 7.10.2 Existing environment

The Site covers approximately 94 ha of rural land, all of which has been cleared for grazing and sown with improved pastures. The Site slopes gently toward the south. In the wider area, due to historic clearing for agriculture, vegetation cover is generally low except along ridgetops, within road reserves, along the banks of the Commissioners Waters, in isolated patches in paddocks and gullies and within gardens surrounding the homesteads which are scattered across the landscape.

In terms of existing fire hazards, to the Proposal's north, there is a small area of vegetation surrounding the southern side of an onsite residence, as well as a larger patch of vegetation further north that runs along the ridge line that forms the northern boundary of the landholding. Ground cover at the Site is dominated by grazed pastures and while managed, it could be susceptible to grass fires in hot, dry and windy conditions. Other onsite ignition sources include:

- Machinery operating in long grass;
- Lightning strikes;
- Agricultural activities; and
- Carelessly discarded cigarette butts.

The overhead electricity transmission and distribution lines to the north also pose a potential hazard, however, TransGrid and Essential Energy are required to maintain infrastructure to minimise fire risk.

None of the Development Envelope or Substation Location Area is mapped as Bushfire Prone Land on the Planning Portal, ePlanning Spatial Viewer Bushfire Prone Land Map, although part of the connection line easement, sections of the wider landholding to the north of the Proposal, as well as land near to the Substation Location Area are classed as mapped as Vegetation Category 1 (NSW Department of Planning and Environment, 2019). Category 1, represented as red on the bush fire prone land map and given a 100m buffer, is considered to be the highest risk for bush fire. This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production. Figure 7-8 shows the Site relative to mapped Bushfire Prone Land.



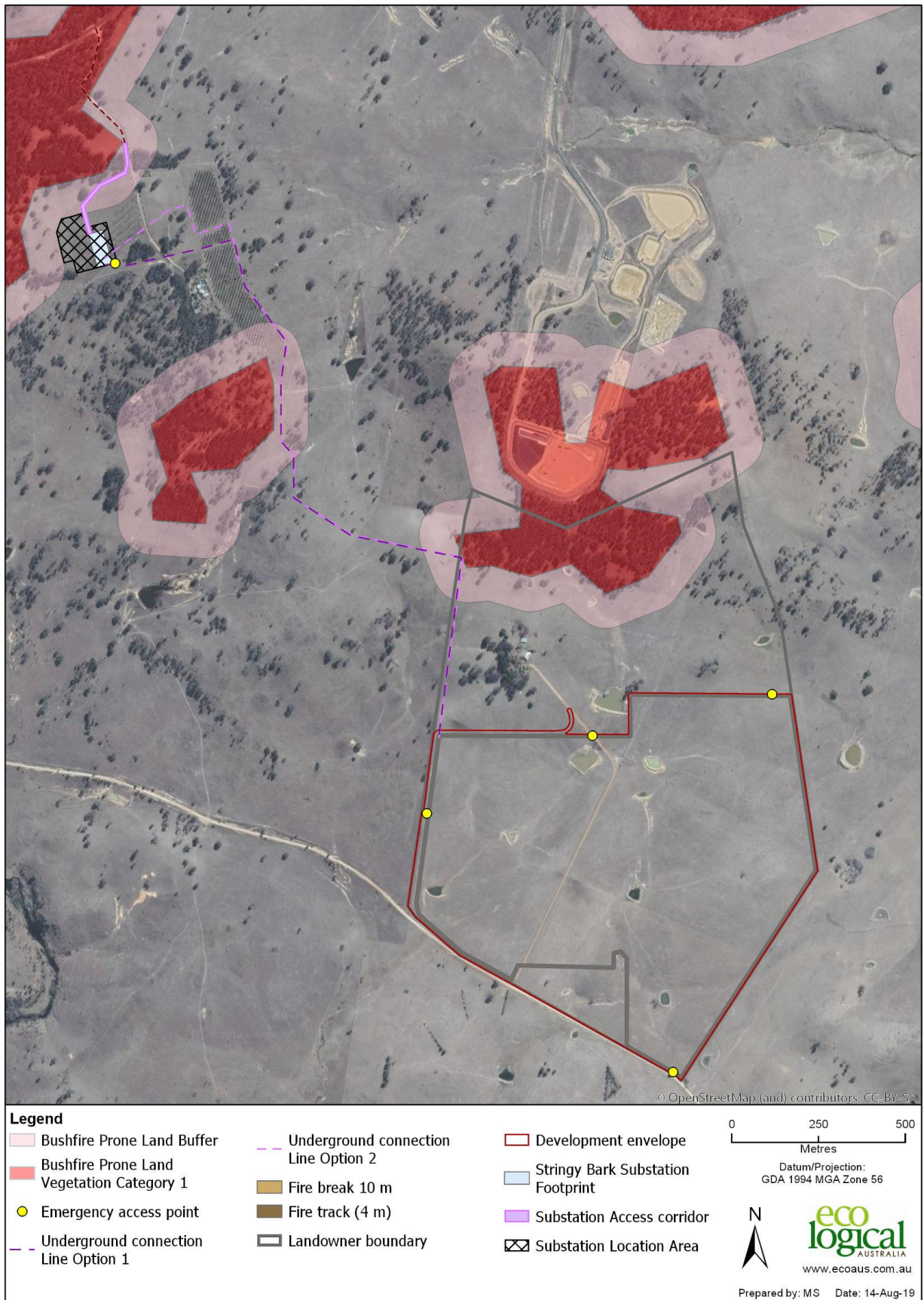


Figure 7-8: Bushfire Prone Land, Asset Protection Zones and potential emergency exit locations



The statutory Bush Fire Danger Period is between October and March reflecting seasonal fire hazards; however, this will vary from year to year depending on the prevailing conditions in the region. The bushfire danger period for 2018 was pulled forward to August 2018 and extended until the end of April 2019 due to prevailing dry conditions (RFS, 2018a).

All NSW Fire and Rescue stations are equipped with the resources and trained personnel required to deal with fire (and hazmat incidents). The nearest NSW Fire Brigade is the Armidale Fire Station, 12 km from the Site. The nearest RFS Brigade is 9 km from the Site, on the eastern edge of Armidale.

In terms of onsite resources, there is a large farm dam situated immediately to the north of the Development Envelope which provides a ready supply of water for fire management if required. The Development Envelope is well serviced by a council road which affords direct access to the Site. The Substation Location Area is also easily accessed via Waterfall Way.

Existing receivers and assets at risk from fire include two involved residences and two neighbouring residences: 686 Gara Road (368 m), 229 Gara Road (896 m), the Armidale regional landfill site that lies 600 m from the Proposal and a residence on the other side of Commissioners Waters (132 Milne Road, 716 m). Additional dwellings and infrastructure are located within 5 km of the Site.

### **7.10.3 Potential impacts**

This Section provides a preliminary discussion of potential impacts to fire risk from the Proposal. In accordance with relevant guidelines, consideration is given to human health and safety as well as potential interruption of existing services during the construction, operational and decommissioning phases of the Proposal. Fire could damage structures and impact the safety of employees and contractors at the Site. Fire leaving the Site poses a human safety and property threat and imperils native flora, fauna and ecosystems.

There are no woodland fragments across the Development Envelope, which is covered in a combination of native and introduced pastures. Exotic trees that occur within the Substation Location Area will be removed prior to the construction of the Substation. However, the Proposal will alter the land management practices within the Development Envelope and the Substation Location Area, potentially resulting in an increase in fuel load as a consequence of removing livestock from these areas. As a result, grassfires within the Site are considered a potential risk, however, it is considered that this risk can be effectively managed through mitigation measures to reduce the fuel load within the Site.

Further, the flammability of a solar farm is very low as they are predominantly constructed of glass, silicon, steel and aluminium.

While the connection cable easement will pass through Bushfire Prone Land, the connection cable itself will be buried, therefore risks only apply to construction phase.

As such, it is considered unlikely the Proposal will pose a significant bushfire risk.

### ***Construction and decommissioning***

Potential ignition sources during the construction and decommissioning phases of the Proposal would include:

- Machinery movement in long grass;
- Hot work activities, including welders and grinders;
- The storage of waste and combustible materials onsite;
- Storage of flammable liquids;
- Electrical faults;
- Lightning strikes; and

- Cigarette butts disposed of carelessly on-site and from cars travelling along Waterfall Way.

Considering the sparse vegetation cover over the Site and other factors discussed above, it is considered unlikely that the Proposal would pose a significant bush fire risk. The bush fire hazard associated with the activities listed above is considered highly manageable through electrical equipment selection and appropriate maintenance programs, access arrangements, fuel load reduction programs, safety protocols during periods of high fire risk and the implementation of an Emergency Response Plan (ERP) as detailed below in Section 7.10.4.

Potential fire risk during decommissioning activities would be similar to those for construction.

### ***Operation***

In addition to the potential ignition sources identified above, the operational phase would include fire risks associated with damaged or faulty electrical equipment.

With appropriate mitigation strategies in place, including electrical equipment selection and appropriate maintenance programs as discussed below, bushfire and electrical fire risks during the operation of the solar farm are considered highly manageable.

#### **7.10.4 Mitigation measures**

The following mitigation measures are proposed in order to reduce and manage the risk of fire, and reduce the impact of any fires within or surrounding the Proposal.

### ***Risk assessment***

Undertake a Bushfire Risk Assessment to assess specific risks associated with the Site, the Proposal and surrounding influences, and develop a Bushfire Management Plan in consultation with relevant fire authorities prior to commencing construction activities and identify a suite of strategies and mitigation measures to manage these risks.

### ***Design***

Electrical equipment selected for the 30 year life span of the Proposal would be designed to minimise the potential for ignition and certified to comply with relevant Australian Standards. The Proposal will ensure that all equipment at the Site is installed correctly and maintained in good order to prevent sources of ignition from faulty equipment. All installed equipment would be earthed appropriately following comprehensive testing of soil conductivity to ensure lightning effects are not harmful to the operation of the Proposal.

Chemical storage will be in accordance with safety data sheet requirements and would consider potential fire hazards (e.g. the use of fire cupboards for the storage of chemicals).

There will also be a dedicated fire emergency water tank located adjacent to the site access near the operational compound, and another at the Substation Location Area, for the sole use of fire protection in line with the RFS standards (RFS, 2018). The size of the tank will be finalised in the development of the Bush Fire Management Plan.

### ***Access and Asset Protection Zones***

Appropriate emergency vehicle access will be provided across the entire Site. The Site access track network will be designed and constructed in compliance with RFS standards.

As such, infrastructure setbacks from boundaries shall include a 10 m wide firebreak that will form an Asset Protection Zone (APZ) around the perimeter of both the Development Envelope and the Substation Location Area. A 4 m wide track will be constructed within the APZ of the Development Envelope to allow

emergency vehicles access to all parts of the Array Area as illustrated in Figure 7-8. The RFS recommends that firebreaks around valuable assets be mown, grazed or ploughed.

There will be five (5) gated emergency entrance and exit points (including the main entrance) along the perimeter of the Development Envelope and two (2) gated emergency entrance and exit points at the Substation Location Area (including the main entrance) ensuring that the Proposal can be accessed or evacuated at a number of locations (see Figure 7-8).

### ***Fuel reduction***

The fuel load across the Proposal will be monitored and will be actively managed through mechanical slashing and/or mowing or grazing as required to reduce the risk of grass fires starting within the Site and ensuring that fires originating from outside the Site do not intensify as a consequence of entering the Site. In addition, the APZs would also be designed in accordance with RFS guidance including *Standards for Asset Protection Zones*, and maintained to reduce the risk of fuel loads building up. These management actions will be included in the CEMP, OEMP and DMP.

### ***Emergency Response Plan (ERP)***

The CEMP, OEMP and DMP will include an ERP and a copy will be provided to the RFS and Fire and Rescue NSW. This will allow the first responders to a fire to have ready access to information that details the effective control measures for a fire at the Proposal Site and for these to be implemented quickly. The ERP will include the controls required to mitigate the potential risks that could be experienced by fire fighters at the Proposal, including the methods required to safely shut down and isolate the necessary components of the solar farm.

### ***Safety protocols***

The CEMP, OEMP and DMP will provide safety protocols to ensure all staff and contractors are aware of the bushfire risk on site and the mitigation measures required to reduce this risk. Protocols, will include, but are not limited to:

- Basic training of all staff on the appropriate response to a fire emergency and in the use of firefighting equipment on site;
- Firefighting equipment lists will be detailed in the Work Method Statements;
- Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and
- Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.

## **7.11 Electromagnetic Interference**

### **7.11.1 Introduction**

This section considers the potential for nuisance and health impacts from Electromagnetic Fields (EMFs) associated with the Proposal within the vicinity of the Site.

In accordance with relevant guidelines, consideration is given to human health and safety as well as potential interruption of existing services during the construction, operational and decommissioning phases of the Proposal.

### **7.11.2 Existing environment**

The existing environment exhibits variable topography, is sparsely populated and is likely to be characterised by relatively weak radio signal strengths (primarily due to distance from transmission sources). Existing potential sources of electromagnetic interference within the vicinity of the Site include two offsite 132 kV transmission lines, a 66 KV distribution line adjacent to the Substation Location Area at the Proposal's connection point, and one 11kV distribution line that traverses the Site.

### **7.11.3 Potential impacts**

EMFs consist of electric and magnetic fields, and are produced by electrical equipment of all size and voltage, and also occur naturally. Electric fields are produced by voltage while magnetic fields are produced by current. EMFs exist close to wires and lines that carry electricity and electrical devices and appliances that are operating. The strength of both electric and magnetic fields reduce quickly with distance, and while electric fields are insulated to an extent by their surroundings (buildings or the earth in which cables may be buried), magnetic fields are not.

In Australia, transmission lines and other electrical devices and infrastructure operate at 50 Hertz (Hz), and fall within the Extremely Low Frequency range of 0 – 300 Hz. Short-term exposure to very high levels of EMFs can be detrimental to human health, however exposure to EMFs generated within the Extremely Low Frequency range, at the low levels experienced by the general public, do not have substantive impacts to health. This is the case for the EMFs that would be produced by the Proposal and the transmission lines listed above.

There is uncertainty about the health impacts of longer term exposure to Extremely Low Frequency EMFs. Advice from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2015) indicates that scientific evidence of exposure to 50 Hz electromagnetic fields near transmission lines has not established a human health hazard. However, where any risk does exist, it would be small (ARPANSA, 2015).

In the absence of a standard for regulating exposure to extremely low frequency EMFs, the National Health and Medical Research Council's (NHMRC) *Interim guidelines on limits of exposure to 50/60 Hertz electric and magnetic fields* has been used to assess the impact of the existing and Proposal infrastructure to contractors and the general public's health (Table 7-16).

**Table 7-16: Summary of NHMRC's Interim Guidelines on limits of exposure to 50/60 Hz electric and magnetic fields**

| Exposure characteristics                          | Electric field strength<br>(Kilovolts per metre – kV/m) | Magnetic flux density<br>(microtesla - $\mu$ T) |
|---|---|---|
| <b>Occupational</b>                               |   |   |
| Whole working day                                 | 10  | 500   |
| Short term (maximum exposure is 2 hours/work day) | 30  | 5,000   |
| <b>General public</b>                             |   |   |
| Up to 24 hours/day                                | 5   | 100   |
| Few hours/day                                     | 10  | 1,000   |

**Construction and decommissioning**

The potential of EMF impacts during the construction and decommissioning phases is considered very low. Exposure by construction staff would be limited to intermittent periods working near to the 66 kV distribution line for Substation works or when cable laying/removal through the 132 kV easement for the Proposal's connection line to the offsite Substation.

**Operation**

Potential EMF impacts would occur only during the operational phase, when the solar farm infrastructure is capable of generating EMFs. The EMFs generated would vary due to the type and size of electrical equipment on site, and whether potential sources of EMF are overhead or buried.

EMF generating components at the Proposal include:

- A new offsite Substation;
- A new 66 kV connection from the Substation to the existing 66 kV distribution line;
- The below ground 11 kV cables connecting the array area to the Substation; and
- The PV array and its wiring system.

The 66 kV connection, connecting the Substation to the adjacent existing 66 kV distribution lines, would be overhead, producing both electric and magnetic fields. The magnetic field associated with the line would typically be 1.8  $\mu$ T directly below the line diminishing to approximately 1.4  $\mu$ T at a distance of 10 m. The electrical field would be approximately 1.8 kV/m (1808 V/m) directly below the line, diminishing to 0.5 kV/m (456 V/m) within 10 m (EMFs Info, 2019). These levels are below the requirements for contractors and public exposure levels as per NHMRC's Interim guidelines in Table 7-16.

The cabling connecting the substation to the Array Area and to the grid distribution lines, would produce significantly stronger EMFs than the substation itself. Therefore any EMFs produced by the Substation would comply with exposure limits (EMFs Info 2019), and are not considered further.

The 11 kV cables connecting the array area with the Substation would be underground. Underground 11 kV cables would produce a magnetic field only, as the electrical field would be insulated by the earth.

The typical magnetic field from the underground cables is less than 1  $\mu$ T immediately above a 11 kV cable buried at 0.5 m (EMF Info, 2019). This is below the requirements for contractors and public exposure levels as per NHMRC's Interim guidelines in Table 7-16.

Magnetic fields produced by the PV solar array would be significantly less than those produced for household applications and are indistinguishable from background levels at the Site boundary (Chang & Jennings, 1994). Therefore the health risk of EMFs from solar arrays would be insignificant and EMFs from the Proposal are likely to be indistinguishable from background levels at the boundary fence.

All AC electrical equipment that would be used as part of the Proposal operates at 50 Hz. Household appliances and devices, as well as telecommunication signals operate at much higher frequencies. For example, microwave ovens and Wi-Fi routers operate at 2.4 GHz, while mobile phones currently operate at 1.8 GHz. As these devices operate at higher frequencies which do not overlap with 50 Hz, and due to the rapid dissipation with distance from the source of EMFs, it is considered that they would not be impacted by EMFs from the Proposal.

#### **7.11.4 Mitigation measures**

##### ***Design principles and staff safety***

In limiting exposure to EMFs, following advice from the International Commission on Non-Ionizing Radiation Protection, priority will be given to engineering and access controls that limit exposure (ICNIRP, 2010). This means that:

- The final design of the Proposal would be undertaken by qualified and competent persons;
- Design would meet relevant Australian standards, ensuring EMFs would be minimised as far as possible; and
- Access to electrical equipment would be limited to qualified personnel only.

In addition to the design and access control measures outlined above, potential exposure levels on Site are predicted to be below the exposure limits for staff in line with the NHMRC's Interim Guidelines (Table 7-16), therefore further mitigation is not proposed.

##### ***Receptors – public safety***

To reduce the potential for chronic or acute exposure to EMFs, no unsupervised public access to the Proposal would be permitted. As discussed above there is unlikely to be any negative impact to public health from EMFs outside the Site.

The landholder or its employees may have limited access (under the supervision) to the Development Envelope for grazing activities, however there will be no need to spend extended periods near electrical infrastructure. As such, the potential for impacts from EMFs is low.

The landholder or its employees would not have access to the Substation or other electrical equipment.

##### ***Receptors - electrical devices***

As noted, electrical equipment commissioned as part of the Proposal would be designed to reduce possible interference in line with Australian Standards. It would also operate at different frequencies to household electrical devices and telecommunication signals. In addition, due to the distance of potential receptors' from the Site, there would be no impact on any electrical devices at neighbouring receptors as a consequence of EMFs during the construction, operation or decommissioning of the Proposal.

As such, impact to household devices created by EMFs would require no additional mitigation measures.



## 7.12 Air Quality

### 7.12.1 Introduction

During the construction, operational and decommissioning phases, the Proposal has the potential to create air quality impacts, particularly dust from soil disturbance and construction traffic, and emissions from vehicles and machinery. These impacts may cause nuisance to nearby residential receptors and the adjoining environment. At worst, they can impact on ecosystem function, pose a human health risk and contribute to anthropogenic climate change.

The statutory framework for managing air emissions in NSW is provided in the POEO Act. The POEO Act is supported by the *Protection of the Environment Operations (Clean Air) Regulation 2010* which provides the regulatory measures required to control emissions. Relevantly, the POEO Act requires that vehicles shall not continuously emit smoky emissions for more than 10 seconds and limits dust deposition to 4 mg/m/m<sup>2</sup>.

### 7.12.2 Existing environment

The current air quality within the Argyle area is typical of a rural area with air quality considered to be moderate to good (Pacific Environment Ltd, 2015). Potential air pollution sources include, agricultural practices, nearby mining and road transport.

The annual average maximum and minimum temperatures recorded at the Armidale Tree Group Nursery station are 20.4°C and 6.2 °C respectively (BoM, 2019). On average, January is the hottest month, with an average maximum temperature of 27.1°C. July is the coldest month, with average minimum temperature of -0.4°C.

Rainfall data collected at the Armidale Tree Group Station shows that November is the wettest month, with an average rainfall of 96.3 mm over an average of 11.6 rain days. The average annual rainfall is 745.2 mm with an average of 116.8 rain days per year (BoM, 2019).

Winds are typically light with the most dominant sector being easterly (this direction is more prevalent in summer), followed closely by westerly (this direction is more prevalent in winter) (BOM, 2019).

### 7.12.3 Potential impacts

#### ***Construction and decommissioning***

Dust generation would accompany excavation and earthworks as well as the movement of trucks and other work vehicles along unsealed access roads during construction and decommissioning of the Proposal. Air emissions would also be produced from equipment and vehicle exhaust fumes.

Dust and exhaust emissions can be a nuisance, interfere with visibility and safety or lead to adverse health impacts where the effects are severe or prolonged. Exhaust emissions also contribute to CO<sub>2</sub> emissions and anthropogenic climate change.

Earthworks associated with construction would be relatively minor, these include:

- Excavation of footings for the Substation, support buildings and invertors;
- Localised areas of cut and fill, development of hardstands and access tracks; and
- Piling activities.

The construction phase is expected to last approximately 9 months. During this time, engine emissions would be generated from road transport, earth-moving equipment, diesel generators, cranes and pile driving equipment.

Construction traffic associated with the development is expected to be low. The majority of construction workers are anticipated to be transported to the Development Envelope in three mini buses (approx. 40 staff) with the remainder using Light Vehicles (approx. 10 staff) which, with the inclusion of misc. vehicles and deliveries equates to approximately 11 Light Vehicles per day. Construction deliveries are anticipated to average 5 Heavy Vehicles per day. Substation related traffic accounts for an additional 5 Light Vehicles per day and 1 Heavy Vehicle per day.

The closest residence will be approximately 368 m to the south-east of any construction activities and out of direct view of the Proposal due to local topography. The next closest residence is approximately 716 m to the south-west of the Proposal and the third closest residence is approximately 896 m south-west of the Substation Location Area with all other residences (the majority to the south-west) being over 1000 m from the Proposal. While some level of dust generation is inevitable during construction, particularly during dry months the dust will not readily carry towards the nearest residence to the south-east during the common easterly winds which prevail during summer when dust is likely to be highest. The same wind conditions would not blow dust towards residential properties in the south where distance will also help to reduce any impacts.

This, in combination with the low potential for dust generation through the main activity of pile driving means that impacts from construction works are considered to be minor, will be short-term in nature, and are unlikely to significantly affect nearby residential receptors. Any dust that is generated through the activities listed above can be effectively mitigated through the measures described below.

No air quality impacts in addition to those detailed for construction are anticipated during the decommissioning phase. Traffic generation would be similar in type but of shorter duration than that required to support the construction phase.

### ***Operation***

The generation of solar energy during the operation of the Proposal would generate negligible air quality impacts and emissions. Indeed, during its operational lifetime, the Proposal would have a positive impact by displacing traditional carbon intensive electricity and as such reducing greenhouse gas emissions.

Maintenance activities during operation would result in some minor, localised vehicle and machinery emissions and potentially some dust generation from vehicles travelling on the unsealed access roads and tracks. However, impacts are likely to be on a par with those associated with current agricultural activities at the Site and, overall, would be very minor.

#### **7.12.4 Mitigation measures**

In order to meet Australian air quality standards, as well as the requirements under the POEO Act and POEO Regulation, the following mitigation measures would be followed during all phases of development:

- Develop protocols for inclusion in the CEMP, OEMP and the DMP to guide vehicle, plant and construction activities to minimise air quality impacts, for example:
  - Define designated access and travel routes;
  - Set onsite speed limits; and
  - Adopt trip management protocols to avoid unnecessary trips e.g.:
    - carpooling for construction staff;
    - coordinating delivery and removal of materials.
- Develop protocols for inclusion in the CEMP, OEMP and DMP to identify, minimise and treat dust emissions, for example:

- The use of a water truck during dust generating activities (and periodically along Gara Road as required) (See Appendix G, Traffic and Transport Assessment);
  - Limit the extent of clearing and excavation;
  - Stage clearing and excavation activities to minimise total areas of exposed soil;
  - Minimise the number and volume of stockpiles on-site and the number of work faces on stockpiles; and
  - Modify activities if dust is observed leaving the Proposal Site towards nearby sensitive receptors.
- Develop protocols for inclusion in the CEMP, OEMP and DMP to reduce emissions, for example:
    - Ensure all vehicles and machinery that enter the site meet relevant standards for emissions; and
    - Maintain vehicles and plant in accordance with manufacturer's requirements to minimise emissions.
  - Develop a complaints' procedure to promptly identify and respond to issues generating complaints.

## 7.13 Waste and resource use

### 7.13.1 Introduction

The consumption of resources, and production and disposal of waste has potential to have negative impacts on the environment, and needs to be managed to ensure that:

- Resources are used efficiently;
- Waste production is minimised;
- Reuse of materials is maximised; and
- Contamination of land and water is avoided.

The Proponent's obligations in regard to waste management are guided by the following legislation:

- *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) – promotes waste avoidance and recovery;
- POEO Act – requires a licence to carry out certain scheduled waste activities and makes it an offence to pollute or potentially pollute land, air or water with waste; and
- *Protection of the Environmental Operations (Waste) Regulation 2014* – prescribes requirements for the tracking and management of certain wastes.

The WARR Act aims to encourage the most efficient use of resources and to reduce environmental harm. Waste management hierarchy principles are provided in the WARR Act and are considered in the following order:

- Avoidance of unnecessary resource consumption;
- Resource recovery (including reuse, reprocessing, recycling and energy recovery); and
- Disposal.

Adopting the above principles would encourage the most efficient use of resources, and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development.

### 7.13.2 Existing environment

The existing site is characterised by agricultural production and grazing activities. Responsibility for the management of waste generated by these activities lies with the landholder.

### 7.13.3 Potential impacts

#### **Resource use**

##### *Construction*

Key resources required for the Proposal include gravel, sand, metal, glass, silicon and water. The supply of these materials is not currently limited or restricted, and the likely quantities required by the Proposal are unlikely to place significant pressure on necessary resources.

##### *Operation*

The production of electricity using PV panels utilises an energy resource (sunlight) that is considered to be renewable, as such, there would be no impact on this resource as a consequence of the Proposal.

During operation the resources used would largely be associated with maintenance activities and the use of machinery and vehicles. While this would require the use of non-renewable resources such as hydrocarbon fuels to power machinery and vehicles, in the very limited volumes required, the Proposal is unlikely to place significant pressure on the availability of these resources. Furthermore their use during this period is considered reasonable in light of benefits of offsetting fossil fuel electricity generation.

Imported potable water may be required for cleaning panels intermittently during dry periods (Section 7.8 details cleaning requirements and 7.12 details the regional climate).

The consumption of resources during the operation of the Proposal would not place significant pressure on necessary resources.

#### *Decommissioning*

The main resources required to support the decommissioning phase of the Proposal would be the use of machinery and vehicles associated with the activities of removing all onsite infrastructure. While this would require the use of non-renewable resources such as hydrocarbon fuels to power machinery and vehicles, in the volumes required, the Proposal is unlikely to place significant pressure on the availability of these resources. Accordingly, their use during this limited period is considered reasonable in light of the benefits of the 30 year life of the Proposal.

#### **Waste Generation**

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction and decommissioning phases would be classified as building and demolition waste within the class general solid waste (non-putrescibles).

Potential impacts associated with waste management on Site are:

- Potential contamination of land and water from inappropriately managed waste and waste storage areas;
- Human and animal health impacts; and
- Resource wastage through inefficient use or the recycling of over-ordered stock.

#### *Construction*

Solid wastes will be the main pollutant generated by construction activities. Solid wastes will include packaging, excavated material, metal and cable off-cuts, excess building materials, general refuse and other non-putrescible wastes. Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescibles) in accordance with the POEO Act.

#### *Operation*

Waste streams during the operation of the Proposal would be very low. No waste streams would be associated with the generation of electricity using PV panels. There would be solid waste streams associated with maintenance activities (non-putrescibles) and the solid waste generated as a consequence of having employees and/or contractors on site (putrescibles). Some materials such as, fuels and lubricants, metals may require replacement over the operational life of the Proposal.

#### **Decommissioning**

The Proposal has a design life of 30 years. At the end of its useful life the Proposal will be decommissioned and the Site will be returned to agricultural use.

Decommissioning activities will involve the removal of all above ground infrastructure, including the PV modules, the racking system, the piles, and grid connection infrastructure. Note, underground cables (inert and stable) at a depth greater than 0.5 m would be left in the ground to avoid unnecessary ground disturbance.

Decommissioning of the site would involve the recycling or reuse of materials including:

- Solar panels and mounting system; and
- Metals from posts, cabling, and fencing.

Infrastructure and equipment that may be suitable for reuse include grid connection equipment, Substation equipment and invertors. Support buildings will be removed from the Site for reuse if possible.

Where reuse of a material is not possible, recycling is considered to be the next desirable option. Solar panels are made of valuable materials that can be recycled at recovery rates greater than 90%, with this figure expected to improve as recycling techniques develop over time (IEA, 2017). The recovery, reuse and/or recycling of panels at the end of their life is necessary to avoid unnecessary landfill waste generation and to fulfil obligations set out in the WARR Act. Typical Crystalline silicon PV panels are comprised of the following components by weight:

- 76% Glass;
- 10% polymer;
- 8% aluminium (mostly the frame);
- 5% silicone;
- 1% copper; and
- 0.1% silver and other metals (mostly tin and led) (IEA & IRENA, 2016).

Industry trends also show that the percentage of glass content is predicted to increase to around 80% of the total weight of a panel by 2030 reducing the respective components of Silicone (to 3%), Aluminium to 7% with a slight reduction also expected in other metals (IEA & IRENA, 2016).

In 2012 it became mandatory to recovery, reuse and/or recycle PV panels in Europe through the modification of the European Waste Electrical and Electronic Equipment Directive (WEEE 2012/19/EU). This has resulted in an emerging and expanding commercial recycling industry which employs a variety of techniques to recycle panels (IEA, 2017). The Australian solar market is not as mature as the European market, however in line with other markets such as the US and Asia, there already signs that industry is developing its capacity to take advantage of the future opportunity that the recovery and recycling of panels will offer in Australia as panels reach the end of their useful life (Reneweconomy 2016).

The mounting system and other metals used to support the solar panels are considered to be readily recyclable.

Solid wastes will be generated by decommissioning activities (non-putrescibles, putrescibles), although to a lesser degree than during the construction phase. Solid wastes will include packaging, excess building materials, general refuse and other non-putrescible wastes.

### **Waste Classification**

The classification and description of the potential waste types likely to be generated by each phase of the Proposal are summarised in Table 7-17 below.

**Table 7-17: Potential waste description**

| Waste Type                     | Project phase* | Waste Classification                                  | Details  |
|--------------------------------|----------------|---|--|
| Hydrocarbons                   | C,D            | Liquid Waste  | Used lubricants, etc.  |
| Construction/ structural Waste | C,D            | General Solid Waste (non-putrescible)                 | Waste from construction would include excess concrete, metal, timber, fittings and packaging.  |
| Domestic/ office waste         | C,O,D          | General Solid Waste (non-putrescible and putrescible) | Waste would consist of everyday items such as paper, aluminium cans, plastics, packaging and other material generated by onsite contractors. |



| Waste Type                      | Project phase* | Waste Classification                              | Details   |
|---------------------------------|----------------|---|---|
| Green Waste                     | C              | General Solid Waste (non-putrescible)             | Cleared vegetation.   |
| Liquid waste                    | C, D           | Liquid waste                                      | Oil, paint, lubricants, glue etc.                             |
| Sewage                          | C,O,D          | Liquid Waste<br>General Solid Waste (putrescible) | Effluent from ablutions and office buildings.                 |
| Chemical/hydrocarbon containers | C,O,D          | General Solid Waste (non-putrescible)             | Fuel and lubricant storage. Herbicides and pesticide storage. |

\* C – construction; O – operation D – decommissioning

Managed effectively, in line with the mitigation measures described in the section below, the generation of waste as a consequence of the construction, operation and decommissioning of the Proposal would not result in significant impacts.

### 7.13.4 Mitigation measures

In order to encourage the efficient use of resources and reduce environmental impacts in line with the POEO Act, POEO (Waste) Regulation, and the WARR Act, resources and waste will be managed according to the following hierarchy:

1. Reduce waste production;
2. Recover resources (including reuse, reprocessing, recycling and energy recovery); and
3. Dispose of waste appropriately.

Waste will be classified in accordance with the NSW EPA *Waste Classification Guidelines – Part 1: classifying waste* (EPA, 2014) and *addendum* (EPA, 2016). Opportunities for recycling will be investigated during both the construction and decommissioning phases. Waste that cannot be recovered will be disposed of lawfully at a licensed waste facility.

A Waste Management Plan will be prepared in order to meet the hierarchy set out above, and will form part of the CEMP, OEMP and DMP. The objectives, protocols and responsibilities within it will be communicated to all staff and contractors through a site induction process and ongoing training.

Specific measures to be incorporated into the Waste Management Plan would include, but not be limited to the following:

- Protocols to identify opportunities to follow the waste hierarchy - to ensure that waste is minimised, recovered, and disposed of appropriately, and also to ensure a culture of responsible waste management is upheld by staff;
- Quantification, classification, and tracking of all waste streams - to encourage waste reduction and minimise inter-contamination of waste streams;
- Controls on the disposal methods of all waste streams;
- Provision of recycling facilities onsite to reduce waste streams;
- Provision of a dedicated waste management area onsite; and
- Protocols on the transportation of waste, for example covered loads.

## 7.14 Socioeconomic Factors

### 7.14.1 Introduction

In this section the potential socioeconomic impacts of the Proposal are considered within the Armidale Regional LGA where the Proposal is located. While it is acknowledged that the Proposal could utilise resources from the surrounding LGA's of Uralla and Tamworth, the scale of the Proposal means that the level of influence is unlikely to be material outside the Armidale Regional LGA. First the socioeconomic makeup of the area is summarised, including a review of the Armidale Regional Council's and the communities' longer term strategies for the region. Secondly, potential socioeconomic impacts throughout the Proposal's lifecycle are considered along with strategies to enhance positive effects and mitigate negative impacts.

### 7.14.2 Existing environment

The Armidale Regional LGA had a population of 29,449, on the night of the last Population and Housing census in 2016, of which 48.3% were male and 51.7% were female (ABS, 2016). Aboriginal and Torres Strait Islander people made up 7.4% of the population. The median age of people within the LGA was 36 years, two years younger than the national median. Children aged between 0 and 14 years made up 18.1% of the population and people aged 65 years and over made up 16.9% of the population. Based on data from the Australian Bureau of Statistics, the projected *estimated resident population* for the LGA has grown by 4.3% to 30,707 to June 2018 (ABS 2018).

The Armidale Regional LGA is a service area for the New England Tablelands and includes the University of New England, educational facilities, transport facilities, sporting and recreational facilities, hospitals as well as services for the agricultural and tourism industries. The main industry of employment is Education and Training making up 20.5% of total employment at the 2016 census. Healthcare and Social Assistance (14.2%), Retail Trade (11.3%) and Agriculture, Forestry and Fishing (10.1%) are all important sectors of employment in the LGA. (ABS 2016 Census of Population and Housing). The LGA's unemployment rate at the 2016 census was reported to be 7.7% which was greater than the NSW Regional unemployment rate of 6.6% (ABS, 2016).

The Armidale Regional LGA and the wider New England North West Region has been identified as one of the best locations in NSW for the generation of renewable energy from wind and solar power in the New England North West Regional Plan 2036 (NSW Government 2017). This is reflected in a number of Plans that are relevant to the LGA encouraging the use and deployment of renewable energy sources.

#### ***Armidale Dumaresq Community Strategic Plan 2013 – 2028***

The Armidale Dumaresq Community Strategic Plan 2013 – 2028 was adopted by Armidale Dumaresq Council in June 2013. The Community Strategic Plan establishes the community's goals and long-term aspirations. The Proposal finds support in a number of the community's main priorities and aspirations which are identified in the Community Strategic Plan and detailed below:

- **Increase the use of Renewable Energy:** The Proposal will provide renewable energy directly to the local distribution network.
- **Enhance employment opportunities:** The Proposal will provide up to 60 full time equivalent jobs during the construction phase, and 3 to 6 positions will be created during the operation phase.
- **Increase Industry in the area:** The Proposal will allow for the diversification of industry in Armidale, which is currently highly geared to the education and rural sectors, by directly providing construction jobs which in turn will benefit the services, hospitality and retail sectors.

- **Respond to Climate Change risk and opportunities:** The Proposal represents a proactive approach to climate change risks and opportunities by reducing greenhouse emissions, hence increasing the community's capacity to respond.

#### ***New England North West Regional Plan 2036***

- The key vision for the New England North West Region is presented in the New England North West Regional Plan 2036 (NSW Government 2017). The plan identifies emerging industries, such as renewable energy and green technology, as a welcome addition to the traditional economic base of the region *'the focus of the future is to leverage the distinctive regional identity to promote intensive agriculture, horticulture, green industries, renewable energy generation and tourism.'* One of the directions outlined in the plan specifically relates to the growth of the region as the renewable energy hub of NSW, drawing attention to the abundant renewable energy resources in the region. The Plan also highlights the employment and investment opportunities associated with large scale wind and solar farms for the region.

#### ***NSW Climate Change Policy Framework (2016)***

- The NSW Climate Change Policy Framework aims 'to maximise the economic and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change'. The Framework outlines the State's long term aspirational objectives to achieve net-zero emissions by 2050 and to ensure NSW is more resilient to climate change (NSW OEH 2016). This aspirational objective is intended to provide a clear statement of the government's intent, commitment and level of ambition and to set expectations about the future emissions pathways that will help the all sectors of the community plan and act. To achieve this ambitious target, the NSW electricity sector will need to transition away from a system heavily reliant on emission intensive fossil fuels. Importantly, it is stated that that 'net-zero emissions [2050] is consistent with strong economic growth and the NSW emission record to date'.

#### ***Community and national attitudes to Solar Farms***

Overall the development of solar generation within the Armidale LGA and the wider New England North West Region aligns with the stated values of the community to the extent that they are expressed in strategic planning documents, community plans and local programs.

The strategic planning documents demonstrate that the community has embraced the idea of becoming a renewable energy hub. In addition, these strategy statements highlight how renewable energy projects align with the broader strategic goals of the LGA, the region and the State, such as the drive for a more diversified economic base and growth in employment (NSW Government 2017).

As detailed in Section 6, during the consultation sessions held in Armidale; overall, attendees expressed positive attitudes towards the growth of renewables in the electricity sector. This response corresponds with wider national views on renewable energy, where in particular solar power is viewed as the single most preferred form of electricity generation. For example in a 2016 survey, 86% of respondents named solar power among their top three most preferred energy sources, up from 81% in the same survey in 2012 (The Climate Institute, 2016).

However, notwithstanding the generic expressions of support, it is noted that proposals to develop renewable energy projects have drawn some opposition from local communities. The main concerns raised by the community in the local vicinity of the Proposal included visual intrusion, fire risk, erosion, cultural heritage impacts, increase in traffic volumes, dust generation, noise disturbance and decommissioning. The matters raised during community consultation have been addressed in the topic specific sections of this SEE and Section 6.

### 7.14.3 Potential impacts

#### General

The socioeconomic and environmental benefits of developing renewable energy projects, and transitioning to a low carbon future are large, providing potential benefits to entire communities and helping to maintain quality of life. Indeed, increased adoption of renewable energy sources will assist Australia to transition away from traditional carbon intensive energy production which is linked to atmospheric pollution and carbon emissions associated with climate change (IPCC 2018). Reduced carbon emissions have the potential to halt or slow the effects of climate change, benefitting current and future generations.

Electricity produced from the Proposal provides a clean power source for local and regional consumers in a cost effective manner. Section 2.4 details that the Proposal would produce approximately 64 GWh of clean renewable energy to the local electricity transmission network (AMEC, 2018). This would provide enough energy to power up to 15,000 NSW homes each year, and in doing so would reduce approximately 53,000 tonnes of CO<sub>2</sub> per annum through the displacement of conventional electricity supply.

At the regional and local level the Proposal will marginally reduce the total area of land under agricultural production in the Armidale LGA and more generally within New England North West Region through the establishment of a solar farm for its life of 30 years. However, given that the Proposal represents approximately 0.01% of the total land area within the Armidale LGA, the utilization of agricultural land by the project will only result in a temporary negligible reduction in the overall agricultural productivity of the Armidale LGA and the New England North West Region.

While the temporary loss of agricultural land to host the Proposal would reduce agricultural output at the Site, the landowners would be compensated through lease payments over the 30 year life of the Proposal. This diversification in income, should increase the landowners resilience to growing seasonal variations in temperature and rainfall in the short term and the effects of climate change in the medium term. Note, the Proposal is fully reversible and would not alter the agricultural capacity of the land allowing existing farming activities to recommence once the development is removed.

#### Construction

*Capital Investment* - Stringybark Solar Farm Pty Ltd will invest in the development of the Proposal.

*Employment Generation* - In terms of direct employment it is estimated that the Proposal would generate 60 full time equivalent jobs over a 9 month construction period. The Armidale LGA has an industry, business and occupational structure well suited to a project of this scale and nature as outlined below.

Table 7-18 indicates the Armidale Regional LGA has a labour force of approximately 3298 resident workers who are occupied in construction related activities (technicians and trade workers, machinery operators and drivers, labours). While it is acknowledged that not all the labour required to construct the Proposal would be sourced from the local LGA, it is clear there is a good local construction workforce which would not be overwhelmed by the Proposals requirement of approximately 60 workers (which represents just 1.8% of the total construction workforce).

**Table 7-18: Local workers occupations, all industries (2016 Census)**

| Occupations                            | Armidale Regional Council |      | New South Wales<br>% |
|--|---------------------------|------|----------------------|
|  | Number                    | %    |                      |
| Managers                               | 1,918                     | 14.6 | 13.5                 |
| Professionals                          | 3,142                     | 24.0 | 23.6                 |
| Technicians and Trades Workers         | 1,428                     | 10.9 | 12.7                 |
| Community and Personal Service Workers | 1,508                     | 11.5 | 10.4                 |
| Clerical and Administrative Workers    | 1,726                     | 13.2 | 13.8                 |

| Occupations                          | Armidale Regional Council |              | New South Wales<br>% |
|--------------------------------------|---------------------------|--------------|----------------------|
|                                      | Number                    | %            |                      |
| Sales Workers                        | 1,327                     | 10.1         | 9.2                  |
| Machinery Operators And Drivers      | 483                       | 3.7          | 6.1                  |
| Labourers                            | 1,387                     | 10.6         | 8.8                  |
| Inadequately described or not stated | 183                       | 1.4          | 1.8                  |
| <b>Total</b>                         | <b>13,102</b>             | <b>100.0</b> | <b>100.0</b>         |

Australian Bureau of Statistics, Census of Population and Housing 2016.

The Proposal is likely to present opportunities for unemployed job seekers in the LGA (Table 7-19). This is because a significant portion of the construction jobs (mainly panel installation), do not require specialist skills or experience. The Proposal offers the potential for a number of the Armidale Regional LGA's unemployed job seekers to find work within the LGA.

**Table 7-19: Employment Status (2016 Census)**

| Employment status              | Armidale Regional Council |              | Regional NSW % |
|--------------------------------|---------------------------|--------------|----------------|
|                                | Number                    | %            |                |
| Employed                       | 12,315                    | 92.3         | 93.4           |
| Employed full-time             | 7,124                     | 53.4         | 55.2           |
| Employed part-time             | 4,956                     | 37.1         | 36.3           |
| Hours worked not stated        | 235                       | 1.8          | 1.9            |
| Unemployed (Unemployment rate) | 1,027                     | 7.7          | 6.6            |
| Looking for full-time work     | 502                       | 3.8          | 3.9            |
| Looking for part-time work     | 525                       | 3.9          | 2.7            |
| <b>Total labour force</b>      | <b>13,342</b>             | <b>100.0</b> | <b>100.0</b>   |

Australian Bureau of Statistics, Census of Population and Housing 2016.

In addition to direct employment, significant employment will be generated indirectly. Indirect or flow on jobs include employment supported locally and in the wider economy (including at the regional, state and national levels), as the economic effects of the capital investment flow through the economy. Indirect employment creation within the LGA may include jobs supported through catering, accommodation, trade and, fuel supplies.

*Business participation opportunities* – The Proposal will provide opportunities for local businesses to participate during the construction of the solar farm. Opportunities include, but would not be limited to: road building, transport and logistics, tree planting services, fencing, bulk water supply, equipment hire and specialist consultants. Again, looking at the mix of business operating in the LGA (Table 7-20) it is clear that many of the Proposal's requirements could be met locally. In terms of cost efficiencies (lower transport costs, equipment hire, labour costs etc.), construction projects located in regional areas are, where possible, best serviced locally.

**Table 7-20: Total registered businesses by industry (2016 Census)**

| Industry                                   | Armidale Regional Council |      | New South Wales<br>% |
|--|---------------------------|------|----------------------|
|  | Number                    | %    |                      |
| Agriculture, Forestry and Fishing          | 887                       | 30.0 | 7.4                  |
| Mining                                     | 13                        | 0.4  | 0.2                  |
| Manufacturing                              | 67                        | 2.3  | 3.6                  |
| Electricity, Gas, Water and Waste Services | 6                         | 0.2  | 0.3                  |
| Construction                               | 352                       | 11.9 | 15.6                 |
| Wholesale Trade                            | 69                        | 2.3  | 3.9                  |
| Retail Trade                               | 168                       | 5.7  | 6.1                  |
| Accommodation and Food Services            | 135                       | 4.6  | 4.2                  |
| Transport, Postal and Warehousing          | 129                       | 4.4  | 6.4                  |
| Information Media and Telecommunications   | 8                         | 0.3  | 1.2                  |
| Financial and Insurance Services           | 165                       | 5.6  | 9.1                  |

| Industry  | Armidale Regional Council |              | New South Wales |
|---|---------------------------|--------------|-----------------|
|   | Number                    | %            | %               |
| Rental, Hiring and Real Estate Services         | 301                       | 10.2         | 11.2            |
| Professional, Scientific and Technical Services | 255                       | 8.6          | 13.0            |
| Administrative and Support Services             | 67                        | 2.3          | 4.0             |
| Public Administration and Safety                | 10                        | 0.3          | 0.4             |
| Education and Training                          | 29                        | 1.0          | 1.4             |
| Health Care and Social Assistance               | 150                       | 5.1          | 5.9             |
| Arts and Recreation Services                    | 26                        | 0.9          | 1.3             |
| Other Services                                  | 91                        | 3.1          | 4.0             |
| Industry not classified                         | 28                        | 0.9          | 1.0             |
| <b>Total business</b>                           | <b>2,958</b>              | <b>100.0</b> | <b>100.0</b>    |

Australian Bureau of Statistics, Census of Population and Housing 2016.

*Boost to the accommodation sector* - The Armidale Regional LGA has a good supply and mix of accommodation including motels, hotels, guest houses, serviced apartments, caravan/holiday parks and short term rental accommodation. The majority of options are in Armidale but it is possible that workers could stay in Guyra or Uralla, both within 50 km of the Proposal. As of June 2019, the following accommodation was available in the Armidale Regional LGA:

- Hotel rooms – 679
- Bed and breakfast – 13
- Apartments – 14
- Cabins – 15
- Houses listed on Airbnb – 92

Available room numbers are based on an internet search 6 June, 2019.

In total, the Armidale Regional LGA has a capacity of 813 rooms/cabins/apartments/houses. Assuming all construction workers come from outside the LGA (which is very unlikely), and they all require individual accommodation, then approximately 7.4% of accommodation in the Armidale Regional LGA would be required by the Proposal for a period of 9 months. In reality many of the workers are likely to come from the study area and the workers that require accommodation would share to reduce costs. However, this high level analysis demonstrates that the Armidale Regional LGA has the ability to absorb the required Proposal workers throughout the construction period and this sector is likely to benefit from increased revenue as a result of higher accommodation occupancy rates.

*Wage spending stimulus* - A considerable proportion of the wages of the workforce will be spent within the Armidale Regional LGA during construction. These wages would be directed toward local business and service providers. This spending would include housing, retail, recreation and medical. This additional spending in the local economy would support employment indirectly in the services sectors associated with retail, accommodation, trade supplies, cafes and restaurants.

*Local Disruption* - Additional traffic on Gara Road due to the movement of workers to site and the delivery of construction materials and supplies may be noticeable to local residents (Traffic and Transport: Section 7.6). In addition, there is likely to be an increase in noise at the Site associated with the 9 month construction phase of the Proposal (Noise: Section 7.9). However, it should be noted that any such traffic or noise impacts would be temporary in nature.



**Operation**

*Employment Generation* - Between 3 and 6 full-time equivalent jobs will be created on an ongoing basis throughout the operation of the Proposal. These jobs would cover the following activities:

- Monitoring of production performance;
- Compliance - industry regulation;
- Monitoring and maintenance of all plant and equipment;
- Site management – security, vegetation monitoring and management, weed and pest control, erosion control, fire risk management, compliance with statutory regulations like occupational health and safety regulations; and
- Any other requirements stipulated through planning conditions.

These new jobs would provide an opportunity for the diversification of rural incomes and, therefore, provide an increase in economic security for the local economy. Employment would also be supported indirectly at the local, regional and state level through existing and new supply chains. Note, operational related direct and indirect employment would be for the operational lifetime of the project, in this case approximately 28 years. Therefore the Proposal would provide new long-term employment opportunities at a local, regional and state level.

*Economic stimulus* - The positive wage stimulus effect of 3 to 6 new jobs and the indirect jobs created as a consequence. In addition, it is widely recognised that increasing the proportion of electricity generated from renewable energy will have the effect of reducing electricity prices for end users (AEMC, 2018). While it is not asserted that this project in isolation would reduce electricity prices, if constructed it would contribute to this end. Note, a reduction in electricity prices would not only benefit consumers within the Armidale Regional LGA but would have a positive effect on the economy as a whole.

*Environmental Benefits* - The Proposal will generate approximately 64 GWh of renewable energy annually which is sufficient to power approximately 15,000 homes (AMEC, 2018). This represents more than 100% of the annual household electricity requirements of the Armidale Regional LGA at the 2016 Census (12,738 private dwellings, ABS 2016). The Proposal will result in the reduction of an estimated 53,000 tonnes of CO<sub>2</sub> emissions on an annual basis, compared to the same amount of electricity generated from the current fuel mix in NSW.

*Offsite impacts* – The operational Proposal would not create major land disturbances or land use conflicts (Section 7.2). Furthermore, the size of the Proposal (94 ha) would not significantly diminish the availability of land for agricultural production purposes within the Armidale Regional LGA (Section 7.2).

*Tourism impacts* - It is not anticipated that the Proposal would have any adverse impacts on tourism given the location of the Proposal on a Gara Road (which is not normally used by tourists), along with the general positive attitude of Australians towards renewable energy and solar developments in particular.

**Decommissioning**

It is anticipated that decommissioning would be of a shorter duration than the construction period (up to 6 months). However, the same economic benefits and opportunities identified for the construction period would arise during this time. Further economic benefits may include local recycling of infrastructure.

#### **7.14.4 Mitigation Measures**

##### ***Construction***

A Community Consultation Plan (CCP) will be prepared and implemented outlining the measures that will be taken during the construction phase to increase positive benefits to the Armidale community and to reduce any adverse impacts. It will note protocols to keep the community updated on project progress during the construction phase, how relevant stakeholders will be informed of potential impacts, and the resolution process, for any complaints received.

The Proponent will liaise with relevant local representatives to maximise the benefits to the local economy, where possible recruiting contractors from the local area and implementing an informal 'buy local' practice where goods and services are purchased from local businesses, provided they are competitive in terms of quality and price. The Proponent is to ensure local contractors/suppliers/workers are provided with timely information regarding potential opportunities.

Mitigation measures, that would reduce risk associated with increased traffic volumes during construction to acceptable levels have been provided in Section 7.6.

Mitigation of noise impacts are addressed in Section 7.9. It is concluded that predicted noise levels for the Site will be acceptable with the implementation of standard construction noise mitigation measures. These procedures will also be included in the CEMP.

##### ***Operation and Decommissioning***

No additional mitigation measures are considered necessary for the operational period. Mitigation and enhancement strategies for the decommissioning period would be the same as those outlined for the operational period.

## 7.15 Cumulative Impacts

The proximity of multiple construction and/or operational projects provides opportunity for potential cumulative impacts. Key mitigation strategies for cumulative impacts are:

- Spatial separation of impacts;
- Temporal separation of impacts; and
- Development of specific mitigation strategies.

The following section provides an assessment of potential cumulative impacts associated with the Proposal.

### 7.15.1 Existing environment

A search of the NSW Major Projects websites (both the old and new) and the Armidale Regional LGA website was undertaken on 9 August 2019 to identify major projects and renewable energy projects which may contribute to cumulative impacts. The location and status of projects identified during the search are provided in Table 7-21 and projects within 20 km of the Proposal are shown in Figure 7-9.

**Table 7-21: Nearby major and/or renewable energy projects**

| Project   | Approximate Distance and Direction from Site  | Development Phase  |
|---|---|--|
| Oxley Solar Farm (300 MW, with 30 MWh battery storage capacity) | Investigation area adjoins the eastern boundary of the Stringybark Solar Farm Site* | Secretary's Environmental Assessment Requirements (SEARs) issued for SSD         |
| Armidale Waste Facility   | 310 m NE  | Soon to be commissioned, with fulltime operational activities commencing in 2020 |
| Olive Grove Solar Farm  | 300 m NE  | Pre-DA consultations with Armidale Regional Council                              |
| Metz Solar Farm (100 MW)  | 9 km NE   | Under Construction   |
| Armidale High School  | 12 km W   | Approved   |
| UNE Wright Block Student Housing & Hub Building                 | 13 km NW  | SEARs issued for SSD   |
| New England Solar Farm (720 MW with energy storage)             | 18 km SW  | More information required for Recommendation                                     |
| Sailsbury Solar Farm  | 19 km SW  | SEARs being prepared for SSD   |
| Tilbuster Solar Farm (300 MW)                                   | 19 km NW  | SEARs issued for SSD   |

\* The Scoping Report for Oxley Solar Farm claims that the PV panels, battery storage and associated infrastructure for the proposed Oxley Solar Farm will likely only occupy half of its proposed 900 ha site (NGH Environmental, 2019). The actual development footprint of the Oxley Solar Farm is not currently known.

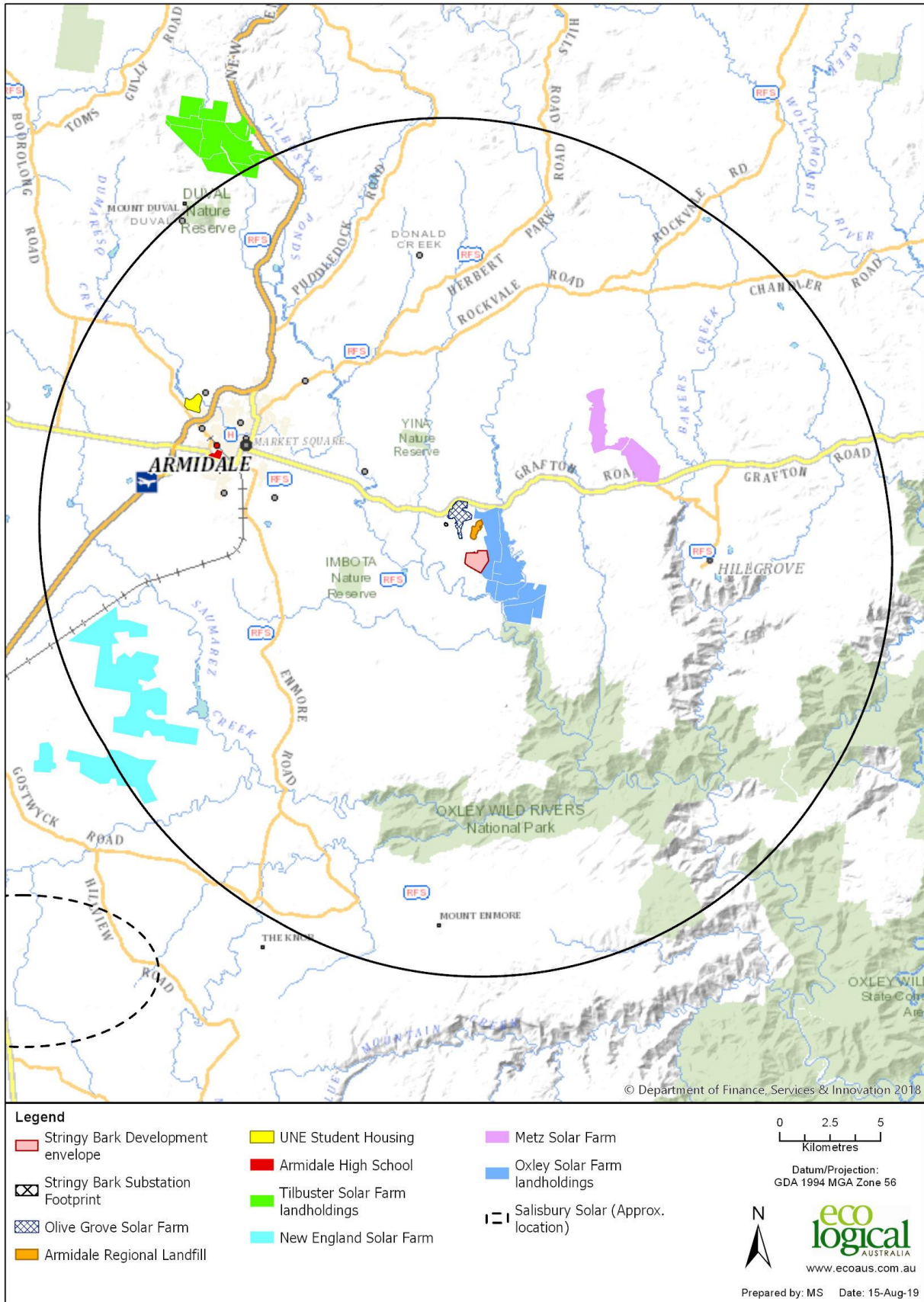


Figure 7-9: Location of major and renewable energy projects within 20 km of the Proposal

### 7.15.2 Potential Impacts

The construction and/or operation of these proposed developments may coincide with construction and/or operation of the Proposal. Potential cumulative impacts have been considered for each issue assessed as part of the Environmental Assessment and are discussed below.

#### ***Land use and Soils***

Land use conflicts and impact to soils have been minimised through the design evolution process outlined in Section 7.2. Development of similar large scale projects in the immediate vicinity of the Proposal, while increasing local demand for land resources, do not constitute a significant impact at a district or regional scale.

#### ***Biodiversity***

The Proposal has reduced its potential biodiversity impacts and residual impacts will be fully offset in accordance with the BAM (Section 7.3 and Appendix A). In accordance with the principles underpinning the BAM, no further cumulative impacts are anticipated.

#### ***Heritage***

As the current Proposal is assessed to not impact any Aboriginal or historic heritage items or places, no cumulative impacts to heritage are anticipated.

#### ***Traffic and Transport***

The cumulative traffic and transport assessment considers the potential cumulative impacts on the road network that would be utilised by the following projects and proposals:

- Armidale Regional Landfill;
- Metz Solar Farm;
- Olive Grove Solar Farm; and
- Oxley Solar Farm.

Figure 7-10 identifies the road network and the location of these projects and proposals.

The Oxley Solar Farm is the only development (other than the Proposal), identified that has the potential to use Gara Road, however the Scoping Report for the Oxley Solar Farm (NGH Environmental, 2019) shows an indicative new site access for construction haulage would likely be established off Waterfall Way (being an approved heavy vehicle access route). As such, it is not considered likely that there will be cumulative traffic and transport impacts associated with the construction of the Oxley Solar Farm and the Proposal on Gara Road. In addition to this, it is also unlikely that the construction phase of the proposed Oxley Solar Farm would coincide with the construction of the Proposal as Oxley Solar Farm is still at a very early stage in the development application process for a SSD.

As identified in Section 7.8, daily traffic flows recorded on Waterfall Way are well within the capacity of the road leaving ample spare capacity to accommodate additional traffic. During the construction of the Proposal (9 months) it is anticipated that an average of 16 light vehicles and 6 heavy vehicles will use Waterfall Way each day, with the majority exiting at the Gara Road intersection. Depending on the timing of development, there is potential for temporary cumulative traffic impacts along Waterfall Way associated with the Proposal and other developments. However, it is believed that this will still be well within the capacity of this road which, as a State Road, has been constructed to support the movement of heavy goods around the State.

Furthermore, as the Metz Solar Farm has begun construction (the substation is almost complete), and the construction period for this development is estimated at 12 months, it is unlikely that the construction period for the Proposal would coincide with this development.



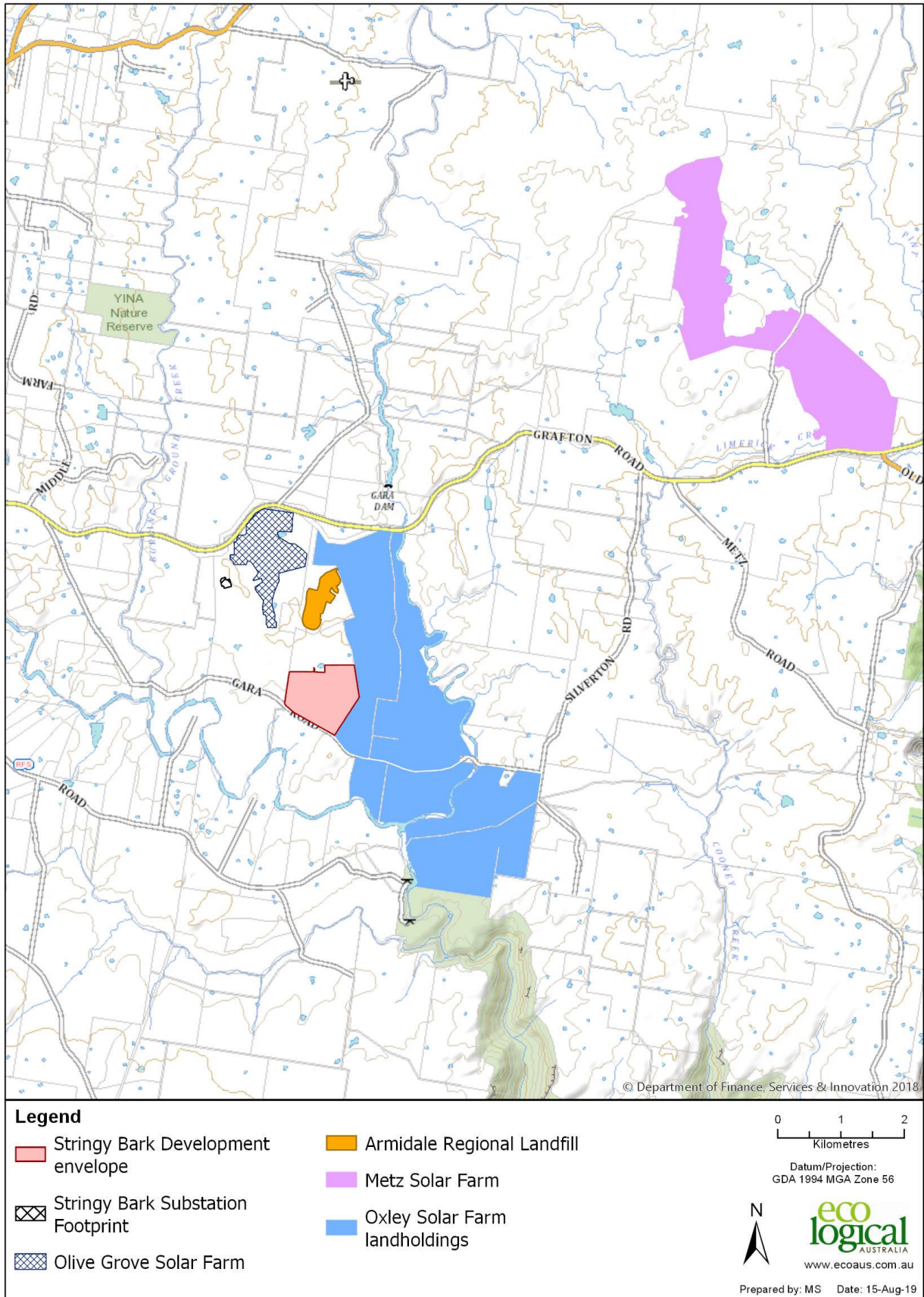


Figure 7-10: Nearby projects relative to the local road network



It should be noted, that there is also potential for cumulative impacts relating to increased traffic volumes on traffic noise, road dilapidation and dust generation. However, with the adoption of good traffic management practices by the Proposal (Section 7.6.3), in combination with the fact that any impacts involving Stringybark Solar Farm would be temporary in nature (occurring only during the 9-month construction period), these potential impacts can be managed to acceptable levels.

Traffic generation during operation will only involve a small maintenance team using light vehicles, and occasional trucks in the event of unplanned maintenance or panel cleaning. Such traffic volumes are considered unlikely to provide potential for future cumulative impacts.

### **Visual impacts**

Cumulative visual impact can be defined as the combined effect of changes brought about by a proposed development in conjunction with other similar developments in an area. Cumulative visual impacts may result in changes to the perceptions of the local community or a visitor to the region due to the presence of multiple solar farms in the area. Cumulative visual impacts can occur through either:

- Sequential and simultaneous views to one or more solar farms and/or similar projects from publicly accessible viewpoints from the surrounding road network; or
- Simultaneous views of multiple solar farms and/or similar projects from private viewing locations.

The greatest potential for cumulative visual impacts to occur is in areas where the viewshed (distance at which a project is a discernible visual feature) of one or more solar farms approved or constructed overlaps.

The Metz Solar Farm is the only approved solar farm in proximity to the Proposal. The Metz Solar Farm, which is approximately 8.4 km to the north-east, is outside the 4.0 km viewshed of the Stringybark Solar Farm. The Metz Solar Farm is also in an area that was demonstrated as having no visibility of the Proposal in the Seen Area Analysis and will therefore not contribute to cumulative visual impacts.

There are two proposed solar farms within the Proposal's viewshed. The first is the Olive Grove Solar Farm which is approximately 750 m to the north of the Development Envelope and lies within an area where the proposed Stringybark Solar Farm is not visible and will therefore not contribute to cumulative visual impacts. The Substation Location Area of the Proposal is approximately 300 m from the potential location of the Olive Grove Solar Farm and does have visibility within the same viewshed in the Seen Area Analysis. However the Substation is a small feature that is highly screened and located a significant distance from any receptors, and will therefore not contribute to any significant cumulative visual impacts.

The second proposed project is the 300 MW Oxley Solar Farm which shares part of the eastern boundary of the Stringybark Solar Farm Development Envelope and has received SEARs from NSW DPE.

The potential for cumulative visual impacts is not able to be accurately assessed because the proposed Oxley Solar Farm is at an early stage of development with limited information available. However, the greatest potential for cumulative visual impacts to be generated by the Proposal in conjunction with the Oxley Solar Farm is from areas within the viewshed where the Proposal has the potential to be a visually noticeable element in views. The viewshed defines this distance as being 500 m from the Site's boundary. Beyond this distance, the Proposal may still be a noticeable feature but will not dominate views.

The potential for simultaneous visual impact to occur is limited to locations where both developments are visible from the same location. This would require each development to be within the same view cone or direction, or visible in different directions from the same location. There is potential for this overlap to occur on sections of Gara Road and a limited section of Castledoye Road (although beyond 500 m), where views may include both solar farms. The LVIA and accompanying photomontages (Appendix E) demonstrates the overall visual impact of the Stringybark Solar Farm would be low to negligible from most locations including areas of potential overlap.

The visual assessment from nearby residential dwellings determined that the Proposal would also have a generally low level of visual impact, due in part to the screening afforded by topography and vegetation and the overall distance between the dwellings and the Proposal.

In summary, while the potential for cumulative visual impacts of the Proposal in conjunction with the Oxley Solar farm is not able to be accurately assessed, the Proposal's relatively small size and its overall visual assessment of low-negligible impacts means that the Proposal's contribution to cumulative visual impact would also be low.

### **Water**

The Proposal is located at the headwaters of its catchment area and has been developed to minimise and contain potential impacts on water resources to an area within the Site (Section 7.8). As the Proposal is unlikely to impact water resources downstream of the Site, no cumulative impacts to water resources as a result of the Proposal are anticipated.

### **Noise**

The cumulative noise assessment has identified two proposed developments that have the potential for cumulative noise impacts in combination with the Proposal:

- Olive Grove Solar Farm; and
- Oxley Solar Farm.

Based on the results of the acoustic assessment for the construction phase of the Proposal (Appendix F), it is predicted that any noise sensitive receptors (NSRs) would be highly noise effected within 40 m. As there are no noise sensitive receptors within 40 m of the Proposal there will be no highly noise effected NSR as a consequence of the concurrent construction of the Proposal and the Olive Grove and Oxley Solar Farms.

There is one NSR (NSR1) that is predicted to be impacted during the Proposal's construction works when construction activities occur within 550 m of this receptor, potentially exceeding the 50 dB(A) noise target using the CONCAWE Met Category 6 (worst-case) by a maximum of 4 dB only for a short duration (typically a maximum of two to three days). As this NSR is also within 550 m of the boundary of the proposed Oxley Solar Farm, it is possible that cumulative noise impacts could occur at this NSR.

It is not possible to quantify the potential impact as the design of the proposed Oxley Solar Farm is not available at the time of preparation of this SEE, however, as mitigation measures will be adopted to further reduce noise impacts at NSR1 during the construction of the Proposal, it is expected that, if best practice noise mitigation measures were also adopted by Oxley Solar Farm, cumulative noise impacts at NSR1 could be managed to acceptable levels. In addition, it must be noted that such noise impacts would only arise if both developments were constructed concurrently, and that construction activities occur at the same time within 550 m of NSR1.

Based on the results of the acoustic assessment (Appendix F), there would be no cumulative noise impacts at any NSRs as a result of the operational phase of the Proposal.

### **Bushfire and Electrical Fire**

The flammability of solar farms is very low as they are predominantly constructed of glass, silicon, steel and aluminium. While fires (such as grassland fires) have the potential to occur, the risk of fire originating from the Site is very low. With appropriate mitigation strategies in accordance with the latest PBP requirements in place (Section 7.10.4), bushfire and electrical fire risks during the operation of the solar farm are considered highly manageable. The Armidale Landfill is adopting best practice fire sensitive design principles and mitigation measures for inclusion in its yet-to-be-finalised Landfill Environmental Management Plan (Armidale Regional Council, 2019). Adopting a similar best practice approach at Olive

Grove Solar Farm and Oxley Solar Farm will help manage impacts. The proximity of multiple projects actively managing fire risk actually assists in management responses and may create a positive cumulative impact, in comparison with existing conditions.

### ***Electromagnetic Interference***

Potential Electromagnetic Field (EMF) impacts would occur only during the operational phase, when the solar farm infrastructure is capable of generating EMFs. As health risk of EMFs from solar arrays would be insignificant and EMFs from the Proposal are likely to be indistinguishable from background levels at the boundary fence, no cumulative EMF impacts as a result of the Proposal are anticipated.

### ***Air Quality***

The Proposal has been developed to minimise and contain potential dust impacts to an area within the Site and measures are provided to mitigate potential dust and greenhouse gas emissions from Project-related vehicular movements (see Sections 7.12 and 7.6). As the Proposal is unlikely to significantly impact air quality, no cumulative impacts to air quality as a result of the Proposal are anticipated.

### ***Waste and Resource Use***

Disposal of waste streams, particularly at the end of life, is becoming an area of community concern. Managed effectively, in line with the mitigation measures described in the Section 7.13.4, the generation of waste as a consequence of the construction, operation and decommissioning of the Proposal would not result in significant impacts.

### ***Socio-economic***

There is potential for the Proposal's construction period to overlap with Oxley Solar Farm and other major projects in the region, leading to potential for positive and negative impacts to workforce accommodation availability, resources, hospitality and health services. However, the Proposal is relatively small in scale and Armidale is a major regional centre in close proximity and is expected to be able to meet potential cumulative demand for accommodation and related services. The construction period is of short duration effectively reducing potential for, and duration of any workforce overlap.

It is important to also note that the agricultural land being developed for solar energy is not lost, such as in the case of rural residential subdivision and, following decommissioning, the land will again be available for agriculture.

### 7.15.3 Mitigation Measures

Generally, the combined effect of temporal and/or spatial separation between the Proposal and other developments occurring, or proposed to occur, in conjunction with project specific mitigation measures are considered appropriate to satisfactorily mitigate potential cumulative impacts.

The following mitigation measures outlined in Table 7-22 may be used to further mitigate potential cumulative impacts with Olive Grove Solar Farm and Oxley Solar Farm if approval of all three solar farm projects is granted, in addition to the subject-specific mitigation measures established that prevent and minimise potential impacts from the Proposal.

**Table 7-22: Mitigation measures for cumulative impacts**

| Impact                | Mitigation Measure  |
|-----------------------|---|
| <b>Traffic</b>        | Preparation of a construction traffic management plan for the Proposal based on contemporaneous traffic information for Olive Grove Solar Farm and Oxley Solar Farm.  |
|                       | Should changes be made to the Proposal's estimated construction period, analysis of the activity levels of other large projects in the region should be undertaken to ensure potential cumulative impacts relating to traffic volumes and accommodation availability are managed accordingly. |
| <b>Socio-economic</b> | Consideration of preparation of a sub-contractor accommodation strategy to co-ordinate and optimise the utilisation of locally available accommodation resources and services.  |
| <b>Noise</b>          | If the construction periods for the Proposal and Oxley Solar Farm overlap, consultation with Oxley Solar Development Pty Ltd may be required to ensure adequate temporal and/or spatial separation of noise impacts.  |
| <b>Visual Amenity</b> | Visual screening shall be established to mitigate potential visual impacts associated with the Proposal, thus minimising potential cumulative effects.  |

## 8 Environmental Management

### 8.1 Environmental Management Plans

Environmental Management Plans would be prepared following the final design of the Proposal and prior to each respective development stage to provide an overall framework for the management of environmental impacts that could potentially arise during the construction, operation and decommissioning of the Proposal. Within these overarching Environmental Management Plans (i.e. the CEMP, OEMP and DMP) there will be an Emergency Response Plan, Erosion and Sediment Control Plan, a Spill Response Plan, a Waste Management Plan, a Construction Noise Management Plan, a Landscape Management Plan, a Bushfire Management Plan, and a Community Consultation Plan.

The Proposal would be designed, constructed, operated and decommissioned in accordance with the requirements of:

- Relevant legislation;
- Conditions of consent; and
- Commitments provided in this SEE.

A final design of the solar farm (Final Layout Plan) would be submitted to Armidale Regional Council for approval. Based on the final layout, the mitigation measures identified throughout this SEE that will minimise any potential adverse impacts from the Proposal on the surrounding environment are to be incorporated into either the CEMP, the OEMP, and/or the DMP. This would provide:

- An environmental operations manual for staff and contractors throughout the construction, operation and decommissioning of the Proposal;
- Identification of the potential impacts of the Proposal and the measures identified to mitigate these impacts as described in the preceding chapters of this SEE;
- Details of how the mitigation measures are to be implemented;
- Details of the timing of the implementation of the mitigation measures;
- Clearly defined allocations of environmental responsibilities for all staff members and contractors;
- Monitoring and reporting requirements to demonstrate compliance with licensing and approval requirements; and
- Procedures for review and updating of the Environmental Management Plans.

Adherence to the Environmental Management Plans would enable the mitigation measures to be effectively implemented and sustainable work practices to be adopted throughout the duration of the Proposal.

This would demonstrate The Proponent's intent to comply with conditions of consent, relevant environmental legislation, prevent environmental pollution and minimise the impact of the Proposal on the environment.

### 8.2 Statement of Commitments

The mitigation measures are summarised in Table 8-1.

Table 8-1: Statement of commitments

| Impact             | Mitigation measures  |
|--------------------|--|
| Land Use and Soils | The Landholding is already fenced, however an appropriate security fence (approximately 2.5 m high) will be constructed around the Proposal to ensure the solar farm remains off limits to the general public. All fences will need to be maintained to avoid the possibility of livestock straying onto the Site from the Landholding or any adjoining properties.  |
|                    | Construction activities will be undertaken predominantly during daylight hours from 7am – 6pm Monday to Friday, 8am – 1pm on Saturday. During the operational phase, lighting will be restricted to the Substation and the operations compound and will only be used infrequently as required.   |
|                    | The Proposal's security system will include CCTV at several locations around the Development Envelope and Substation (Section 4.1.5).  |
|                    | <p>The CEMP, OEMP and DMP will incorporate an Erosion and Sediment Control Plan in accordance with the <i>Managing Urban Stormwater: Soils and Construction</i> series to be developed following project approval that will include a requirement for the establishment and maintenance of erosion and sedimentation controls at the commencement of works and throughout construction, operation and decommissioning, including the following measures:</p> <ul style="list-style-type: none"> <li>• Construction and/or installation of erosion and sediment control structures shall be in accordance with the specifications provided in the Blue Book;</li> <li>• Regular inspection and programmed maintenance of erosion and sedimentation controls will be undertaken and documented in a register of inspections. Further, inspection of the Array Area following significant rainfall events and stabilisation works would be undertaken as required;</li> <li>• Cable trenches will be constructed in accordance with relevant regulations and ground conditions. Trenches will be excavated and filled progressively to ensure they are left open for the shortest period possible. Surface conditions will be rehabilitated as soon as practicable to prevent the formation of preferential flow pathways;</li> <li>• Management of erosion generated by traffic shall include a driving code of practice, installation of appropriate drainage controls, inspection and maintenance of unsealed road surfaces and dust management strategies. Maintaining access tracks in good condition and ensuring that associated drains and/or sedimentation traps are monitored and maintained will ensure that the potential erosion associated with the tracks is minimised. Water carts may be used if necessary, to limit wind erosion and dust generation;</li> <li>• Separation of topsoil and subsoil for stockpiling and correct reinstatement to ensure a suitable growth medium is retained;</li> <li>• Commence revegetation and vegetation cover maintenance as soon as practicable to minimise the risks of erosion (including scouring under panels during operation) and to minimise area likely to create dust;</li> <li>• Appropriate stockpile management to ensure air and water erosion is minimised, soil health, organic matter and structure are retained and weed infestation minimised; and</li> <li>• Account for climatic events during construction: <ul style="list-style-type: none"> <li>○ If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and</li> <li>○ Works methods shall be modified during high wind conditions if excess dust is generated.</li> </ul> </li> </ul> |



| Impact       | Mitigation measures   |
|--------------|---|
|              | <p>To avoid contaminant release to the environment:</p> <ul style="list-style-type: none"> <li>• All hazardous materials (fuels, lubricants, herbicides, etc.) will be stored in accordance with relevant regulations;</li> <li>• All hazardous materials will be disposed of offsite in accordance with DECC guidelines;</li> <li>• Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area;</li> <li>• Machinery are to arrive and leave site in a clean condition, free of oil leaks to prevent contamination and sediment tracking on sealed roads;</li> <li>• Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery;</li> <li>• Good weed management practices will be implemented to ensure that pesticide use is minimised (including the potential use of sheep to graze between the panel rows to manage vegetation loads);</li> <li>• The application of any pesticides will be in accordance with the NSW Pesticides Act 1999, such that only registered pesticides are used based on label instructions that are designed to minimise impacts on surrounding land;</li> <li>• Despite no recorded contaminated sites, the potential remains for unidentified contamination to be encountered during excavation. Should this be the case, works in the area would cease and the relevant authorities would be notified. Protocols for such an event would be included in the CEMP, OEMP and DMP.</li> <li>• All subsurface infrastructure should be placed a minimum of 0.5 m below ground level, or removed when the site is decommissioned, to ensure that no future agricultural activities may possibly be impacted by this infrastructure. Detailed location and identification of any remaining subsurface infrastructure should be provided</li> <li>• All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills; and,</li> <li>• The CEMP OEMP and DMP will incorporate a Spill Response Plan (SRP). The SRP will outline the procedures to respond to a spill event and the measures required to prevent the spread of spills to adjacent areas. It will also include an emergency response protocol, EPA notification procedures and remediation requirements.</li> </ul> <p>Vegetation management strategies will be included within a Landscape Management Plan in the CEMP OEMP and DMP. To keep fuel levels down over the Site, vegetation can be managed by mechanical methods including mowing or slashing. In addition, sheep may be permitted to graze within the solar array. The Proponent would need to ensure adequate water supplies are located within the Site for the welfare of grazing animals. This would contribute to weed management and fuel load reduction and provides for the potential continuation of agricultural activities at a reduced scale.</p> |
| Biodiversity | <p>The CEMP, OEMP and DMP will incorporate a Landscape Management Plan that will specify controls to reduce impacts including:</p> <ul style="list-style-type: none"> <li>• An induction and awareness program for construction workers;</li> <li>• Methodology for a two stage clearing process;</li> <li>• Develop a plan for replanting and vegetation management;</li> </ul>  |

| Impact | Mitigation measures  |
|--------|--|
|        | <ul style="list-style-type: none"> <li>• Develop a plan for on-going weed control; and</li> <li>• Monitoring program focusing on on-going impacts, including erosion.</li> </ul> <p>A qualified ecologist/licensed wildlife handler will be present to supervise during clearing of identified fauna roosting or nesting habitat, in accordance with best practice methods to relocate fauna in a sensitive manner. Any fauna utilising habitat within the Site will be identified and managed to ensure clearing works minimise the likelihood of injuring fauna.</p> <p>If possible in considering the Proposal construction schedule, construction activities should be programmed to avoid impacts; for example, timing construction activities for when migratory species are absent from the Site, or when particular species known to or likely to use the habitat on the Site are not breeding or nesting. Where possible, timing of vegetation clearance should be planned to occur outside of the period between August and March, during the breeding/nesting/nursing time for the majority of avian and micro-bat species, to avoid impacts to fauna during these critical life cycle events.</p> <p>Clearing of vegetation will be undertaken via a two-stage clearing process. Clearing will not be undertaken until pre-clearance survey of trees to be removed and identification of habitat trees are conducted by a qualified ecologist. Stage 1 of the clearing process involved marking of habitat features, and removal of all vegetation except habitat features. Stage 2 involves removal of habitat features under the supervision of a qualified ecologist/licensed wildlife handler to relocate resident fauna. Vegetation that is to be removed nearby to retained vegetation will be removed using a chain-saw rather than heavy machinery to avoid any additional impacts on adjacent vegetation. All clearing staff will be briefed about the two-stage clearing process, and their responsibilities to minimise impacts to biodiversity.</p> <p>Construction works are to occur during standard construction hours to maximise daylight hours. Any request for an out of hours works protocol should consider construction activities during non-daylight hours as having potential fauna impacts.</p> <p>Control of sediment and erosion in accordance with an Erosion and Sediment Control Plan incorporated in the CEMP OEMP and DMP (as per Section 7.2.2) will include the management of exposed soil surfaces and stockpiles to prevent sediment discharge into waterways, and the installation of stormwater management systems, sediment barriers (e.g. silt nets downslope from workings) or sedimentation ponds to control the quality of water released from the Site into the receiving environment. The Landscape Management Plan includes a requirement to commence revegetation as soon as practicable to minimise the risks of erosion and to minimise area likely to create dust.</p> <p>Weed management strategies will be included within a Landscape Management Plan in the CEMP OEMP and DMP for the Site that aim at preventing and minimising the spread of weeds to and from, and within the Site. Weed management strategies that will be implemented, include:</p> <ul style="list-style-type: none"> <li>• Protocols for weed hygiene in relation to the cleaning and inspection of vehicles, mobile plant and machinery prior to entering and leaving the Site, and for the importation of fill; and</li> </ul> |

| Impact              | Mitigation measures   |
|---------------------|---|
|                     | <ul style="list-style-type: none"> <li>While there are currently no weeds on the Site listed under the <i>NSW Biosecurity Act 2015</i>, management and removal strategies for any future pathogen or declared priority weed infestations should be implemented by a qualified bush regenerator according to the stipulations of the <i>Biosecurity Act</i>.</li> </ul> <p>All staff entering / working at the Site will undertake an environmental induction to communicate environmental features to be protected and measures to be implemented as part of their Site familiarisation. Site briefings should be updated based on phase of the work and when environmental issues become apparent. This induction will include items such as:</p> <ul style="list-style-type: none"> <li>Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and weeds);</li> <li>What to do in case of environmental emergency (chemical spills, fire, injured fauna); and</li> <li>Key contacts in case of environmental emergency.</li> </ul> <p>Development control measures to regulate activity in vegetation and habitat adjacent to development will be detailed within the CEMP and DMP should be implemented to protect flora and fauna surrounding the Site. These measures should include installation of signage to indicate no go zones, rubbish disposal guidance, prohibition of wood collection, prohibition from lighting fires, prohibition of disturbance to vegetation outside of the Site, and pest &amp; disease management to advise contractors of their responsibilities and prevent any accidental construction damage.</p> <p>Temporary fencing is to be installed prior to works, to delineate work zones and clearing boundaries, to protect retained vegetation and to prevent rubbish dumping by contractors. Trees for retention within open areas will be marked. Appropriate security measures will also be in place to reduce illegal dumping.</p> <p>A monitoring program will be considered within the management plans to measure infrequent and cumulative impacts of the Proposal such as erosion and dust.</p> |
| Aboriginal Heritage | <p>If suspected Aboriginal objects, such as stone artefacts are located during future works, works must cease in the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, the OEHL shall be notified under section 89A of the NPW Act. Appropriate management and avoidance or approval under a section 90 AHIP should then be sought if Aboriginal objects are to be moved or harmed.</p> <p>In the extremely unlikely event that human remains are found, works should immediately cease and the NSW Police should be contacted. If the remains are suspected to be Aboriginal, the OEHL may also be contacted at this time to assist in determining appropriate management.</p>  |
| Historic Heritage   | <p>The culvert underlying the Waterfall Way - Gara Road intersection (the feature with the potential to be directly impacted) is recommended to be mitigated by avoidance. The associated feature is close to the surface on the southern side of Waterfall Way and follows the natural depression of the landscape, emerging approximately 3 m below Waterfall Way on its northern side. Should works be undertaken at this access point, the eastern bound lane (northern side of Waterfall Way) would require modification, as such, it is expected that works will be able to avoid the areas where this feature is present. This</p>   |

| Impact                | Mitigation measures   |
|-----------------------|---|
|                       | <p>assessment will continue through approval of the works and in conjunction with the assessed requirements for the modifications of the intersection when they are available.</p> <p>In the unlikely event potential historic heritage items are found during construction activities, works in that area shall cease until an assessment is made by an appropriately qualified archaeologist and OEHL has been consulted.</p>   |
| Traffic and Transport | <p>A Traffic Management Plan (TMP) and driver code of conduct will be prepared and included in the CEMP for implementation during the construction phase. This will assist with the control of Proposal-related traffic movements (including the use of mini buses), and ensure that driver behaviour within the Site and on the surrounding road network is maintained to a safe level that accounts for local conditions in line with the Road Safety Audit.</p> <p>To facilitate construction traffic safely, the assessment recommends shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment as well as the provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the Gara Road intersection, during the construction phase.</p> <p>At the intersection of Waterfall Way to the Substation Location Area (1060 Waterfall Way), the assessment also recommends the provision of shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment. Both intersection upgrades are to be completed to a level that satisfies the requirements for a rural property access as per Figure 7.4 of <i>AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General</i>.</p> <p>Existing road safety issues along Gara Road between the Waterfall Way and the Site access have been identified. Measures, such as the provision of give way signage in one direction at the locations where the road has a narrow formation and tight radius bends, could be implemented during the construction phase to ensure that Heavy Vehicle passing maneuvers at these locations are mitigated.</p> <p>The proposed Site access is currently the main access to the landholding at 597 Gara Road, as a result of the Proposal, a new access for the landowner will be required. It is proposed that this new access be located further west along Gara Road and be constructed to satisfy the requirements for a rural property access as per Figure 7.4 of <i>AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General</i>.</p> |
| Visual amenity        | <p>Vegetation screens are intended to grow densely and to a height taller than the panel array as shown in Figure 3-4 along the southern and western edges of the Development Envelope and along the eastern boundary of the Substation Location Area.</p> <p>Ensure that establishment of the vegetation screens is conducted as one of the first activities of Site construction.</p> <p>To ensure the success of the landscape screening, a Landscape Management Plan would be developed for the establishment and maintenance of the proposed landscaping in consultation with the Armidale Tree Group and included in the CEMP and OEMP. This plan will include:</p> <ul style="list-style-type: none"> <li>• Preparation of the vegetation screenings;</li> <li>• Local endemic species selection based on guidance from local nurserymen or Landcare groups and agreed performance criteria to provide complementary biodiversity outcomes;</li> </ul>   |

| Impact | Mitigation measures  |
|--------|--|
|        | <ul style="list-style-type: none"> <li>Care and maintenance requirements over the lifetime of the Proposal; and</li> <li>Procedures to follow if planting fails or does not achieve objectives, including alternative species.</li> </ul> <p>Use muted, low contrast colours for all supporting infrastructure, so that they blend into the landscape as far as possible.</p> <p>Minimise night lighting to the Substation and support buildings area.</p> <p>Minimise vegetation clearing and earthworks and rehabilitate progressively in accordance with the Landscape Management Plan..</p>  |
| Water  | <p>As a result of a design philosophy that, in the first instance seeks to avoid impacts, the following environmental protections apply:</p> <ul style="list-style-type: none"> <li>Exclusion of higher order streams from the Site;</li> <li>Avoidance of footings and pilings, where practicable, from 1<sup>st</sup> and 2<sup>nd</sup> order drainage line riparian zones;</li> <li>Minimisation of drainage line crossings for internal access and electrical cabling, and in accordance with permit conditions where necessary;</li> <li>Avoidance or offsetting of existing vegetation within the potential GDEs mapped in the Site, where appropriate;</li> <li>Sourcing of non-potable water from rainwater tanks, and/or existing licenced water sources offsite; and</li> <li>Sourcing all potable water requirements from offsite.</li> </ul> <p>All works undertaken in and around watercourses should be carried out in accordance with DPI Water <i>Guidelines for Controlled Activities</i> (2012). A CEMP and OEMP shall be developed in consultation with DPI Water (<a href="mailto:water.referrals@dpi.nsw.gov.au">water.referrals@dpi.nsw.gov.au</a>), prior to the commencement of activities, to assess and identify appropriate construction and operational protocols to ensure the protection of surface and groundwater quality, maintenance of water supplies and rights of access, and, where relevant, the appropriate protection of riparian and aquatic ecosystems and the potential GDEs. A similar plan would be developed within the DMP to guide decommissioning activities in accordance with relevant requirements at the time.</p> <p>Erosion and sedimentation impacts associated with soil disturbance from construction activities will be minimised by undertaking works in accordance with provisions of the <i>Managing Urban Stormwater: Soils and Construction</i> series, in particular:</p> <ul style="list-style-type: none"> <li>Managing Urban Stormwater: Soils and Construction, Volume 1, 4<sup>th</sup> edition (Landcom, 2004), known as ‘the Blue Book’;</li> <li>Volume 2A Installation of Services (DECC, 2008a); and</li> <li>Volume 2C Unsealed Roads (DECC, 2008b).</li> </ul> <p>Procedures shall be adopted to minimise the risk of water quality impacts associated with sedimentation and contamination of surface water resources (Section 7.2 provides detail on contamination mitigation measures and an Erosion and Sediment Control Plan to be incorporated in the CEMP OEMP and DMP).</p> |

| Impact | Mitigation measures   |
|--------|---|
|        | <p>Water quality protocols include establishing and maintaining ground vegetation cover across the Site to minimise potential for erosion (including erosion associated with scouring beneath the panels following significant rainfall events during operation), and consequently, to therefore minimise sedimentation impacts to water quality. Groundcover species selection and management will be undertaken in continued consultation with local agronomists (GrazAg) and seek to balance between maintaining groundcover at the Site, future agricultural land uses, and bushfire management objectives to avoid a build-up in combustible vegetation. Protocols for the management and reinstatement of groundcover will be compiled in a Landscape Management Plan to make sure groundcover is reinstated after disturbance during construction and preserved and managed during the operational life of the solar farm. GrazAg advice indicates that the establishment of groundcover within the array area would not be problematic; however, the Landscape Management Plan will also include alternative measures to protect soils in the unlikely event that pasture establishment is unsuccessful in producing adequate cover to protect soils.</p> <p>Access tracks shall be maintained in good condition, ensuring that associated drains and/or sedimentation traps are monitored and maintained so that potential erosion associated with the tracks, which could lead to impacts on water quality, is minimised.</p> <p>Management of construction waste and sewage would be detailed in the CEMP. Waste produced from toilets shall be stored in a septic tank until it is trucked off site and disposed of in accordance with EPA (2016) requirements. All hazardous materials will be classified and appropriately stored to prevent contamination of drainage lines.</p> <p>All hazardous materials (fuels, lubricants, construction chemicals, herbicides, etc.) will be transported and disposed offsite in accordance with EPA (2016) guidelines to avoid release to the environment, and contamination of water systems. Onsite refuelling shall occur within designated areas located more than 100 m from the nearest drainage line and within an impervious bund. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from engines or hydraulic systems. All contractors and staff will participate in toolbox talks to prevent, minimise and manage accidental spills.</p> <p>A Spill Response Plan (SRP) will be developed and included in the CEMP, OEMP and DMP. All contractors and staff will be trained regarding the appropriate spill response strategies. Should a spill occur, incident management procedures provided in the SRP will be implemented and the EPA will be notified of any incidents that cause harm to the environment, pursuant to sections 147 – 153 of the POEO Act.</p> <p>Non-potable water required for the Proposal would be sourced offsite under agreement with existing water access licences. Accordingly, a water access licence from DPI Water would not be required for construction activities.</p> <p>Potable water required for the construction, maintenance and decommissioning phases of the Proposal will be sourced from local water cartage services in the surrounding area, along with ensuring appropriate DPI water licences are held.</p> <p>Construction and decommissioning activities will avoid impacts to riparian and aquatic ecology, avoiding direct impacts where possible and adopting best practice where necessary.</p> |

| Impact              | Mitigation measures   |
|---------------------|---|
|                     | <p>To minimise direct impacts to riparian, aquatic and groundwater dependent ecosystems, excavation activities will be located away from drainage lines where possible. However, vehicular culvert crossings and cables required for the Proposal will cross 1<sup>st</sup> and 2<sup>nd</sup> order drainage lines. Approval under the WM Act is required as installation of vehicular and cable crossings on waterfront land is a controlled activity. Accordingly, relevant design considerations will be followed as per the NSW Office of Water's <i>Controlled Activities: Guidelines for laying pipes and cables in watercourses</i>, and where vehicular crossings are required, a culvert would be used in line with the requirements of Class 4 waterway recommendations under the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (NSW DPI, 2013) and <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull &amp; Witheridge, 2003). These measures will avoid negative impacts to the two riparian, aquatic and groundwater dependent ecosystems.</p>   |
| Noise and Vibration | <p>As the Acoustic Assessment predicted minimal exceedances of the ICNG noise management level at NSR1 for short periods of time, it is recommended that a Construction Noise and Vibration Management Plan is produced by the contractor and incorporated in the CEMP and DMP to provide a framework for construction noise management on-site. This should include all pertinent information regarding the control and management of noise and vibration, and would be used as a working document on-site by contractors and sub-contractors so that everyone is aware of their responsibilities. The following management measures will be employed to minimise construction noise:</p> <ul style="list-style-type: none"> <li>• Informing potentially effected residences regarding impending or current construction activities that may cause high levels of noise along with an estimation of the duration of these works. This could take the form of letter drops, an email or a message on a community notice board;</li> <li>• Provide a complaints telephone number prominently displayed at the site, and on any community information material;</li> <li>• Respite hours can be agreed with residents when noisy works will not take place, if necessary;</li> <li>• Investigate complaints when received to establish the cause, and where possible implement corrective action such as providing a respite period or other practical measure;</li> <li>• Minimising the operational noise of machinery brought to Site;</li> <li>• Where appropriate obtain acoustic test certificates for machinery brought on to the Site;</li> <li>• Ensure that plant is not left idling when not in use;</li> <li>• Ensure plant is well maintained; and</li> <li>• All access hatches for plant to be kept closed.</li> </ul> <p>If there is unexpected excessive noise from any process, that process will be stopped and if possible that noise attenuated to acceptable levels. Where there is no alternative the process will be rescheduled to non-sensitive hours.</p> <p>The Construction Noise and Vibration Management Plan will also:</p> <ul style="list-style-type: none"> <li>• Define hours of work in accordance with construction noise guidelines;</li> <li>• Specify the requirement for noise management and selection of mobile plant;</li> <li>• Include noise awareness training and induction for workers so that everyone understands the importance of controlling noise and vibration; and</li> </ul> |



| Impact                       | Mitigation measures   |
|------------------------------|---|
|                              | <ul style="list-style-type: none"> <li>Consider adverse weather conditions.</li> </ul>  |
| Bushfire and Electrical Fire | Undertake a Bushfire Risk Assessment to assess specific risks associated with the Site, the Proposal and surrounding influences, and develop a Bushfire Management Plan in consultation with relevant fire authorities prior to commencing construction activities and identify a suite of strategies and mitigation measures to manage these risks.  |
|                              | Electrical equipment selected for the 30 year life span of the Proposal would be designed to minimise the potential for ignition and certified to comply with relevant Australian Standards. The Proposal will ensure that all equipment at the Site is installed correctly and maintained in good order to prevent sources of ignition from faulty equipment. All installed equipment would be earthed appropriately following comprehensive testing of soil conductivity to ensure lightning effects are not harmful to the operation of the Proposal.  |
|                              | Chemical storage will be in accordance with safety data sheet requirements and would consider potential fire hazards (e.g. the use of fire cupboards for the storage of chemicals).   |
|                              | There will also be a dedicated fire emergency water tank located adjacent to the site access near the operational compound, and another at the Substation Location Area, for the sole use of fire protection in line with the RFS standards (RFS, 2018). The size of the tank will be finalised in the development of the Bush Fire Management Plan.  |
|                              | <p>Appropriate emergency vehicle access will be provided across the entire Site. The Site access track network will be designed and constructed in compliance with RFS standards.</p> <p>As such, infrastructure setbacks from boundaries shall include a 10 m wide firebreak that will form an Asset Protection Zone (APZ) around the perimeter of both the Development Envelope and the Substation Location Area. A 4 m wide track will be constructed within the APZ of the Development Envelope to allow emergency vehicles access to all parts of the Array Area as illustrated in Figure 7-8. The RFS recommends that firebreaks around valuable assets be mown, grazed or ploughed. In addition, the APZs would also be designed in accordance with RFS guidance including <i>Standards for Asset Protection Zones</i>, and maintained to reduce the risk of fuel loads building up. These management actions will be included in the CEMP, OEMP and DMP.</p> <p>There will be five (5) gated emergency entrance and exit points (including the main entrance) along the perimeter of the Development Envelope and two (2) gated emergency entrance and exit points at the Substation Location Area (including the main entrance) ensuring that the Proposal can be accessed or evacuated at a number of locations (see Figure 7-8).</p> |
|                              | The fuel load across the Proposal will be monitored and will be actively managed through mechanical slashing and/or mowing or grazing as required to reduce the risk of grass fires starting within the Site and ensuring that fires originating from outside the Site do not intensify as a consequence of entering the Site.  |

| Impact                       | Mitigation measures  |
|------------------------------|--|
|                              | <p>The CEMP, OEMP and DMP will include an ERP and a copy will be provided to the RFS and Fire and Rescue NSW. This will allow the first responders to a fire to have ready access to information that details the effective control measures for a fire at the Proposal Site and for these to be implemented quickly. The ERP will include the controls required to mitigate the potential risks that could be experienced by fire fighters at the Proposal, including the methods required to safely shut down and isolate the necessary components of the solar farm.</p> <p>The CEMP, OEMP and DMP will provide safety protocols to ensure all staff and contractors are aware of the bushfire risk on site and the mitigation measures required to reduce this risk. Protocols, will include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Basic training of all staff on the appropriate response to a fire emergency and in the use of firefighting equipment on site;</li> <li>• Firefighting equipment lists will be detailed in the Work Method Statements;</li> <li>• Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and</li> <li>• Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.</li> </ul> |
| Electromagnetic Interference | <p>In limiting exposure to EMFs, following advice from the International Commission on Non-Ionizing Radiation Protection, priority will be given to engineering and access controls that limit exposure (ICNIRP, 2010). This means that:</p> <ul style="list-style-type: none"> <li>• The final design of the Proposal would be undertaken by qualified and competent persons;</li> <li>• Design would meet relevant Australian standards, ensuring EMFs would be minimised as far as possible; and</li> <li>• Access to electrical equipment would be limited to qualified personnel only.</li> </ul> <p>To reduce the potential for chronic or acute exposure to EMFs, no unsupervised public access to the Proposal would be permitted.</p> <p>The landholder or its employees may have limited access (under the supervision) to the Development Envelope for grazing activities, however there will be no need to spend extended periods near electrical infrastructure. As such, the potential for impacts from EMFs is low.</p> <p>The landholder or its employees would not have access to the Substation or other electrical equipment.</p> <p>Electrical equipment commissioned as part of the Proposal would be designed to reduce possible interference in line with Australian Standards.</p>   |
| Air Quality                  | <p>Develop protocols for inclusion in the CEMP, OEMP and the DMP to guide vehicle, plant and construction activities to minimise air quality impacts:</p> <ul style="list-style-type: none"> <li>• Define designated access and travel routes;</li> <li>• Set onsite speed limits; and</li> <li>• Adopt trip management protocols to avoid unnecessary trips e.g.: <ul style="list-style-type: none"> <li>○ car-pooling for construction staff;</li> </ul> </li> </ul>   |

| Impact                 | Mitigation measures  |
|------------------------|--|
|                        | <ul style="list-style-type: none"> <li>○ coordinating delivery and removal of materials.</li> </ul> <p>Develop protocols for inclusion in the CEMP, OEMP and DMP to identify, minimise and treat dust emissions, for example:</p> <ul style="list-style-type: none"> <li>• The use of a water truck during dust generating activities (and periodically along Gara Road as required) (See Appendix G);</li> <li>• Limit the extent of clearing and excavation;</li> <li>• Stage clearing and excavation activities to minimise total areas of exposed soil;</li> <li>• Minimise the number and volume of stockpiles on-site and the number of work faces on stockpiles; and</li> <li>• Modify activities if dust is observed leaving the Proposal Site towards nearby sensitive receptors.</li> </ul> <p>Develop protocols for inclusion in the CEMP, OEMP and DMP to reduce CO<sub>2</sub> emissions, for example:</p> <ul style="list-style-type: none"> <li>• Ensure all vehicles and machinery that enter the site meet relevant standards for emissions; and</li> <li>• Maintain vehicles and plant in accordance with manufacturer's requirements to minimise emissions..</li> </ul> <p>Develop a complaints procedure to promptly identify and respond to issues generating complaints.</p>   |
| Waste and resource use | <p>To encourage the efficient use of resources and reduce environmental impacts, resources and waste will be managed according to the following hierarchy:</p> <ol style="list-style-type: none"> <li>1. Reduce waste production;</li> <li>2. Recover resources (including reuse, reprocessing, recycling and energy recovery); and</li> <li>3. Dispose of waste appropriately.</li> </ol> <p>Wastes will be classified in accordance with the NSW EPA <i>Waste Classification Guidelines – Part 1: classifying waste</i> (EPA 2014) and <i>addendum</i> (EPA 2016). Opportunities for recycling will be investigated during both the construction and decommissioning phases. Waste that cannot be recovered will be disposed of lawfully at a licensed waste facility.</p> <p>A Waste Management Plan will be prepared and included in the CEMP, OEMP and DMP. The objectives, protocols and responsibilities within it will be communicated to all staff and contractors through a site induction process and ongoing training. Specific measures to be incorporated into the Waste Management Plan would include, but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• Protocols to identify opportunities to follow the waste hierarchy - to ensure that waste is minimised, recovered, and disposed of appropriately, and also to ensure a culture of responsible waste management is upheld by staff;</li> <li>• Quantification, classification, and tracking of all waste streams - to encourage waste reduction and minimise inter-contamination of waste streams;</li> <li>• Controls on the disposal methods of all waste streams;</li> <li>• Provision of recycling facilities onsite to reduce waste streams;</li> </ul> |

| Impact             | Mitigation measures   |
|--------------------|---|
|                    | <ul style="list-style-type: none"> <li>• Provision of a dedicated waste management area onsite; and</li> <li>• Protocols on the transportation of waste, for example covered loads.</li> </ul>  |
| Socio-economic     | A Community Consultation Plan (CCP) will be prepared and implemented outlining the measures that will be taken during the construction phase to increase positive benefits to the Armidale community and to reduce any adverse impacts. It will note protocols to keep the community updated on project progress during the construction phase, how relevant stakeholders will be informed of potential impacts, and the resolution process, for any complaints received.     |
|                    | The Proponent will liaise with relevant local representatives to maximise the benefits to the local economy, where possible recruiting contractors from the local area and implementing an informal 'buy local' practice where goods and services are purchased from local businesses, provided they are competitive in terms of quality and price. The Proponent will provide local contractors/suppliers/workers with timely information regarding potential opportunities. |
| Cumulative Impacts | Preparation of a construction Traffic Management Plan (TMP) for the Proposal based on contemporaneous traffic information for Olive Grove Solar Farm and Oxley Solar Farm.  |
|                    | Should changes be made to the Proposal's estimated construction period, analysis of the activity levels of other large projects in the region should be undertaken to ensure potential cumulative impacts relating to traffic volumes and accommodation availability are managed accordingly.   |
|                    | Consideration of preparation of a sub-contractor accommodation strategy to co-ordinate and optimise the utilisation of locally available accommodation resources and services.  |
|                    | If the construction periods for the Proposal and Oxley Solar Farm overlap, consultation with Oxley Solar Development Pty Ltd may be required to ensure adequate temporal and/or spatial separation of noise impacts.  |
|                    | Visual screening shall be established to mitigate potential visual impacts associated with the Proposal, thus minimising potential cumulative effects.  |

## 9 Project Justification

### 9.1 Introduction

As a conclusion to the environmental assessment, the construction, operation and decommissioning of the Proposal is evaluated and justified through the consideration of its potential impacts against triple-bottom-line considerations (environment, community, economics) and its potential benefits to the local, regional and NSW community.

### 9.2 Residual environmental risks and impacts

The *Australian New Zealand Risk Management Standard (AS/NZS ISO 31000:2009)* defines risk management as the "coordinated activities to direct and control an organisation with regard to risk" (Standards Australia 2009). Risk arises in all aspects of a project life cycle and offers both opportunity and threat, and must therefore be managed appropriately. Risk management involves establishing an appropriate risk management culture, and applying logical and systematic risk management processes to all stages in the life cycle of any activity, function or operation.

This SEE adopts an environmental impact assessment methodology aligned to the *AS/NZS ISO 31000:2009* standard:

- Potential risks (environmental impacts) have been identified through the Environmental Assessment (Section 7);
- Strategies and actions are identified to mitigate the impact of the risk (Section 8);
- An assessment is made of the likelihood of the risk occurring and the consequence if the risk were to occur:
  - the likelihood of the risk occurring is described as *very unlikely*, *unlikely*, *possible*, *likely*, or *almost certain* to occur; and
  - the consequences or potential impact if the risk event occurred are described as *minor*, *major*, *severe*, *critical* or *catastrophic*.

The risk matrix below (Table 9-1) determines a risk rating of low, medium, high or extreme.

**Table 9-1: Residual environmental risk assessment**

| Risk Assessment Matrix |   | Consequence |        |        |          |              |
|------------------------|---|-------------|--------|--------|----------|--------------|
| Likelihood             |   | Minor       | Major  | Severe | Critical | Catastrophic |
|                        |   | A           | B      | C      | D        | E            |
| Very Unlikely          | 1 | Low         | Low    | Medium | Medium   | Medium       |
| Unlikely               | 2 | Low         | Low    | Medium | Medium   | High         |
| Possible               | 3 | Low         | Medium | High   | High     | High         |
| Likely                 | 4 | Medium      | Medium | High   | High     | Extreme      |
| Almost Certain         | 5 | Medium      | High   | High   | Extreme  | Extreme      |

In each case the likelihood and consequence is independently assessed in order to assign a mitigate risk score (Table 9-2).

**Table 9-2: Residual risks for all impacts identified in the environmental assessment**

| Factor         | Receptor                | Potential Impact   | Mitigated Likelihood | Mitigated Consequence | Mitigated Risk |
|----------------|-------------------------|--|----------------------|-----------------------|----------------|
| Land resources | The Site                | Disturbance and erosion of soils and productive topsoil    | 2                    | A                     | Low            |
|                |                         | Soil compaction leading to concentrated runoff and erosion | 2                    | A                     | Low            |
|                | Nearby properties       | Reduced agricultural viability                             | 1                    | A                     | Low            |
| Biodiversity   | Plant communities       | Disturbance/loss of habitat                                | 3                    | A                     | Low            |
|                | Flora and fauna         | Injury and mortality                                       | 2                    | A                     | Low            |
|                | Terrestrial and aquatic | Introduction/spread of weeds                               | 2                    | A                     | Low            |
|                |                         | Introduction/spread of pests                               | 2                    | A                     | Low            |
|                |                         | Sedimentation and erosion                                  | 2                    | A                     | Low            |
|                |                         | Soil and water pollution                                   | 2                    | A                     | Low            |
|                |                         | Indirect impacts of proposal e.g. light, noise, dust       | 2                    | A                     | Low            |
| Heritage       | Aboriginal heritage     | Impacts on known artefacts/values                          | 1                    | A                     | Low            |
|                |                         | Impacts on unknown artefacts/values                        | 2                    | B                     | Low            |
|                | Historic heritage       | Impacts on known artefacts/values                          | 2                    | A                     | Low            |
|                |                         | Impacts on unknown artefacts/values                        | 2                    | A                     | Low            |

| Factor                | Receptor              | Potential Impact                                    | Mitigated Likelihood | Mitigated Consequence | Mitigated Risk |
|-----------------------|-----------------------|---|----------------------|-----------------------|----------------|
| Traffic and transport | Existing road network | Significant increase in traffic volumes             | 2                    | A                     | Low            |
|                       |                       | Increased risks to road users and/or reduced safety | 1                    | C                     | Medium         |
| Visual amenity        | Landscape             | Altered landscape character                         | 2                    | A                     | Low            |
|                       | Nearby residences     | Significant reduction in visual amenity             | 2                    | A                     | Low            |
|                       | Adjoining landscape   | Reduction in visual amenity                         | 2                    | A                     | Low            |
| Water resources       | Surface water         | Degradation of water quality                        | 1                    | A                     | Low            |
|                       |                       | Reduction in water quantity                         | 1                    | A                     | Low            |
|                       |                       | Flooding  | 1                    | A                     | Low            |
|                       |                       | Littering   | 2                    | A                     | Low            |
|                       | Groundwater           | Degradation of water quality                        | 1                    | A                     | Low            |
|                       |                       | Reduction in water quantity                         | 1                    | A                     | Low            |
| Noise                 | Nearby residences     | Nuisance noise levels during construction           | 3                    | A                     | Low            |
|                       |                       | Nuisance noise levels during operation              | 1                    | A                     | Low            |
|                       | Adjoining environment | Disturbance   | 3                    | A                     | Low            |
| Hazards and risks     | The Site              | Bushfire Fire and Electrical Fire                   | 2                    | C                     | Medium         |
|                       |                       | Lightning strikes                                   | 2                    | A                     | Low            |
|                       | Adjoining environment | Electromagnetic interference                        | 1                    | A                     | Low            |



| Factor              | Receptor                     | Potential Impact                     | Mitigated Likelihood | Mitigated Consequence | Mitigated Risk |
|---------------------|------------------------------|--------------------------------------|----------------------|-----------------------|----------------|
| Air quality         | Nearby residences            | Dust deposition                      | 2                    | A                     | Low            |
|                     | Adjoining environment        | Dust deposition                      | 2                    | A                     | Low            |
|                     |                              | Significant greenhouse gas emissions | 1                    | A                     | Low            |
| Waste management    | The Site and adjoining areas | Contamination of land and water      | 1                    | B                     | Low            |
|                     |                              | Resource wastage                     | 2                    | A                     | Low            |
|                     |                              | Human and environmental health       | 2                    | B                     | Low            |
| Social and economic | Nearby properties            | Altered property values              | 2                    | A                     | Low            |
|                     | Local community              | Reduced economic activity            | 1                    | B                     | Low            |

Most residual risks are assessed as low (Table 9-2). Medium residual risks are discussed below.

- Traffic – The Proposal is considered highly unlikely to increase the likelihood of vehicular accidents, however, the potential for fatalities remains;
- Bushfire and Electrical Fire – Appropriately designed and maintained, the Proposal is considered unlikely to increase the likelihood of fire, however, the potential for damage to assets remains.

Based on these findings, environmental impacts associated with construction, operation and decommissioning of the Proposal are compliant with the requirements for RSD under the *State Environmental Planning Policy (State and Regional Development) 2011* and Division 4.1 of the EP&A Act. Therefore, environmental impacts associated with the construction, operation and decommissioning of the Proposal, with the implementation of the mitigation strategies and management plans identified within this SEE, are deemed acceptable.

## 10 Conclusion

The proposed utility-scale Stringybark PV solar farm is located on Gara Road, approximately 14 km east of Armidale, NSW. The Proposal would have a nameplate generation capacity of 29.9 MW, and would produce enough energy to power the equivalent of 15,000 average NSW households each year. In addition, the Proposal would result in an annual reduction of greenhouse gas emissions of approximately 53,000 tonnes of CO<sub>2</sub> (based on the current energy mix in the electricity sector in NSW).

The Proposal is recognised as RSD and is subject to assessment under Part 4 of the EP&A Act. This SEE has examined and taken into account all matters affecting or likely to impact the environment by reason of the Proposal.

Information about the Proposal has been shared with the local community through a variety of consultation approaches including Information Sessions held in Armidale. Issues raised during the consultation process have been addressed in this SEE and through the evolution of the design of the Proposal.

Potential environmental impacts associated with the Proposal have been first avoided, and then reduced during the iterative development process. In the absence of mitigation the Proposal would result in some impacts on biodiversity, soil and water, noise, visual amenity, air quality and the road network via increased vehicle movements.

Mitigation measures as detailed in this SEE would ameliorate or minimise these expected impacts to acceptable levels. The Proposal would also provide a number of employment opportunities and benefits to the local economy, while reducing carbon emissions and providing progress towards national and international environmental commitments.

On the basis of the information provided in this SEE, it is concluded that the proposal presents relatively minor and manageable environmental impacts, which can be effectively mitigated using best practice strategies and methodologies. Potential benefits associated with the Proposal are a reduction in greenhouse gas emissions, reduced reliance on non-renewable energy sources and positive socioeconomic outcomes for the local community at the local, regional and state level. On this basis the Proposal is strongly justified.

# References

- AEMO. (2019). *Generation Information Page: Generation Information NSW January 2019*, [excel spreadsheet]. Retrieved from <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information>. Accessed 31 May 2019.
- Armidale Dumaresq Council. (2012). *Development Control Plan 2012*.
- Armidale Dumaresq Council. (2012). *Local Environmental Plan 2012*.
- Armidale Regional Council. (2019). *New Landfill - Armidale Regional Council*. Retrieved from <https://www.armidaleregional.nsw.gov.au/council/newsroom/works-and-projects/new-landfill>. Accessed 13 August 2019
- Australian Bureau of Statistics (ABS). (2016). *2016 Census of Population and Housing: General Community Profile - Armidale Regional (A) LGA10130 (Catalogue Number 2001.0)*. Retrieved from [https://quickstats.censusdata.abs.gov.au/census\\_services/getproduct/census/2016/communityprofile/LGA10130?opendocument](https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/communityprofile/LGA10130?opendocument). Accessed 7 August 2019
- Australian Bureau of Statistics (ABS). (2018). *Natural Resource Management Regions*.
- Australian Energy Market Commission (AEMC). (2018). *Electricity Price Trends Report*. Retrieved from <https://www.aemc.gov.au/sites/default/files/2018-12/NSW%20fact%20pack.pdf>. Accessed 29 July 2019.
- Australian ICOMOS. (2013). *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*.
- Bureau of Meteorology (BoM). (2017). *Atlas of Groundwater Dependent Ecosystems*. Retrieved from <http://www.bom.gov.au/water/groundwater/gde/map.shtml>. Accessed 23 May 2019.
- Bureau of Meteorology (BoM). (2018). *Groundwater Explorer database*. Retrieved from <http://www.bom.gov.au/water/groundwater/explorer/map.shtml>
- Bureau of Meteorology (BoM). (2019). *Monthly climate statistics for Armidale (Tree Group Nursery) (056037)*. Retrieved from [http://www.bom.gov.au/climate/averages/tables/cw\\_056037\\_All.shtml](http://www.bom.gov.au/climate/averages/tables/cw_056037_All.shtml). Accessed 7 August 2019
- Chang, G. J. and Jennings, C. (1994). *Magnetic field survey at PG&E photovoltaic sites*. Prepared for Pacific Gas and Electric Company Research and Development Department, California.
- Cook L.M. and McCune R.H. (2013). *Hydrological Response of Solar Farms*. *Journal of Hydrologic Engineering*. **18** (5) 536 - 541
- Department of Environment and Energy (DEE). (2017). *Climate change Government and international initiatives*. Retrieved from <https://www.environment.gov.au/climate-change/government>. Accessed 5 August 2019.
- Department of Environment and Energy (DEE). (2019). *The Renewable Energy Target (RET) scheme*. Retrieved from <http://www.environment.gov.au/climate-change/government/renewable-energy-target-scheme>. Accessed 5 August 2019.
- Department of Environment and Energy (DEE). (n.d.). *Climate change impacts in Australia*. Retrieved from <https://www.environment.gov.au/climate-change/climate-science-data/climate-science/impacts>. Accessed 5 August 2019.

Department of the Environment (2019a). *Litoria castanea* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat> Accessed 27 May 2019

Department of the Environment (2019b). *Litoria piperata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat> Accessed 27 May 2019

Department of the Environment (2019c). *Wollumbinia belli* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat> Accessed 27 May 2019

Eco Logical Australia (ELA). (2017). *High level flood modelling for Metz Solar Farm*. Prepared for Infinergy Pacific Ltd

Eco Logical Australia (ELA). (2018). *High level flood modelling for Sapphire Solar Farm*. Prepared for CWP Solar Pty. Ltd.

Eco Logical Australia (ELA). (2019). *Glenellen Solar Farm Hydrological Assessment Report*. Prepared for Glenellen Solar Farm Pty Ltd

EMFs info. (2019). *EMFs.info Electric and Magnetic Fields and Health*. Retrieved from <http://www.emfs.info/>. Accessed 23 July 2019.

Environment Protection Authority (EPA). (2016). *Hazardous waste storage and processing: guidance for the liquid waste industry*.

Fairfull, S. & Witheridge, G. (2003). *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*. NSW Department of Primary Industries.

Fairfull, S. (2013). *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management*. NSW Department of Primary Industries.

Fitzpatrick, R., Powell, B. & Marvanek, S. (2011). *Atlas of Australian Acid Sulfate Soils v2*. Retrieved from <http://doi.org/10.4225/08/512E79A0BC589>. Accessed 5 June 2019.

FutureAnalytics (2016). *Planning and Development Guidance Recommendations for Utility Scale Solar Photovoltaic Schemes in Ireland*. Funded by the Sustainable Energy Authority of Ireland's Energy Research, Development & Demonstration Programme 2016. Retrieved from <http://www.futureanalytics.ie/wp-content/uploads/2016/11/Solar-Research-Report-2016.pdf>

Geoscience Australia. (2017). *Groundwater Dependent Ecosystems*. Retrieved from <http://www.ga.gov.au/scientific-topics/water/groundwater/understanding-groundwater-resources/groundwater-dependant-ecosystems>. Accessed 5 June 2019.

Gojak et.al. (1988). *Gara River Hydro-electric Scheme Oxley Wild Rivers National Park, New South Wales: Conservation Plan*

Heritage Branch of the Department of Planning. (2009). *Assessing Significance for Historical Archaeological Sites and 'Relics'*. Heritage Branch of the Department of Planning, Sydney.

ICNIRP. (2010). *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields*.

IEA (2017). *Life Cycle Inventory of Current Photovoltaic Module Recycling Processes in Europe*. International Energy Association Photovoltaic Power Systems Program (PVPS T12-12: 2017).

IEA & IRENA (2016). *End of Life Management. Solar Photovoltaic Panels*. Retrieved from: [https://www.irena.org/DocumentDownloads/Publications/IRENA\\_IEAPVPS\\_End-of-Life\\_Solar\\_PV\\_Panels\\_2016.pdf](https://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf). Accessed 15 August 2019.

Intergovernmental Panel on Climate Change (IPCC). (2018). *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skeea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. *World Meteorological Organization*, Geneva, Switzerland.

Jempson, M.A. (2019). 520 Meningoort Road, Bookaar Expert Witness Statement Hydrology VCAT Ref: P2390/2018. Prepared for Bookaar Renewables Pty Ltd.

King, D. (2009). *Soil Landscapes of the Armidale 1:100,000 Sheet*. NSW Department of Environment and Climate Change, Sydney.

Landcom. (2004). *Managing Urban Stormwater: Soils and Construction (Blue Book)*. New South Wales Government.

Learmonth, R., Whitehead, R., Boyd, B. & Fletcher, S. (2007). *Living and Working in Rural Areas: A handbook for managing land use conflict issues on the NSW North Coast*. NSW Department of Primary Industries, Wollongbar NSW.

McGarr, P. (2018). Property Value Impact Study – Proposed Newark Road Solar Energy Use. Retrieved from <http://www.co.kendall.il.us/wp-content/uploads/Attachment-29-Property-Value-Study.pdf>

National Health and Medical Research Council (NHMRC). (1989). *Interim guidelines on limits of exposure to 50/60 Hertz electric and magnetic fields*.

NGH Environmental. (2019). *Scoping Report Oxley Solar Farm*. Prepared for Oxley Solar Development Pty Ltd. Sourced from NSW DPE Major Project websites: <http://www.majorprojects.planning.nsw.gov.au/> and <https://www.planningportal.nsw.gov.au/major-projects>

NSW Department of Environment & Climate Change (DECC). (2009). *Interim Construction Noise Guideline*. Department of Environment & Climate Change, Sydney. <https://www.environment.nsw.gov.au/resources/noise/09265cng.pdf>. Accessed 26 July 2019.

NSW Department of Environment & Climate Change (DECC). (2008a). *Managing Urban Stormwater: Soils and Construction Volume 2A Installation of Services*. Retrieved from <http://www.environment.nsw.gov.au/resources/stormwater/0801soilsconststorm2a.pdf>. Accessed 28 May 2019.

NSW Department of Environment & Climate Change (DECC). (2008b). *Managing Urban Stormwater: Soils and Construction Volume 2C Unsealed Roads*. Retrieved from <http://www.environment.nsw.gov.au/resources/stormwater/0802soilsconststorm2c.pdf>. Accessed 28 May 2019.

NSW Department of Environment Climate Change and Water (DECCW). (2006). *Macleay River Water Quality Objectives explained*. Retrieved from <https://www.environment.nsw.gov.au/ieo/Macleay/report-03.htm> [Accessed 23 May 2019].

NSW Department of Environment, Climate Change & Water (DECCW). (2010). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. Department of Environment, Climate Change & Water, Sydney.

NSW Department of Planning and Environment. (2019). Planning Portal, ePlanning Spatial Viewer. Accessed at <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>

NSW Department of Primary Industries (DPI)- Water (2016). *Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources* Retrieved from <https://www.legislation.nsw.gov.au/#/view/regulation/2016/385> [Accessed 27 May 2019].

NSW Department of Primary Industries (NSW DPI). (n.d.). *Key Fish Habitat: Armidale*. Retrieved from <http://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps>. Accessed 23 May 2019.

NSW DPI Water. (2018). *Macleay Catchment Snapshot*. NSW Department of Primary Industry. Retrieved from <https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/macleay>

NSW Environment Protection Authority (EPA). (2016). *Addendum to the Waste Classification Guidelines (2014) - Part 1: Classifying Waste*. Retrieved from <https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste>.

NSW Environmental Protection Authority (EPA). (2014). *Waste Classification Guidelines. Part 1: Classifying Waste*. EPA, Sydney.

NSW Environmental Protection Authority (EPA). (2017). *NSW Noise for Industry Policy*. EPA, Sydney.

NSW Government. (2017). *New England North West Regional Plan 2036*. Retrieved from <https://www.planning.nsw.gov.au/Plans-for-your-area/Regional-Plans/New-England-North-West>. Accessed 7 August 2019.

NSW Heritage Office & NSW Department of Urban Affairs and Planning. (1996). *NSW Heritage Manual*. NSW Heritage Office & NSW Department of Urban Affairs and Planning, Sydney.

NSW Heritage Office. (2001). *Assessing Heritage Significance*. NSW Heritage Office, Sydney.

NSW Office of Environment & Heritage (OEH). (2009). *Culvert*. Retrieved from <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1010603>. Accessed 29 July 2019

NSW Office of Environment & Heritage (OEH). (2009). *Gara River Hydro-Electric Scheme*. Retrieved from <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5051463>. Accessed 29 July 2019

NSW Office of Environment & Heritage (OEH). (2012). *The land and soil capability assessment scheme – second approximation*. NSW Office of Environment and Heritage, Sydney.

NSW Office of Environment & Heritage (OEH). (2016). *NSW Climate Change Policy Framework*. Retrieved from <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/nsw-climate-change-policy-framework-160618.pdf>.

NSW Office of Environment and Heritage (OEH). (2017). *Land and Soil Capability Mapping for NSW*. NSW Office of Environment and Heritage, Sydney.

NSW Rural Fire Service (RFS). (2006). *Planning for Bushfire Protection: A guide for Councils, Planners, Fire Authorities and Developers*. NSW Rural Fire Service.

NSW Rural Fire Service (RFS). (n.d.). *Standards for Asset Protection Zones*. Retrieved from [https://www.rfs.nsw.gov.au/\\_data/assets/pdf\\_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf](https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf). Accessed 7 August 2019.

NSW Rural Fire Service (RFS). (2018a). *Ten LGAs to commence Bush Fire Danger Period on 1 August*. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/media-releases/ten-lgas-to-commence-bush-fire-danger-period-on-1-august>. Accessed 30 July 2019.

Pacific Environment Ltd. (2015). *Clarks Gully Mine – Air Quality and Greenhouse Gas Assessment*. Prepared for Hillgrove Mines Pty Ltd.

Reneweconomy (2016). *Solar panel recycler leads Australia in emerging industry*. Retrieved from <https://reneweconomy.com.au/solar-panel-recycler-leads-australia-in-emerging-industry-99038/>. Accessed 15 August 2019.

Strahler, A. N. (1952). Hypsometric (area-altitude) analysis of erosional topography. *Geological Society of America Bulletin*, 63(11): 1117 – 1142.

The Climate Institute. (2016). *Climate of the Nation 2016: Australian Attitudes on Climate Change*. The Climate Institute, Sydney.

UNESCO. (2019). *UNESCO World Heritage List: Gondwana Rainforests of Australia*. Retrieved from <https://whc.unesco.org/en/list/368/>. Accessed 9 August 2019.

Urbis (2016). *Review of the Impact of Wind Farms on Property Values*. Prepared for Office of Environment and Heritage.

WaterNSW. (n.d.). *All Groundwater Map*. Retrieved from [https://realtimedata.watarnsw.com.au/?ppbm=206\\_MACLEAY&ag&1&aglm\\_org](https://realtimedata.watarnsw.com.au/?ppbm=206_MACLEAY&ag&1&aglm_org)