



# Environmental Impact Statement

AVONLIE SOLAR FARM



JUNE 2018



## Document Verification

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Amendment	Section	Page	Reason
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## Certification

For submission of an Environmental Impact Statement under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979.

**EIS prepared by:** NGH Environmental

**Applicant:** RES Australia Pty Ltd

**Proposed development:**

The Avonlie Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce up to 200 Megawatts of electricity. Associated infrastructure includes a substation, battery storage facility, staff amenities, internal access tracks and fencing.

**Land to be developed:**

Lots 1 and 2 DP 606800, and Lots 13, 22, 26, 30, 43, 53 DP 754538.

**Certification:**

I certify that I have prepared the contents of this Environmental Impact Statement in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000. To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the project and that information is neither false nor misleading.

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## TERMS AND DEFINITIONS

<b>ABARE</b>	Australian Bureau of Agricultural and Resource Economics
<b>ABS</b>	Australian Bureau of Statistics
<b>AEMO</b>	Australian Energy Market Operator
<b>AEP</b>	Annual Exceedance Probability
<b>AGO</b>	Australian Greenhouse Office
<b>ACHA</b>	Aboriginal Cultural Heritage Assessment
<b>AHIMS</b>	Aboriginal Heritage Information Management System
<b>AHIP</b>	Aboriginal Heritage Impact Permit
<b>ARENA</b>	Australian Renewable Energy Agency
<b>ARPANSA</b>	Australian Radiation Protection and Nuclear Safety Agency
<b>AWS</b>	Automatic weather station
<b>BC Act</b>	<i>Biodiversity Conservation Act 2016 (NSW)</i>
<b>BCC</b>	Biobanking Credit Calculator
<b>BOM</b>	Australian Bureau of Meteorology
<b>BLM</b>	Bureau of Land Management
<b>BREE</b>	Bureau of Resources and Energy Economics
<b>BSF</b>	Battery Storage Facility
<b>BFRMP</b>	Bush Fire Risk Management Plan
<b>CEMP</b>	Construction environmental management plan
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>DA</b>	Development Application
<b>dB(A)</b>	A measure of A-weighted ( <i>c.f.</i> ) sound levels.
<b>DEC</b>	Department of Environment and Conservation (now OEH)
<b>DECC</b>	Department of Climate Change (now OEH)
<b>DECCW</b>	Department of Climate Change and Water (now OEH)
<b>DEE</b>	Department of the Environment and Energy (Commonwealth)
<b>DPE</b>	Department of Planning and Environment
<b>DSEWPC</b>	Department of Sustainability, Environment, Water, Population and Communities (now DEE)
<b>EEC</b>	Endangered Ecological Community
<b>EIS</b>	Environmental Impact Statement
<b>ELF</b>	Extremely low frequency, in relation to Hz ( <i>c.f.</i> )
<b>EMFs</b>	Electromagnetic fields
<b>EP&amp;A Act</b>	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
<b>EP&amp;A Regulation</b>	<i>Environmental Planning and Assessment Regulation 2000 (NSW)</i>
<b>EPA</b>	(NSW) Environment Protection Authority
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>

<b>EPL</b>	Environment Protection Licence issued under the POEO Act ( <i>c.f.</i> )
<b>ESD</b>	Ecologically sustainable development
<b>GA</b>	Geoscience Australia
<b>GHG</b>	Greenhouse gas
<b>GWh</b>	Gigawatt hours
<b>ha</b>	hectares
<b>Heritage Act</b>	<i>Heritage Act 1977 (NSW)</i>
<b>Hz</b>	Hertz
<b>ICNG</b>	Interim Construction Noise Guideline
<b>ISEPP</b>	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
<b>km</b>	kilometres
<b>kV</b>	kilovolts
<b>L<sub>A90</sub> (15 minutes)</b>	The A-weighted sound pressure level that is exceeded for 90% of a 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.
<b>L<sub>Aeq</sub>(15 minutes)</b>	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period that excludes other noise sources such as from industry, road, rail and the community.
<b>LALC</b>	Local Aboriginal Land Council
<b>LCA</b>	Life Cycle Assessment
<b>LCU</b>	Landscape Character Unit
<b>LEP</b>	Local Environment Plan
<b>LGA</b>	Local Government Area
<b>LMZ</b>	Landscape Management Zone
<b>LRET</b>	Large scale Renewable Energy Target
<b>m</b>	metres
<b>mm</b>	millimetres
<b>MNES</b>	Matters of National Environmental Significance, under the EPBC Act ( <i>c.f.</i> )
<b>MRET</b>	Mandatory Renewable Energy Target
<b>MVA</b>	Megavolt-ampere
<b>MW</b>	Megawatt
<b>MWh</b>	Megawatt hours
<b>NHMRC</b>	National Health and Medical Research Council
<b>NPI</b>	<i>NSW Noise Policy for Industry</i>
<b>NPW Act</b>	<i>National Parks and Wildlife Act 1974</i>
<b>NSW</b>	New South Wales
<b>OEH</b>	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
<b>PCT</b>	Plant Community Type



<b>POEO Act</b>	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
<b>PMF</b>	Probable Maximum Flood
<b>PV</b>	Photovoltaic
<b>RBL</b>	Rating Background Level - the level of background noise
<b>RDA</b>	Regional Development Australia
<b>RE Act</b>	<i>Renewable Energy (Electricity) Act 2000 (Commonwealth)</i>
<b>REAP</b>	Renewable Energy Action Plan (NSW)
<b>RFS</b>	NSW Rural Fire Service
<b>RNP</b>	<i>NSW Road Noise Policy</i>
<b>Roads Act</b>	<i>Roads Act 1993 (NSW)</i>
<b>RMS</b>	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
<b>SAIL</b>	Serious and Irreversible Impacts
<b>SEARs</b>	Secretary's Environmental Assessment Requirements
<b>Sensitive Receptor</b>	A place or object that is sensitive to a particular environmental impact. e.g. school, place of worship, residence, heritage building/structure, pipeline (for vibration/blasting). These may be separately defined by government and industry policies and guidelines
<b>SEPP</b>	State Environmental Planning Policy (NSW)
<b>ISEPP</b>	<i>State Environmental Planning Policy (Infrastructure) 2007 (NSW)</i>
<b>Sound level</b>	<b>pressure</b> The noise at a given distance from plant or equipment
<b>sp/spp</b>	Species/multiple species
<b>SPRAT</b>	EPBC Act Species Profiles and Threats Database
<b>SRD SEPP</b>	<i>State Environmental Planning Policy (State and Regional Development) 2011 (NSW)</i>
<b>SSD</b>	State significant development
<b>µT</b>	Microtesla, multiples of a unit of magnetic field
<b>VIA</b>	Visual Impact Assessment
<b>V</b>	Volts
<b>WHO</b>	World Health Organisation
<b>WM Act</b>	<i>Water Management Act 2000</i>
<b>WMP</b>	Waste Management Plan
<b>WSP</b>	Water Sharing Plan
<b>ZVI</b>	Zone of Visual Influence

<b>The Proposal</b>	The construction and operation of the proposed Solar Farm
<b>The Proponent</b>	RES Australia Pty Ltd
<b>Subject land</b>	All land within the affected lot boundaries. The subject land comprises Lots 1 and 2 DP 606800, and Lots 13, 22, 26, 30, 43, 53 DP 754538.
<b>Development site</b>	The area of land that is subject to the proposal. The subject land is made up of 633 ha of Lots 1 and 2 DP 606800, and Lots 13, 22, 26, 30, 43, 53 DP 754538. The development

site is the area surveyed for this assessment prior to identified constraints and exclusions.

**Development  
footprint**

The area of land that is directly impacted by the proposal, including, solar array design, perimeter fence, access roads, transmission line footprint and areas used to store construction materials. The development footprint is approximately 534 ha.

## EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction and operation of a proposed 200 Megawatt (MW) photovoltaic (PV) solar farm and associated infrastructure at Avonlie (SSD 9031) (the 'proposal'). The 581 hectare (ha) development site is located on freehold rural land approximately 20 km south-east of Narrandera. The proposal is State significant development (SSD).

NGH Environmental have prepared the EIS on behalf of the proponent, RES Australia Pty Ltd ('the proponent'). The EIS has been prepared in accordance with Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs) provided by NSW Department of Planning and Environment (DPE) on 9 February 2018.

## PROPOSAL DESCRIPTION

The development site covers approximately 581 ha of land.

The proposal comprises of the following key infrastructure components:

- photovoltaic solar arrays ground-mounted on a single-axis tracking system.
- Power conversion units.
- A substation including an elevated busbar, switch room, a lightning protection system, current and voltage transformers and a connection into the existing TransGrid overhead transmission line.
- A battery storage facility (BSF).
- Operations and maintenance buildings with associated car parking.
- Access point to the site via Muntz Road.
- Underground and overhead cabling.
- Internal access tracks.
- Emergency lighting.
- CCTV system including infrared (non-visible) lighting.
- Security fencing.
- Subdivision of the property for the purpose of the substation and continued agricultural purposes.
- Clearing of vegetation.
- Road upgrades.
- Temporary facilities.

Approximately 670,000 solar panels would be mounted in rows on a single axis tracking system, with trackers likely to have a typical maximum tilt height of 4 m. Ground cover would be established under the panels and would likely be managed using sheep grazing.

An existing TransGrid-owned 132 kV transmission line runs through the development site, proposal and substation to be sited within the Avonlie Property. The area for the substation will be subdivided from the

residual lot and would be constructed on a gravel bench and surrounded by security fencing. The Substation site will be transferred in freehold to TransGrid on completion of the proposal.

The proposal includes a BSF, which is proposed to be constructed at the same time as the solar farm, or as part of a staged development within 5 years of the commissioning of the solar farm. Subject to economic and technical considerations, the BSF will comprise banks of lithium-ion batteries housed in customised buildings. The BSF would have the ability to house approximately 205 MW/205 MW hr rated capacity, with an initial pilot study of 10MW hr.

An internal access track system would be established for the construction and maintenance of both the solar farm and the BSF.

The solar farm is expected to operate for 30 years. The construction phase of the proposal is expected to take eighteen months and commence in Autumn 2019. After the operating phase, the proposal would either be decommissioned, removing all above ground infrastructure and returning the site to its existing land capability (12 months), or upgraded with new photovoltaic equipment.

## **PROJECT NEED**

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and upset the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the United Nations Paris Agreement on Climate Change (DEE, 2017). Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE, 2017). Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

There have been many government policies in place in Australia influencing the development of renewable energy. The Commonwealth Government's Large-scale Renewable Energy Target (LRET) aims to ensure that adequate incentives are provided for large-scale grid connected renewable energy. The current LRET is 33,000 GWh by 2020 (CER, 2018).

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013). The Government's vision is for a secure, affordable and clean energy future for NSW. The Plan positions the state to increase energy from renewable sources by attracting investment, building community support, and growing expertise in renewable energy, at least cost to the energy customer and with maximum benefits to NSW. Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors. It also supports the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013).

## **PROJECT BENEFIT**

The Avonlie Solar Farm would produce an estimated 473,000 Megawatt Hours (MWh)/year of renewable electricity and supply over 11,000 GWh over its life. This would assist in meeting the LRET targets. The solar farm would also help implement the NSW Government's Renewable Energy Action Plan.

Key benefits of the solar farm include:

- Generation of approximately 473,000 MWh of renewable electricity per year.
- Based on the assumption that power generation would otherwise be made by brown coal with a carbon factor of 0.33372 tonnes per MWh, the proposed solar energy facility would

displace more than 158,000 tonnes of carbon dioxide (CO<sub>2</sub>) or greenhouse gas emissions per year (Source: Department of the Environment National Inventory Report).

- Supply of enough power each year to service approximately 80,000 average New South Wales households (Essential Economics Pty Ltd, 2018).
- A solar energy facility that displaces over 158,000 tonnes of CO<sub>2</sub> per annum is the equivalent of taking approximately 56,400 cars off the road each year, based on an average car in NSW travelling 14,000 km per year with CO<sub>2</sub> emissions of 200 g/km (or 2.8 tonnes of CO<sub>2</sub> emissions per car per year) (DIT, 2011).

Local social and economic benefits that would be associated with the construction and operation of the Avonlie Solar Farm include:

- Direct and indirect employment opportunities during construction and operation of the solar farm; this includes up to 200 direct and 320 indirect jobs at the peak of construction and 4 direct and 12 indirect during operation.
- Direct business volume benefits for local services, materials and contracting businesses.
- Assistance in meeting the future national electricity demands.
- \$250,000 grant to support the community.

Additionally, the proposal takes into account the environmental constraints of the development site, and has been designed to:

- Preserve biodiversity features, through minimising tree removal.
- Minimise impacts to soil and water, by adopting pile driven panel mounts rather than extensive soil disturbance and excavation.
- Minimise impacts to items of Aboriginal cultural significance.
- Minimise visual impacts to neighbours by retaining boundary vegetation and existing vegetative screening.
- Preserve agricultural production values, as the project is highly reversible at the end of the project's life.
- Retain some agricultural production value through stock grazing.

## **KEY ENVIRONMENTAL ASSESSMENT ISSUES**

A detailed investigation of risks and impacts was undertaken for the construction, operation and decommissioning phases of the Avonlie Solar Farm. Additional to addressing the project-specific SEARs, a risk assessment was carried out to identify key environmental risks of the proposal, to guide the depth of investigation that would be undertaken in the EIS. The risk assessment identified five environmental aspects as key risks, and detailed investigations were subsequently undertaken in these areas:

- Biodiversity
- Aboriginal cultural heritage
- Land use and resources
- Noise impacts
- Watercourses and hydrology

### ***Biodiversity***

A Biodiversity Development Assessment Report (BDAR) was prepared by NGH Environmental.

Field Surveys of the development site identified two plant community types (PCTs); Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregion (PCT 76) and Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 80). These vegetation communities form part of the Endangered Ecological Community (EEC): Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt South Bioregion. Sections of this community along Muntz Rd and Sandigo-Boree Creek Rd met the criteria for the EPBC listed community.

Consideration has been given to avoid and minimise impacts to native vegetation where possible. Site design options have been assessed against key environmental, social and economic criteria. Mitigation and management measures will be put in place to adequately address impacts associated with the proposal, both direct and indirect.

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- Up to 1 ha of Western Grey Box – White Cypress Pine tall woodland;
- 0.9 ha of Planted Old Man Saltbush – mixed chenopod shrubland; and
- 49 Paddock trees over exotic vegetation.

Two ecosystem credit species, Grey crowned Babbler *Pomatostomus temporalis temporalis* (Vulnerable, BC Act) and White Fronted Chat *Epthianura albifrons* (Vulnerable, BC Act) were detected during the site survey. These species are accounted for in the ecosystem credit requirements of the development determined by the PCT and do not require targeted surveys.

Seven species credit species, comprising five flora species and two fauna species were unable to be surveyed for during the recommended survey time and were assumed to occur on site.

0.7 ha of suitable habitat for the Sand-hill Spider Orchid (*Caladenia Arenaria*), Oaklands Diuris (*Diuris* sp.), Pine Donkey Orchid (*Diuris tricolor*), Spear Grass (*Austrostipa wakoolica*) and Mossgiel Daisy (*Brachyscome papillosa*) occurs along Muntz Rd and Sandigo-Boree Creek Rd that would be impacted by the development.

25 hollow bearing trees that could provide nesting opportunities for the Superb Parrot (*Polytelis swainsonii*) and Major Mitchell Cockatoo (*Lophochroa leadbeateri*) would be removed by the development.

Credits were calculated from the BAM Calculator for these entities and generated the following credits:

- Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion - **62.25 ecosystem credits required.**
- Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (Persistently dry) and arid climate zones (north western NSW) – **15 ecosystem credits required.**
- Sand-hill Spider Orchid (*Caladenia Arenaria*) – **25 species credits required.**
- Oaklands Diuris (*Diuris* sp.) – **25 species credits required.**
- Pine Donkey Orchid (*Diuris tricolor*) – **12 species credits required.**
- Mossgiel Daisy (*Brachyscome papillosa*) – **16 species credits required.**
- A Spear Grass (*Austrostipa wakoolica*) – **16 species credits required.**
- Superb Parrot (*Polytelis swainsonii*) – **2 species credits required.**
- Major Mitchell Cockatoo (*Lophochroa leadbeateri*) – **2 species credits required.**

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme under the BC Act.

## Aboriginal heritage

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the development site, to assess the cultural and scientific significance of any Aboriginal heritage sites recorded, to identify whether any Aboriginal objects or places would be impacted by the proposal.

Consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the *National Parks and Wildlife Regulation 2009*, following the consultation steps outlined in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRP) guide provided by OEH.

The assessment included a review of relevant information relating to the landscapes within the development site. Included in this was a search of the OEH AHIMS database. No Aboriginal heritage sites have previously been recorded within the subject land.

The survey strategy was to cover as much of the ground surface as possible within the development site given that the proposal was going to disturb approximately 570 hectares, within the subject land. Survey transects were undertaken on foot across the development site to achieve maximum coverage. All mature trees within or adjacent to the development footprint were also inspected for evidence of Aboriginal scarring. Between the survey participants, over the course of the field survey, approximately, 60 km of transects were walked within the development site.

Four artefact scatters, a scarred tree and 64 isolated artefacts were recorded during the survey:

- Avonlie Artefact Scatter 1, Avonlie Artefact Scatter 3 and Avonlie Artefact Scatter 4 have had either partial or total exclusion zones placed over them and the design of the Avonlie Solar Farm updated to reflect this exclusion.
- The remainder of Avonlie Artefact Scatter 1, Avonlie Artefact Scatter 2 and all isolated artefacts are within the development footprint and could be impacted by the proposed activity.
- Avonlie Scarred Tree 1 and potential Scarred Tree 2 has also been excluded from the development footprint and will not be impacted.

Based on the land use history, an appraisal of the landscape, soil, level of disturbance and the results from the field survey it was concluded that there was negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the development site.

Given that the majority of the development site has been subject to extensive modification, the disturbed and fragmented nature of the scatters and a lack of ovens/hearths as a site type was not unexpected.

The impact to the scientific values of the sites and isolated artefacts is considered to be low. While these sites are likely to be impacted by the proposal, they are considered to be sites of low potential to enhance our current understanding of the Aboriginal occupation of the area.

Pursuant to section 4.41(1)(d) of the EP&A Act, an Aboriginal heritage impact permit under section 90 of the NPW Act is not required to impact any Aboriginal heritage sites for SSD.

During operation, it is unlikely the proposal would impact any Aboriginal heritage sites. No mitigation is required.

## **Land use and resources**

The current land use of the development site is for agriculture. The site is not mapped as being Biophysical Strategic Agricultural Land (BSAL). It is not land that meets the BSAL criteria levels for soil fertility, land and soil capability classes and access to reliable rainfall levels.

The site is not located in an area mapped for “Important Agricultural Land”. The land capability class of the site is Class 3. Class 3 is described as land capable of sustaining cultivation on a rotational basis. As per the Land and Soil Capability Assessment Scheme, Class 3 is classed as “High Capability Land”.

The development site is zoned RU1 land for primary production. The land surrounding the development site is RU1 (primary production), RU3 (forestry) and RU4 (primary production small lots). Surrounding agricultural land consists of cropping and grazing. Buckingham State Forest is within 5 km of the site.

The development site is not the subject of any mineral exploration licences nor licence applications and there are no exploration licences nor licence applications within 3 km of the development site.

A land use conflict risk assessment was undertaken. A moderate to high risk ranking was identified for potential conflicts including contaminated surface water runoff, fire/bush fire, traffic generation and dust, flood and visual amenity. These potential conflicts have been addressed with appropriate management strategies and have low revised risk ratings.

The expected impact on surrounding land uses during construction is considered to be minimal given the temporary nature of the work. The implementation of mitigation strategies would further reduce the level of impact.

Potential agricultural impacts as a result of the development include limited resource loss for the lifetime of the solar farm, changes in biosecurity and potential increased bushfire risk. However, the land lost represents less than 0.1% of all productive cropping land supply in the NSW Murray Region.

The proposal would not result in the permanent removal of agricultural land, and agricultural activities could continue through sheep grazing. Once decommissioned, the site could be rehabilitated to restore it to its pre-existing condition for alternate land uses, including agriculture or mining.

During operation of the proposal it is considered that all potential land use conflicts could be adequately managed through the implementation of land management mitigation measures.

## **Visual amenity**

Moir Landscape Architecture completed a Visual Impact Assessment (VIA) of the proposed Avonlie Solar Farm. A total of 12 viewpoints were assessed and are representative of where the development would be most prominent based on the degree of exposure or the number of people likely to be affected.

Viewpoints were selected to represent a range of views in the region, informed field observations, access, residences, landscape character and the popularity of vantage points.

The proposal is likely to be visible from all of the viewpoints. The visual sensitivity is rated as low for all viewpoints due to a combination of the viewing distances and land use. The visual impact is rated as low for most of the viewpoint locations due to distance and vegetation screening.

The proposal will be screened from viewpoints VP05 and VP07 and therefore there would be no change to the existing landscape character. A moderate visual effect was recorded for VP02 due to the close proximity to the proposal. However, due to the low visual sensitivity of the viewpoint, the visual impact will be low.

Visual impact of the proposal is limited due to a combination of:



- Distance to the site from publicly accessible viewing locations.
- Existing boundary planting surrounding the site.
- Roadside vegetation.
- Vegetation surrounding homesteads.

Low visual impact from the Sturt Highway is also likely due to a combination of speed, direction of travel and fragmentation by roadside vegetation.

During construction, additional traffic and dust generation are considered the greatest for cumulative visual impacts. During operation, cumulative visual impacts are considered negligible. Any adverse cumulative impacts are anticipated to be manageable due to the ability to effectively screen infrastructure.

### **Noise**

Muller Acoustics Consulting Pty Ltd. (MAC) was engaged to complete a Noise Assessment (NA) for the proposed Avonlie Solar Farm.

Noise management levels were calculated for the proposal and were based on the measured rating background noise level (NSW Noise Policy for Industry (NPI) 2017) and the NSW Interim Construction Noise Guideline (2009). Modelling was used to quantify project noise emissions to neighbouring receptors for typical construction activities and operations.

Construction activities are proposed to be progressive and will occur at several locations simultaneously. Noise emissions were modelled for the following scenarios:

- Earthworks involving trenching for cabling.
- Piling of panel supports.
- Assembly of panels.

Daytime construction noise levels were assessed for 17 neighbouring receptors. The highest predicted noise level is well within the range for the Noise Management Levels (NMLs) within standard hours and complies at all 17 receptors.

The predicted operational noise levels were assessed for the 17 neighbouring receptors and have been demonstrated to comply with the Project Intrusive Noise Levels (PNTLs) at all residential receptors.

A detailed maximum noise level assessment is not required as the predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40 dB  $L_{Aeq,15min}$  and/or 52 dB  $L_{Amax}$ .

The results of the noise assessment demonstrate that construction noise levels satisfy relevant regulatory construction and operational noise levels for all nearby receptors. The results of the assessment show compliance with the relevant construction, operational and road noise criteria. Therefore, no ameliorative measures are be required.

## **LOWER RISK ISSUES**

The following lower risk issues were assessed for the proposed Avonlie Solar Farm:

### **Soil**

DM McMahon Pty Ltd prepared a soil report to provide an assessment of the landforms, soil types and characteristics of the proposed development site.

A desktop and field study were undertaken across the development site. Two soil landscapes were identified at the development site. The soils were classified as Chromosols and Sodosols. These soils have a high risk of erosion, a moderate salinity risk, and a moderate risk of waterlogging. Sodosols are dispersible soils with extremely high risks of erosion, reflected by the severe gully and streambank erosion along some drainage lines at the development site.

The proposed activities for the construction, operation and decommissioning stages of the solar farm have the potential to increase soil erosion during rainfall events. Proposed activities could lead to the removal of vegetation and ground cover, increased compacted surfaces and decreased permeability.

Impacts during construction and decommissioning could also result from earthmoving activities for the construction of internal roads, site access points and the overhead transmission line, trenching for the underground cabling and activities within the ephemeral drainage line.

Impact to soils during operation would be minimal, as maintenance activities and vehicles would be mostly confined to formalised tracks.

These potential impacts have been accounted for and addressed with a suite of safeguards and mitigation measures. Overall, the risk of erosion impacts resulting in soil loss is considered low.

### **Water use and quality, including groundwater**

The development site is in the Murrumbidgee Catchment and is located 13 km to the south of the Murrumbidgee River. Sandy Creek is located within 1.5 km of the northern boundary of the site. There is 1 drainage line and 2 farm dams located within the development footprint.

The development site is not located in an area identified as having groundwater vulnerability and no bores are located on the site.

There are areas of moderate to high potential Groundwater Dependent Ecosystems (GDEs) along Sandy Creek, outside of the development site. There is low to moderate potential for groundwater interaction at the development site.

No construction or operational activities would affect the groundwater. It is considered that this project would have negligible impact on groundwater.

The site is not mapped in the Narrandera LEP (2013) as a flood planning zone. However, modelled flood events across various recurrence intervals demonstrates potential for the site to be flooded under a 1 in 200 year or greater recurrence interval flood. Modelled flood height mapping indicates overland inundation would not exceed 0.10 - 0.90 m in a probable maximum or extreme flood. It should be noted that the boundary of the modelled data does not include the development site but is in proximity to the site.

The flood heights indicated are unlikely to cause any potential impacts to development infrastructure. The proposed development is not considered to impact on flood behaviour that could be detrimental to other developments or land.

Water during construction would be sourced from standpipes operated by Narrandera Shire Council. The anticipated amount of non-potable water required during construction is 11.2 ML. This water is predominantly used for dust control.

During operation, water for panel washing and other maintenance activities would similarly be sourced from the available standpipe. It is expected 1.7 ML of water would be required each year.

The proposal would not directly affect the surface water quality. Indirectly, the proposal would involve a range of activities during construction and operation that could disturb soils. This could potentially lead to erosion and sediment laden runoff. This could impact surface water quality in local waterways during rainfall events. The impacts are considered low for this project.

### **Climate and air quality**

The air quality at the development site is generally expected to be good. Existing sources of air pollution at the site include vehicle emissions, dust from surrounding unsealed roads, and agricultural activities.

During construction and decommissioning there could be an increase in dust generation and air emissions from earthwork activities and vehicles.

Earthworks associated with construction and decommissioning are relatively minor and would not be likely to cause significant dust emissions. The piling machine used for the installation of the solar arrays is designed to reduce soil disturbance and corresponding dust pollution. It is expected that existing groundcover vegetation would remain largely intact during construction to assist in minimising dust.

Operation of the proposed solar farm would generate minimal emissions and air quality impacts. Vehicle use at the site during operation and maintenance would be minimal. The impacts on local and regional air quality are expected to be negligible.

### **Traffic, transport and road safety**

TDG Pty Ltd prepared a traffic and transport study for the proposal. This study included an assessment of material delivery routes and intersection capacity for accommodating construction and operation vehicles.

During construction there will be an increase in cars, utility vehicles and trucks to the development site. Vehicle movements at the site would be generally confined to the standard hours of construction and operation. Vehicles will travel around the site on constructed internal access tracks. These tracks will remain unsealed but would be sheeted with gravel or crushed and compacted soil.

The potential impacts from traffic to the site during construction and decommissioning could include damage to road infrastructure, increased collision risks, noise and dust.

The addition of passing bays on Sandigo Road and Muntz Road will allow passage of vehicles around trucks during the construction period. The widening of Muntz Road at the S-bend is recommended to allow for 2 articulated vehicles to pass concurrently. A minor upgrade of the intersection of Sandigo Road and Muntz Road is required to allow concurrent truck movements into and out of Muntz Road. Additionally, it is recommended that the intersection of the Sturt Highway and Sandigo Road be upgraded to allow for basic right turn and basic left turn turning treatment.

Overall, traffic impacts from the proposal are expected to be low and manageable.

### **Socioeconomic and community**

The Narrandera Community Strategic Plan 2030 identifies the community's main priorities and aspirations for the future. It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with reference to supporting economic development and implementing renewable energy projects.

Community feedback was sought from surrounding neighbours and the general community through one-on-one meetings, community information sessions and by the creation of a dedicated website and email address. The website provides information about the proposal and allows for communication and feedback

to be received through the portal. No responses have been submitted through the website. No objections or concerns were raised by any potentially affected residents. No issues or objections were raised at the community information sessions.

Positive socio-economic impacts from the proposal include a boost to the local and regional economy through the employment of around 320 staff during peak construction, through a one-off payment or community grant, and through increased demand for accommodation, goods and services.

Potential adverse impacts include those associated with increased traffic on the roads, a change in the rural landscape and visual amenity of the area. These potential impacts are likely to be reduced during the operation and decommissioning stages of the project, with less staff and reduced traffic numbers.

Negative socio-economic impacts from the proposed development are considered to be minimal.

### **Resource use and waste generation**

The resource management options of the proposed development would be considered against the principles of avoidance of unnecessary resource consumption, resource recovery and disposal. These principles would act as a guide to achieving efficient use of resources and reducing costs and environmental harm.

Waste would be produced during the construction and decommissioning stages. During operation, waste materials would be fuels, lubricants and metals. Items that cannot be reused or recycled will be disposed of in accordance with the POEO Act.

No significant impact for any of these aspects is expected from the solar farm.

### **Hazards**

#### **HAZARDOUS MATERIALS AND DEVELOPMENT**

Classified hazardous materials required to be transported to site include:

- Class 2.1 Flammable Gases – LPG.
- Class 2.2 Non-flammable, Non-toxic Gases – inert fire suppression gas.
- Class 3 Flammable Liquids (PG II) – fuel.
- Class 6.1 Toxic Substances (PG II, III) – pesticides and herbicides.
- Class 9 Miscellaneous Dangerous Substances and Articles – Li-ion batteries.

Transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, therefore would not be considered potentially hazardous and would not require a Preliminary Hazard Assessment (PHA).

All energy storage systems carry risks associated with the uncontrolled release of energy and while lithium-ion (Li-ion) batteries offer significant advantages, these advantages also elevate the risk of fire. The Li-ion based battery storage facility will be designed with appropriate disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate the fire risk to the required level of safety.

Other important factors in mitigating Li-ion fire risks include proper planning, risk assessment, storage methods, maintenance protocols and response protocols.

#### **FIRE AND BUSHFIRE**

The development site is set within a flat, cleared and cultivated landscape. Groundcover has been largely removed or reduced due to cultivation practices.

Existing bushfire hazards within the development site are:

- Narrow strips of planted eucalypt woodland along the internal boundaries and the northern, western and southern boundaries.
- Remnant patches of vegetation are located along the western boundary.

These and the substation, solar panel infrastructure and all associated infrastructure are potential bushfire hazards.

The closest emergency resources to fight fires are 2 Rural Fire Services, both about 12 km away. Internal tracks would ensure safe operational access and egress for emergency services personnel.

Activities that may cause or increase fire hazards include the careless disposal of cigarettes on site, hot works, battery storage and operating fuel-powered motor vehicles and plant fitted with power hydraulics on land containing combustible materials.

Best practice management actions associated with the construction, operation and management of the solar farm will ensure that bush fire risk is minimised. Additionally, asset protection zone prescriptions would be applied to the solar farm infrastructure and fuel hazard management will be in accordance with Planning for Bushfire Protection guidelines.

Bush fire risks during operation of the solar farm and connection infrastructure would be manageable.

#### ELECTRIC AND MAGNETIC FIELDS

The proposal includes four main types of EMFs. These include solar panels and invertors, underground cables, 132 kV transmission lines and a solar substation. There is no external electric field associated with the underground cabling. The highest electromagnetic fields are produced by the lines and cables supplying the substation. If the substation produces a field outside its perimeter, it usually falls away over the first few metres. Therefore, all other EMFs are not expected to extend beyond the development site boundary.

The construction site would be fenced to protect the public from construction health and safety risks. The design of the solar farm would minimize exposure to EMFs, thereby minimising potential adverse health effects.

Overall, there are not considered to be any risks to public health from EMFs from the proposal.

#### Historic heritage

In the Narrandera Local Government Area there are 11 listed items/places on the Commonwealth Heritage List, seven listed items/places on the NSW State Heritage Register and 2 listed items/places on the NSW State Agency Heritage Register. There are 95 listed items/places in the Narrandera Local Environment Plan (LEP) 2013. One item of heritage was located within 1 km of the development site, Sandigo Hall. There would be no direct or indirect impact to this item. No other items were located within 10 km of the development site.

No impacts are considered likely on heritage values by the proposed solar farm development.

#### Cumulative impacts

Adverse cumulative impacts occur when the infrastructure or activities at the development site exacerbate the negative impacts on other infrastructure or activities occurring nearby. There are three major projects listed on the Major Projects Register within the Narrandera LGA, with the proposed Sandigo Solar Farm within approximately 10 km of the site. In the broader study area, there are also a number of SSD projects.

No undetermined development applications are within proximity of the development site (Narrandera Shire Council, 2018).

The proposal is unlikely to impact on labour and resources required to support these developments due to the different construction timeframes and staging of all projects and there being a large construction base in the region.

Development of the Avonlie Solar Farm could be concurrent with the development of the Sandigo Solar Farm. However, there are significant resources available in the broader region for both developments to be constructed concurrently, including Wagga Wagga, for commercial accommodation facilities and employment.

Generally, adverse cumulative impacts to the road network, noise, visuals etc. are anticipated to be negligible.

## **MANAGEMENT OF IMPACTS**

The solar farm has been designed to avoid environmental impacts, including:

- Avoidance of the majority of native vegetation, including threatened biota.
- Avoidance of the Aboriginal heritage items - 2 scar tree and 2 pads.
- Selection of technologies that minimise noise and vibration outputs.

A range of additional management and mitigation measures have been developed to further reduce any residual impact. These strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks and include the following key measures:

- A range of management measures to minimise risk of potential flooding and bushfire events.
- Traffic management measures during construction.
- A range of standard construction mitigation measures to minimise dust, soil erosion, waste and noise impacts.
- Protocols in place for managing Aboriginal heritage and biodiversity.
- All stages of the development will be designed and operated in accordance with Australian Standards to minimise any risks to the health and safety of the public and employees.

## **CONCLUSION**

Overall, the Avonlie Solar Farm would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous agricultural capacity.

A suite of management measures has been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas.

The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Impacts are considered justifiable and acceptable.

# 1 INTRODUCTION

## 1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed 200-Megawatt (MW) Avonlie Solar Farm SSD 9031 (the proposal). NGH Environmental has prepared this EIS on behalf of the proponent, RES Australia Pty Ltd (the proponent).

The EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to support a Development Application (DA) to be lodged with NSW Department of Planning and Environment (DPE).

The objective of this EIS is to fulfil the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and section 4.15 (formerly section 79C) of the EP&A Act. The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPE on 9 February 2018 (refer Appendix A).

The EIS also addresses the assessment requirements of the *Biodiversity Conservation Act 2016* (BC Act) and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proponent has engaged NGH Environmental to prepare the EIS. Other independent consultants have been contracted to carry out specialist technical assessments as required. This EIS will be independently evaluated by the NSW Government, considering input from the community provided during the public exhibition period. The development assessment process places the onus on the proponent to provide the information required for the State Government to make an informed decision. The process provides for public transparency, accountability and participation in development approval decision-making.

## 1.2 PROJECT OVERVIEW

### 1.2.1 *The proponent*

RES (Renewable Energy Systems) was established in the UK in the early 1980s and has grown to become the world's largest independent renewable energy company. The company has deployed over 12 GW of utility scale wind, solar and battery energy storage projects around the world, with operations in Europe, the Americas, Turkey and Australia.

The proponent, a subsidiary of RES, has been developing renewable energy projects in Australia since 2004 and is based at Chatswood, Sydney. Recent projects in Australia include the Currawarra and Tarleigh Park Solar Farms near Deniliquin, NSW, the Taralga Wind Farm in NSW, the Ararat and Murra Warra Wind Farms in Victoria, and the Emerald solar project in Queensland.

### 1.2.2 *Development site location*

The proposed Avonlie Solar Farm is in the Narrandera Local Government Area (LGA) approximately 20 kilometres (km) south east of Narrandera (Figure 1-1). The subject land occupies approximately 633 hectares (ha) of land and includes Lots 1 and 2 DP 606800, and Lots 13, 22, 26, 30, 43, 53 DP 754538.

The development site is agricultural land comprising several large paddocks which are generally flat, mostly cleared and cultivated for pastures and grazing. Muntz Road runs along the southern boundary of the site and Quilters Road bounds the development site to the north.

### **1.2.3 Key components of the Avonlie Solar Farm**

The development site covers approximately 581 ha of land and involves the construction of a ground-mounted photovoltaic solar array generating approximately 200 MW of renewable energy.

Key development and infrastructure components would include:

- Solar arrays mounted on a single-axis tracking system.
- Power conversion units.
- A substation including an elevated busbar, switchroom, a lightning protection system, current and voltage transformers and a connection into the existing 132 kV TransGrid overhead line.
- A battery storage facility (BSF).
- Operations and maintenance buildings with associated car parking.
- Access point to the site via Muntz Road.
- Underground cabling.
- Internal access tracks.
- Emergency lighting.
- CCTV system including infrared (non-visible) lighting.
- Security fencing.

The Proposed Infrastructure map (Figure 1-2) illustrates the indicative layout, including a concept footprint for the solar arrays. Detailed design would allow for avoidance of sensitive features on the site.

### **1.2.4 Capital investment**

The proposal would have a capital investment of approximately \$250 million.

### **1.2.5 Land ownership**

The development site is under the 2 following land ownerships:

- Lot 1 DP 606800 and Lot 30 DP 754538 are privately owned by 1 landowner.
- Lot 2 DP 606800 and Lots 13, 22, 26, 43 and 53 DP 754538 are privately owned by another landowner.

RES proposes to lease land for the purposes of constructing and operating the solar farm.

### **1.2.6 Development history**

An Informal Access Application under the *Government Information Public Access Act 2009* was submitted to Narrandera Shire Council in December 2017. It was determined that no Development Applications of relevance were recorded in respect of the development site (Appendix C.1).

A search of the Major Projects website (accessed 17/05/18) of the Narrandera LGA did not indicate any Development Applications in respect of the development site. However, the proposed Sandigo Solar Farm SSD is within 10 km of the development site.



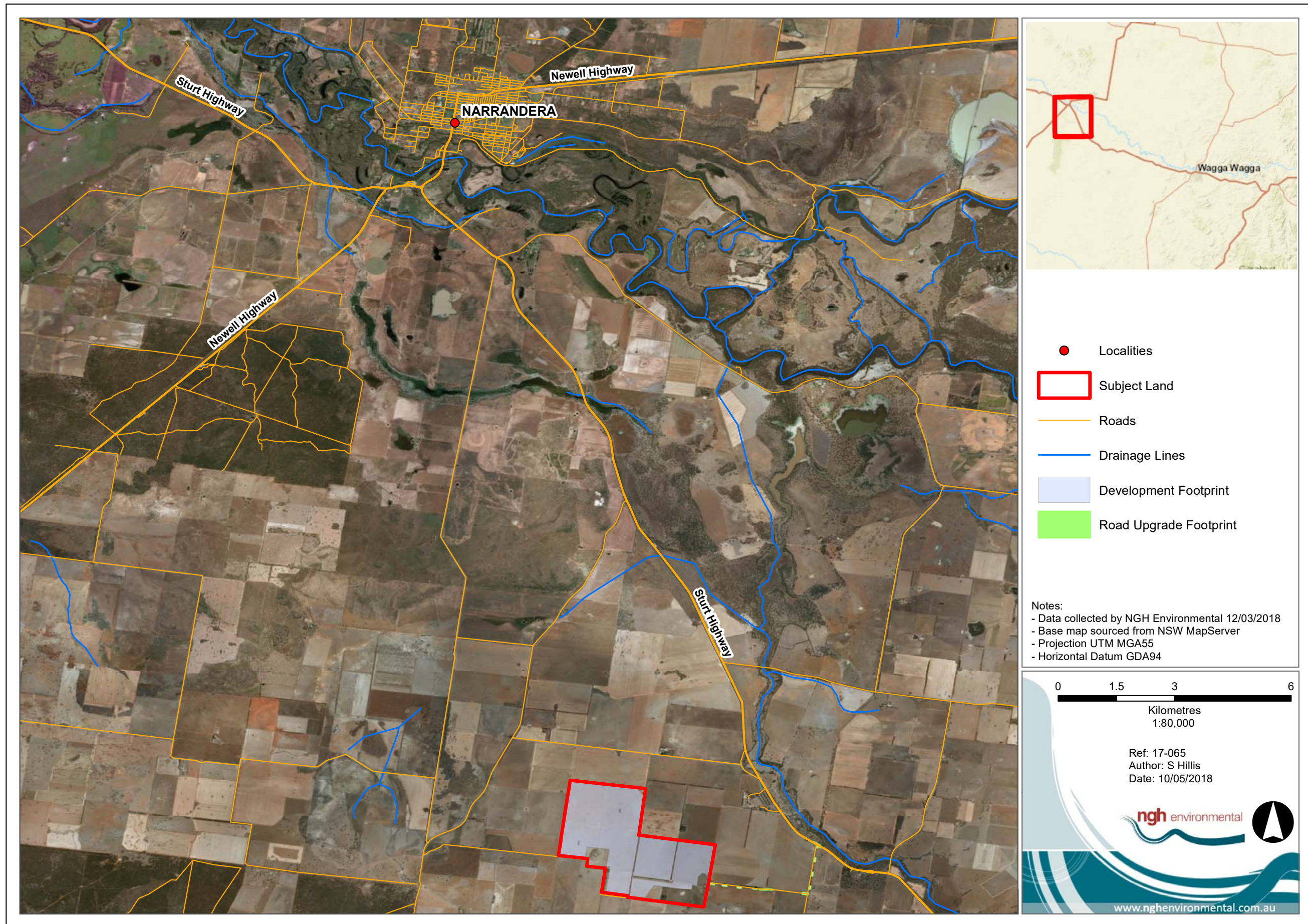


Figure 1-1 General location of the development site

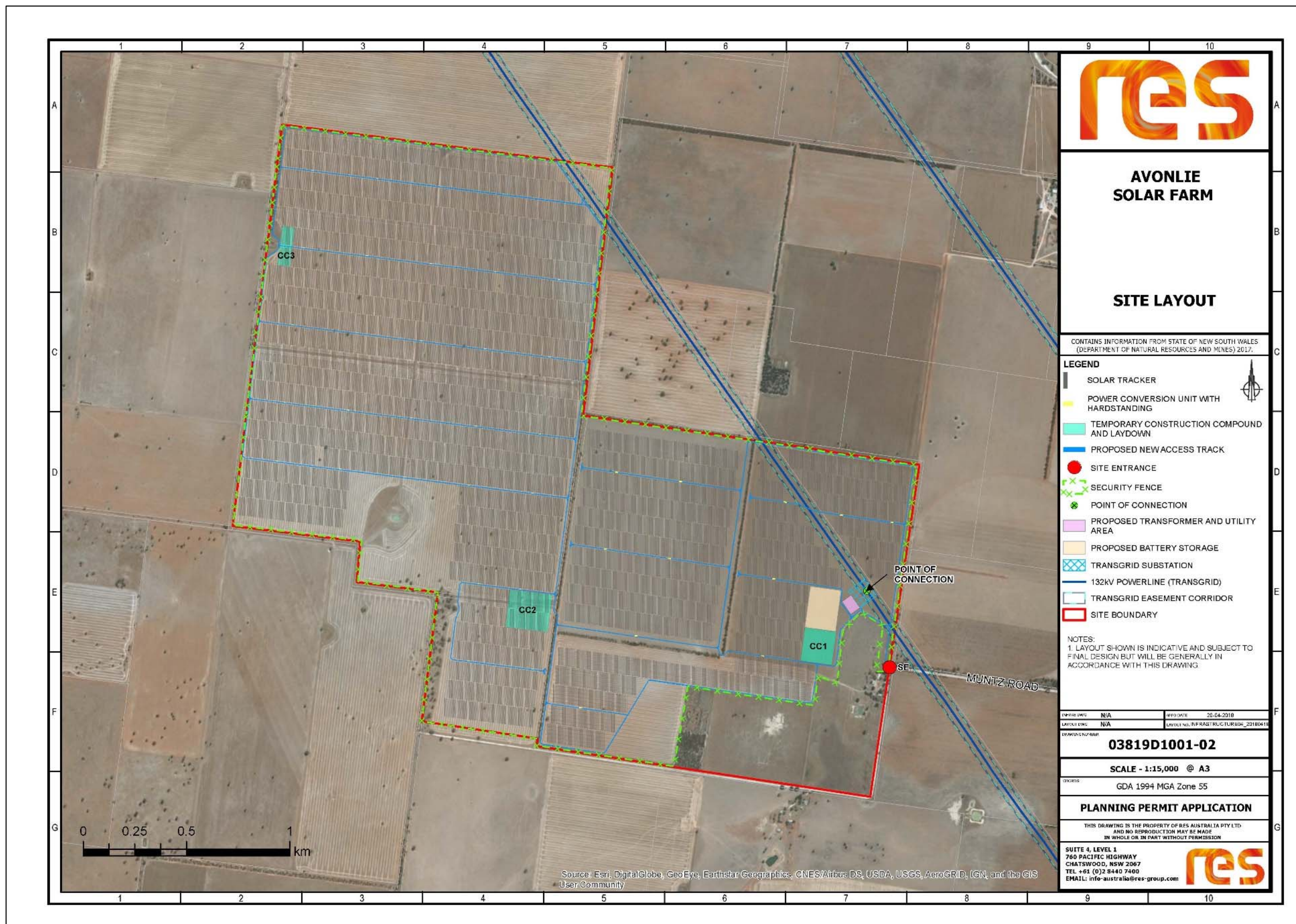


Figure 1-2 Proposed Infrastructure

## 2 STRATEGIC JUSTIFICATION AND ALTERNATIVES CONSIDERED

### 2.1 STRATEGIC NEED

#### 2.1.1 Global warming

Human activity is resulting in the release of large amounts of greenhouse gasses (GHGs) which trap the sun's heat in our atmosphere and upset the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the United Nations Paris Agreement on Climate Change (DEE 2017). Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE, 2017). Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

#### 2.1.2 National renewable energy targets

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Australian Prime Minister signed Australia's instrument of ratification of the Kyoto Protocol in 2007, thereby committing Australia to reduce its collective GHG emissions.

There have been many government policies in place in Australia influencing the development of renewable energy. In 2001, the Commonwealth Government introduced the Mandatory Renewable Energy Target (MRET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The initial MRET was for Australia to provide 9,500 gigawatt hours (GWh) of new renewable energy generation by 2010.

This target was revised and from January 2011 the target was expanded to 45,000 GWh of additional renewable energy between 2001 and 2020. The MRET was split into 2 components, a Small-scale Renewable Energy Scheme and Large-scale Renewable Energy Target (LRET), to ensure that adequate incentives were provided for large-scale grid connected renewable energy. The LRET aims to create a financial incentive for the establishment and growth of renewable energy power stations, such as wind and solar farms, or hydro-electric power stations through the creation of large-scale generation certificates.

In June 2015, the Australian parliament passed the *Renewable Energy (Electricity) Amendment Bill 2015*. As part of the amendment bill the LRET was reduced from 41,000 GWh to 33,000 GWh by 2020 with interim and post 2020 targets adjusted accordingly. The current projection is that about 23.5% of Australia's electricity generation in 2020 will be from renewable sources.

#### 2.1.3 Finkel Report

The 2017 Independent Review into the Future Security of the National Electricity Market (Finkel Report) is a report commissioned by the Commonwealth Government in order to establish a framework for the development of the Australian energy sector. It recommends the use of a Clean Energy Target (CET) scheme to stimulate renewable energy production throughout the National Electricity Market (NEM) and would likely replace the present Commonwealth MRET scheme due to expire in 2020. The report modelled outcomes to achieve a trajectory committed to by the Commonwealth government by 2030 and determined that renewable energy would constitute approximately 42% of the NEM.

### **2.1.4 NSW Renewable Energy Action Plan**

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government, 2013). The Government's vision is for a secure, affordable and clean energy future for NSW.

The Plan positions the state to increase energy from renewable sources, at least cost to the energy customer and with maximum benefits to NSW. The strategy is to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in NSW.

The Plan details 3 goals and 24 actions to efficiently grow renewable energy generation in NSW:

1. Attract renewable energy investment and projects
2. Build community support for renewable energy
3. Attract and grow expertise in renewable energy

Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors. Storage allows renewable energy investors to increase revenue by selling power at times of peak market prices as opposed to when the electricity is generated. This in turn places downward pressure on electricity prices by encouraging more supply at times of peak demand and reducing the need for additional distribution and transmission infrastructure.

Storage technology (including rechargeable batteries and thermal energy storage) is a global market, with many other countries currently grappling with ways to integrate increasing amounts of renewable energy into their networks. NSW can leverage the work being done overseas as well as develop storage expertise within NSW to create a long-term export industry.

### **2.1.5 State and Commonwealth support for renewable energy**

At present, Australia has one of the world's highest GHG emissions per unit of electricity produced in the world, with the vast majority of its power generated by aging coal-fired power plants. The REAP and LRET incentives are supported at the Commonwealth level by grant programs from the Australian Renewable Energy Agency (ARENA), and financing programs from the Clean Energy Finance Corporation.

### **2.1.6 Climate Change Fund Draft Strategic Plan 2017 to 2022**

The Climate Change Fund Draft Strategic Plan sets out priority investment areas and potential actions using \$500 million of new funding from the \$1.4 billion Climate Change Fund over the next five years. Investment in these areas will help New South Wales make the transition to a net zero emission by 2050 and adapt to a changing climate.

This strategic plan is an important first step to implementing the policy framework. The strategic plan organises potential actions into 3 priority investment areas that will form the basis of future action plans:

- Accelerating advanced energy (up to \$200m)
- National leadership in energy efficiency (up to \$200m)
- Preparing for a changing climate (up to \$100m)

The advanced energy priority area focuses on supporting the transition to a net-zero emissions economy by providing greater investment certainty for the private sector, accelerating new technology to reduce future costs, and helping the community and industry make informed decisions about a net-zero emissions future.

### 2.1.7 NSW 2021: A Plan to Make NSW Number One

This plan was released in 2011, replacing the State Plan as the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation. Goal 22 of this plan seeks to protect our natural environment and includes a specific target to increase renewable energy.

A commitment is made to:

*Contribute to the national renewable energy target [i.e. 20% renewable energy supply] by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources (NSW Government, 2011).*

Specific initiatives under this target that directly support building solar power plants included the Solar Flagships Program, in partnership with the Commonwealth Government, established in 2009 (now closed). Additionally, a strategic move towards renewable energy generation is supported through the establishment of a Joint Industry Government Taskforce to develop a Renewable Energy Action Plan for NSW, which would identify opportunities for investment in renewable energy sources.

### 2.1.8 Greenhouse gas emissions - life cycle analysis and benefits of solar technology

Life cycle emissions consider emissions produced during the manufacture, construction, operation and decommissioning of, in this case, electricity generation technologies. When compared with existing conventional fossil-fuel based electricity generation, solar PV technology generates far less life-cycle GHG emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al* 2008).

Unlike fossil fuel systems, most of the GHG emissions for solar technology occur upstream of the lifecycle, with most of the emissions (50-80%) arising during the production of the module (Weisser, n.d). Other lifecycle emissions relate to construction and decommissioning activities. During plant operation, the production of electricity with photovoltaic modules emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources. Support activities, such as maintenance works, may however generate emissions but the amount would be regarded as being negligible. End of life and associated transport activities do not result in meaningful cumulative GHG emissions (Weisser, n.d).

Emissions from conventional fossil fuel-based energy generation can therefore be avoided by replacing conventional methods of fossil fuel energy generation with solar PV energy generation.

## 2.2 PROPOSAL BENEFITS

### 2.2.1 Key benefits

Key benefits include:

- The Avonlie Solar Farm would generate approximately 473,000 MWh of renewable electricity per year.
- Based on the assumption that power generation would otherwise be made by brown coal with a carbon factor of 0.33372 tonnes per MWh, the proposed solar energy facility would displace more than 158,000 tonnes of carbon dioxide (CO<sub>2</sub>) or greenhouse gas emissions per year (Source: Department of the Environment National Inventory Report).
- Supply of enough power each year to service approximately 80,000 average New South Wales households (Essential Economics Pty Ltd, 2018).

- A solar farm that displaces over 158,000 tonnes of CO<sub>2</sub> per annum is the equivalent of taking approximately 56,400 cars off the road each year, based on an average car in NSW travelling 14,000 km per year with CO<sub>2</sub> emissions of 200 g/km (or 2.8 tonnes of CO<sub>2</sub> emissions per car per year) (DIT, 2011).

### **2.2.2 Broad benefits**

Broad benefits that would be associated with the operation of the proposal include:

- Reduced GHG emissions, assisting the transition towards cleaner electricity generation.
- Provision of a renewable energy supply that would assist the Commonwealth and NSW Governments to reach Australia's LRET and other energy and carbon mitigation goals.
- Embedding electricity generation supply into the Australian grid, closer to the main consumption centres.

### **2.2.3 Local benefits**

Local social and economic benefits that would be associated with the construction and operation of the Avonlie Solar Farm include:

- Direct and indirect employment opportunities during construction and operation of the solar farm; this includes up to 200 direct and 320 indirect jobs at the peak of construction and 4 direct and 12 indirect operational staff for the life of the project.
- The proposal will provide significant participation opportunities for businesses and workers located in the area.
- The external proposed labour requirements would be expected to generate an accommodation need for 60 project workers at the peak of the project. Workers would be expected to inject approximately \$2.7 million in additional spending into the regional economy over the construction phase through accommodation and additional services.
- Direct business volume benefits for local services, materials and contracting businesses.
- Assistance in meeting the future national electricity demands.
- Council rates revenue associated with the solar farm will be subject to negotiations between Narrandera Shire Council and the proponent; however, financial benefits to Council are likely to be significant over the 25 to 30 year project lifecycle.
- A commitment to providing a one-off \$250,000 payment into a Community Fund at the start of the construction phase of the project. The Community Fund could be used to support a range of projects, which might include environmental and local community projects.

Additionally, the proposal would address the environmental constraints of the site appropriately. It would be designed to:

- Preserve biodiversity features, through minimising tree removal.
- Preserve Aboriginal Cultural Heritage through avoidance of sensitive areas.
- Minimise impacts to soil and water, through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Minimise visual impacts to neighbours, incorporating vegetation screens located in consultation with neighbours.
- Preserve agricultural production values, being highly reversible at the end of the project's life and utilising the area for grazing for the lifetime of the project.

## 2.3 PROPOSAL OBJECTIVES

The objectives of the Avonlie Solar Farm proposal are to:

- Select and develop a site which is suitable for commercial scale solar electricity generation.
- Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals.
- Develop a project which is acceptable to the local community.
- Provide local and regional employment opportunities and other social benefits during construction and operation.
- Provide a clean and renewable energy source to assist in reducing GHG emissions.
- Avoid and minimise environmental and cultural impacts wherever practicable through careful design and best practice environmental protection and impact mitigation.
- Provide electricity generation close to a consumption centre.

## 2.4 ALTERNATIVES CONSIDERED

During the development of the proposal, a number of alternatives were considered. These include the 'do nothing option' (not developing the solar farm), alternative development site locations and developing different renewable technologies.

### 2.4.1 The 'do nothing' option

The consequences of not proceeding with the proposal would be to forego the identified benefits. This would result in the **loss** of:

- Opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- A renewable energy supply that would assist in reaching the LRET.
- Additional electricity generation and supply into the Australian grid.
- Social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.

Doing nothing would avoid the environmental impacts associated with the development and operation of the proposed solar farm, which include vegetation impacts, construction noise, traffic and dust, visual impacts and a temporary reduction in agricultural production at the site.

These impacts are considered to be manageable and would not result in a significant impact to the environment. Given the benefits of the proposal, the do-nothing option is not considered to be a preferred option. Considering the benefits of the proposal and the low level of environmental impact (assessed within this EIS), the proposal is considered to be ecologically sustainable and justifiable.

### 2.4.2 Technology alternatives

The LRET and REAP outline the commitment by Australia, and NSW more specifically, to reducing GHG emissions and having set targets for increasing the supply of renewable energy. Other forms of large-scale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depends on the availability of energy resources and grid capacity.

Superior solar resources have been identified in New South Wales, providing excellent opportunities for solar projects. Available grid capacity at a suitable voltage at the nearby TransGrid substation was also instrumental in making Avonlie an ideal choice for a renewable energy development.

### 2.4.3 Alternative site locations

The proponent has reviewed the solar generation potential of many areas in NSW using a GIS (Geographic Information System) model. A number of renewable energy projects are required in NSW to meet the needs case outlined in Section 2.1. Projects are also being explored by the proponent in other areas of NSW.

The proposed site was selected because it satisfies the proposal objectives. The site is of a scale that allows for flexibility in the design, allowing the proponent to avoid or effectively mitigate the ecological and other constraints that have been identified during the EIS process.

The design of the proposal is the result of an iterative process and has been adapted progressively as information regarding site constraints and the potential impacts and risks associated with the development of the proposal have become available.

Based on biodiversity, heritage and other studies carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while avoiding and minimising environmental impacts.

### 2.4.4 Alternative PV technologies

Alternative technologies for renewable energy generation at the proposal site encompass generation technology (principally solar or wind), Photovoltaic (PV) solar equipment and the energy storage system.

#### Generation technology

PV solar technology was chosen for electricity generation because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. Solar generation is well suited to the characteristics of the site and can be rapidly deployed to assist in meeting both state and national climate change targets.

#### PV solar farm components

Technology options considered for the Avonlie Solar Farm proposal include:

- The type of PV panels.
- Solar panel mounting system - fixed tilt or tracking.
- The type and number of Power Conversion Units.

#### SOLAR PANELS

The solar panel dimensions would typically be approximately 1 m x 2 m, and 50 mm thick. The solar panels may be mounted on racking which is either fixed or rotates around the horizontal axis, tracking the sun's trajectory (refer below).

#### ARRAY MOUNTING SYSTEM

The PV mounting structure can be fixed or incorporate a mechanism that enable the modules to track the path of the sun:

- **fixed:** the modules are fixed and installed at an optimal orientation and tilt/angle for the site.
- **single axis tracking system:** a mechanism enables the modules to track the sun from east to west, following the path of the sun. The tilt/angle of the module is fixed. This is the preferred option.
- **dual axis tracking system:** a mechanism enables the modules to track the sun from east to west and north to south. This tracking ensures the module surface is always presented perpendicular to solar radiation, and therefore achieves maximum exposure.



The mounting options are compared in Table 2-1. The mounting system is installed on steel piles that have been driven or screwed into the ground, with generally very little ground disturbance or pre-installation preparation. The total production, including generation window, will also be subject to the final solar panel selection.

Table 2-1 Comparison of mounting options

Element	Fixed	Single axis tracking system	Dual axis tracking system
Land area required	Low	Medium	Very High
Production	Medium	High	High
High generation output window	Noon +- 2 hours	Sunrise + 30 min to sunset – 30 min	Sunrise + 30 min to sunset – 30 min
Investment	Low	Medium	Very High
Operation expense	Low	Low	High
Wind resistance	Very High	Very High	Low
System reliability	Very High	Very High	Medium

## POWER CONVERSION UNITS

Inverter/transformer stations, also known as Power Conversion Units (PCUs) convert the power collected from direct current (DC) energy into grid-compatible alternating current (AC) energy. Indicatively a central inverter design with a PCU capacity of approximately 5 MW would be used, rather than smaller capacity string inverters connected directly to solar panels, because this system is best suited to large scale PV plants. PCU will be approximately 3 m high, with a total of 41 spread across the site.

## Energy storage technology

There are several alternative technologies that could be used for the proposed BSF. Battery technology was selected over mechanical or physical storage methods (flywheel, pumped hydro, liquid air, compressed air) or thermal storage (such as hot water or molten salt) because it enables modular installation without major infrastructure or specialised landform features. Batteries generally have lower weight and physical volume and better scalability compared to other technologies. Disadvantages of batteries include their relatively limited life, some batteries are made from hazardous materials, and their sensitivity to climatic conditions (Finkel *et al.*, 2016).

The lithium-ion ('Li-ion') battery is currently the preferred technology for storing energy generated from wind and solar sources (Nova, Academy of Science 2017), and is likely to dominate battery chemistry for the next 20 years (Randell Environmental Consulting 2016). The shift to Li-ion batteries is because of their greater energy density (which means they are smaller and lighter), expected longer life spans and ability to undergo deeper discharges, reducing the capacity required (Helen Lewis Research 2016). Li-ion batteries have a very long lifetime compared to other battery technologies, with 5,000 or more charge cycles (Finkel *et al.*, 2016).

Alternative battery technologies include lead acid and relatively new technologies such as hydrogen, molten-state, sodium-ion, flow (vanadium redox, hydrogen bromide or zinc bromide) and salt water batteries. Many of the competing technologies are either still in technical or commercial development, environmentally unfriendly or offer low energy and power density compared to Li-ion.

Li-ion battery cells were selected for the Avonlie site because they provided the optimal combination of:

- Proven ability to complement solar generation developments.

- Ability to support the network to increase renewable energy penetration.
- Ability to provide energy during periods of peak demands.
- Minimal environmental impact.
- Safety and ease of integration.
- Demonstration and maturity of technology.
- Value for money.

Li-ion technology is established, proven, compact, lightweight, highly efficient, very high energy density, economically attractive, commercially available and easily installed with low maintenance requirements.

#### **2.4.5 Scale of the proposal**

The scale of the proposal has been influenced by:

- Property boundaries.
- Demand for new renewable electricity generation to meet generation targets.
- Commercial investment and viability considerations.
- Consideration of biodiversity and Aboriginal Cultural Heritage values.
- Transmission grid capacity.

The proposed scale of the solar farm successfully responds to the constraints and opportunities inherent in these factors.

As part of the site selection process, the proponent has undertaken detailed electrical load-flow modelling of the NSW electricity transmission system. This detailed modelling has shown the available capacity on this section of the 132 kV grid system to be sufficient to support a proposal of this scale. The modelling also considered other committed future generation. These assessments have been discussed with TransGrid as part of the ongoing grid connection consultation and agreement process.

#### **2.4.6 Site suitability and justification**

The Avonlie Solar Farm would meet the proposal objectives, principally the development of a commercial scale solar electricity power station. It is justified in terms of reducing Australia's GHG emissions and meeting future energy demands. It will contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. Finally, it will contribute to economic development in Narrandera and surrounding region.

The development site is considered to be suitable for the proposal given:

- It is located within close proximity to existing electricity infrastructure.
- The land has been heavily disturbed from past and current agricultural activities.
- Given the location, site attributes and heavy disturbance of the land, the proposal would have low impacts on the environment.
- The development site is not subject to land hazards such as flooding or bush fire and is not known to hold land contamination.
- The proposal is not likely to generate land use conflicts with surrounding land uses.
- The community has provided support for the proposal.

## **3 PROJECT DESCRIPTION**

### **3.1 DEVELOPMENT SITE DESCRIPTION**

The proposed Avonlie Solar Farm would occupy approximately 581 ha of land and includes Lots 1 and 2 DP606800, and Lots 13, 22, 26, 30, 43, 53 DP754538 (Figure 3-1). Of this, approximately 534 ha makes up the development footprint (or area of disturbance). The development site is agricultural land comprising several large paddocks which are generally flat, largely cleared and cultivated for pastures and grazing (Figure 3-2).

The development site holds several dams (Figure 3-3), with an unnamed irrigation channel occurring on the east of Lot 30 DP 754538 (Figure 3-4). Sandy Creek occurs approximately 1.5 km to the north east. There are no residences within the development site, and adjoining land uses include grazing and cropping for agriculture.

The development site holds remnant native vegetation in the form of paddock trees. Remnant native woodlands occur along the western boundary of the development site and along Muntz Road. Planted vegetation is located between paddocks, and along the southern boundary on Muntz Road.

There is an existing TransGrid 132 kV powerline that runs through the eastern side of the property, allowing a connection to the existing grid.

The development site has been heavily modified for the purposes of irrigation. This has included:

1. Extensive clearing of native vegetation.
2. Paddocks sown with wheat, soy beans and pasture.
3. Wide spread earth moving to flatten and level the paddocks.
4. Construction of irrigation supply channels.

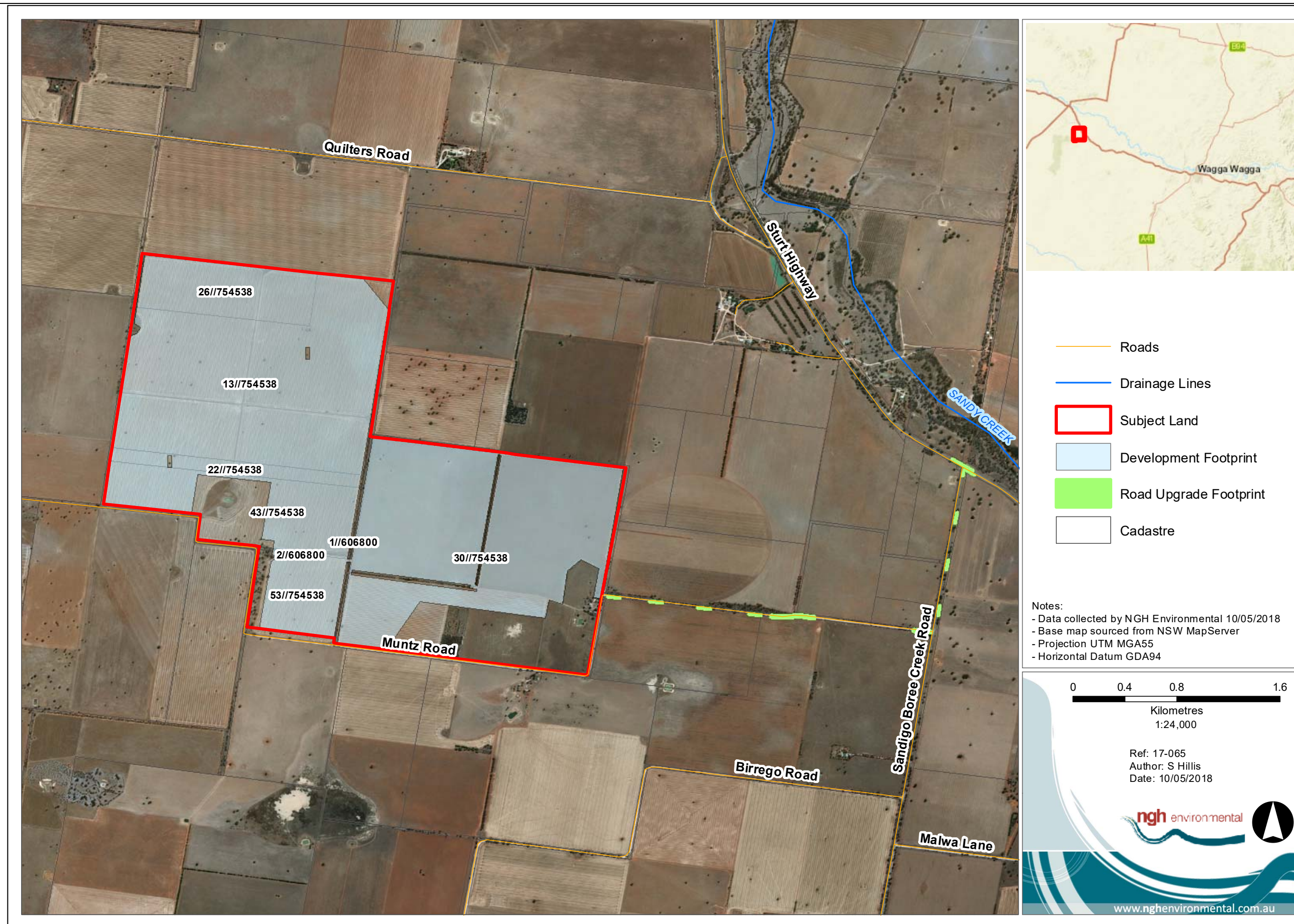


Figure 3-1 Avonlie Solar Farm development site



Figure 3-2 Typical view of large flat tree lined paddocks



Figure 3-3 Typical dams within the development site



Figure 3-4 Unnamed irrigation channel

No sensitive receptors are located within the development site, with the closest receptors located on Quilters Road, approximately 1 km from the proposal footprint (Figure 3-5). This receptor would have broken views of the proposed Avonlie Solar Farm through existing vegetation. Six involved and 1 uninvolved receptor is located within 2 km of the Subject Land, with an additional 2 uninvolved receptors located within 3 km of the subject land. One uninhabited building exists within the development site.

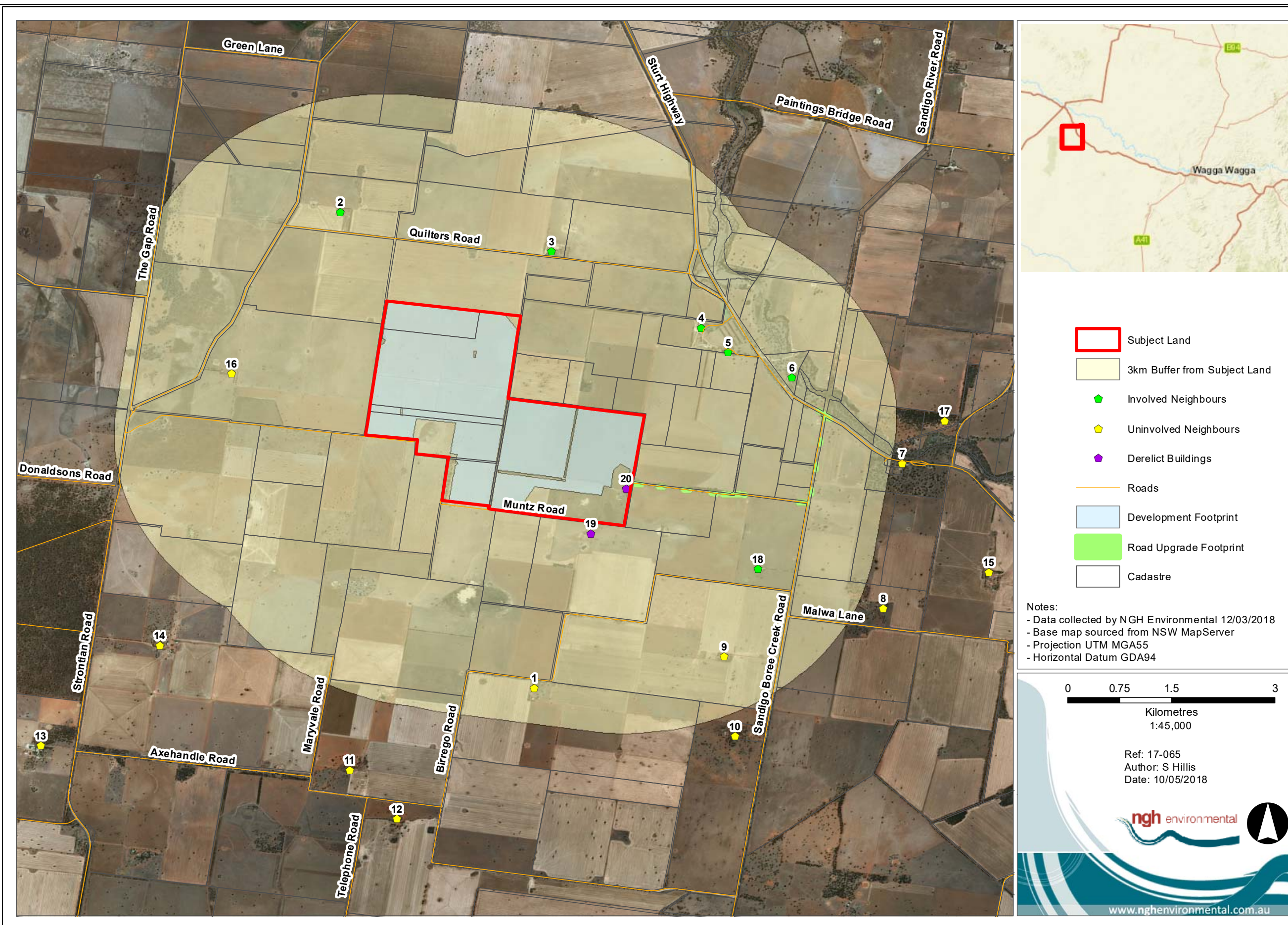


Figure 3-5 Location of Sensitive Receptors

Access to the Avonlie Solar Farm would be off Sandigo Road and Muntz Road (Figure 3-6), which are local roads under the jurisdiction of the Narrandera Council. Sandigo Road is accessed off the Sturt Highway, approximately 17 km south of Narrandera (Figure 3-7). Muntz Road is expected to experience a low level of traffic, predominantly used by local traffic and agricultural machinery.



Figure 3-6 Unsealed Muntz Road to the development site



Figure 3-7 Sturt Highway / Sandigo Road Intersection



## 3.2 THE PROPOSED AVONLIE SOLAR FARM

Key features of the proposed Avonlie Solar Farm are summarised in Table 3-1. Component specifications are subject to detailed design and product selection:

Table 3-1 Summary of Key Features of the Avonlie Solar Farm

Proposal element	Description
Proposal	Avonlie Solar Farm
Proponent	RES Australia Pty Ltd
Capacity	200 MW <b>Note:</b> the approximate capacity is based on the proposed technology available at the time of the EIS but may change through the life of the solar farm as advances in technology occur.
Subject Land	633 ha
Development Site	581 ha
Development footprint	534 ha
Site description	Lots 1 and 2 DP606800, and Lots 13, 22, 26, 30, 43, 53 DP754538. The development site is agricultural land comprising several large paddocks which are generally flat, largely cleared and cultivated for pastures and grazing.
Local Government	Narrandera Shire
Subdivision	Lot 30 DP 754538 would be subdivided to create a 1 ha lot for the proposed substation, a 48.4 ha lot retained by the landowner for agricultural purposes, and the residual lot being 212.6 ha for the solar farm infrastructure. At the end of the life of the solar farm, the lot would be reconsolidated into the residual lot.
Solar array	Approximately 670,000 solar panels mounted in rows up to 100 m long, with 3-9 m row spacing. The panels are likely to have a maximum height of approximately 4 m and the 95,000 array posts are expected to be inserted to approximately 2.4 m into the ground.
Battery Storage Facility	The proposal includes a BSF, which will be constructed at the same time as the solar farm, or as part of a staged development within 5 years of the commissioning of the solar farm. Subject to economic and technical considerations, an approximately 205MW/205 MWh rated capacity facility will comprise lithium-ion batteries housed in 2 Heating, Ventilation, Air Conditioning (HVAC) plants comprising of 16 HVAC plant enclosures with up to 144 external HVAC units. The ESF would be located in a secure compound enclosed by security fencing. An initial pilot study of 10MW hr will be conducted.
Substation	An on-site substation occupying around 1 ha with gravelled hardstand and security fencing. A short section of overhead cabling will connect the substation to the existing TransGrid 132 kV overhead line, and this will be located within the TransGrid easement.
Access tracks	Access tracks constructed of engineered fill topped with crushed stone pavement would access the solar farm infrastructure for maintenance. The driving surface would be 4 m wide, plus shoulders and any required drainage.
Operations and maintenance buildings	Buildings would be constructed to provide control, switch room and storage facilities for the solar farm.
Security fencing, lighting and CCTV	Continuous security lighting (infra-red) and CCTV cameras would be installed on posts up to 3.5 m high adjacent to the perimeter security fencing and around the operation and maintenance buildings. Security fencing installed around the site would indicatively be 2 m high.
Construction hours	Standard daytime construction hours would be 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays.

Proposal element	Description
Construction timing	18 months commencing Autumn 2019.
Workforce	Construction – approximately 200 direct workers and 320 indirect workers. Operation 4 direct and 12 indirect full time equivalent staff.
Operation period	Up to 30 years
Decommissioning	The site would be returned to its pre-works state. All above ground infrastructure would be removed to a depth of 500 mm. The site would be rehabilitated in consultation with the landowner consistent with land use requirements. Life extension options may be considered, subject to future approvals.
Capital investment	Estimated \$250 million.

### 3.3 PROPOSAL LAYOUT

The proposed layout has been developed iteratively in tandem with the environmental assessment and community and stakeholder consultations to ensure potential impacts are avoided and minimised wherever possible.

A constraints analysis of the proposal site was undertaken to assist with designing the solar farm layout and planning the environmental assessment. Environmental constraints are factors which affect the ‘developability’ of a site, and include physical, ecological, social and planning aspects. Specific constraints at the site were allocated to 3 classes: high, medium and low. Environmental constraint classes are described in Table 3-2.

The layout of the proposed solar farm has been adapted to avoid high constraint areas as far as practicable and at least minimise impacts to moderate constraint areas (Figure 3-9). In terms of biodiversity values, Endangered Ecological Community vegetation and threatened flora and fauna habitat were avoided as far as practicable.

The layout and works have been designed to comply with setback and other requirements in the TransGrid and Essential Energy guidelines (TransGrid and Essential Energy 2013) as well as setback and access requirements obtained from the Rural Fire Service (RFS).

Table 3-2 Environmental constraints at the Avonlie Solar Farm

High constraint
<p><b>Remnant woodland vegetation</b></p> <p>Remnant woodland with native understorey, including a stand belonging to an EEC in moderate-good condition. Woodland remnants have high conservation value in the heavily cleared Riverina region. Some trees are hollow-bearing and provide potential threatened bird habitat.</p>
<p><b>Existing powerlines</b></p> <p>Development within existing powerline easements would be constrained by restrictions to maintain access for inspection and maintenance. 132 kV powerlines run north-south across the eastern side of Avonlie Solar Farm.</p>
Moderate constraint
<p><b>Isolated paddock trees</b></p> <p>Isolated trees in cropland (some derived from an EEC and many hollow-bearing) have habitat and connectivity value for native wildlife.</p>
<p><b>Water storage dam</b></p>

2 dams, 1 large and 1 small, are present on the property, which represents a practical constraint for the solar farm. Both farm dams will be retained for stock watering.

**Low constraint**

**Cleared, cultivated paddocks with no paddock trees**

These areas do not carry native vegetation and have low habitat value.

**Existing dwellings**

No inhabited dwellings are present on the proposal site/footprint. A derelict building is located in the south-east corner of the development site but will not be touched or altered.

### **3.4 SUBDIVISION**

The proposal area is zoned RU1 Primary Production, with a minimum lot size of 400 ha. The proposal would require subdivision of Lot 30 DP754538. Approximately 1 ha would be excised for the construction of the substation, and approximately 48.4 ha subdivided for the landowner for agricultural purposes. The residual lot, being 212.6 ha, will be for solar farm infrastructure. Narrandera Shire Council has indicated they are supportive of the development and are therefore willing to provide in-principle agreement to any newly created lots under the minimum lot size (Appendix C-1).

A subdivision plan is provided in Figure 3-10.

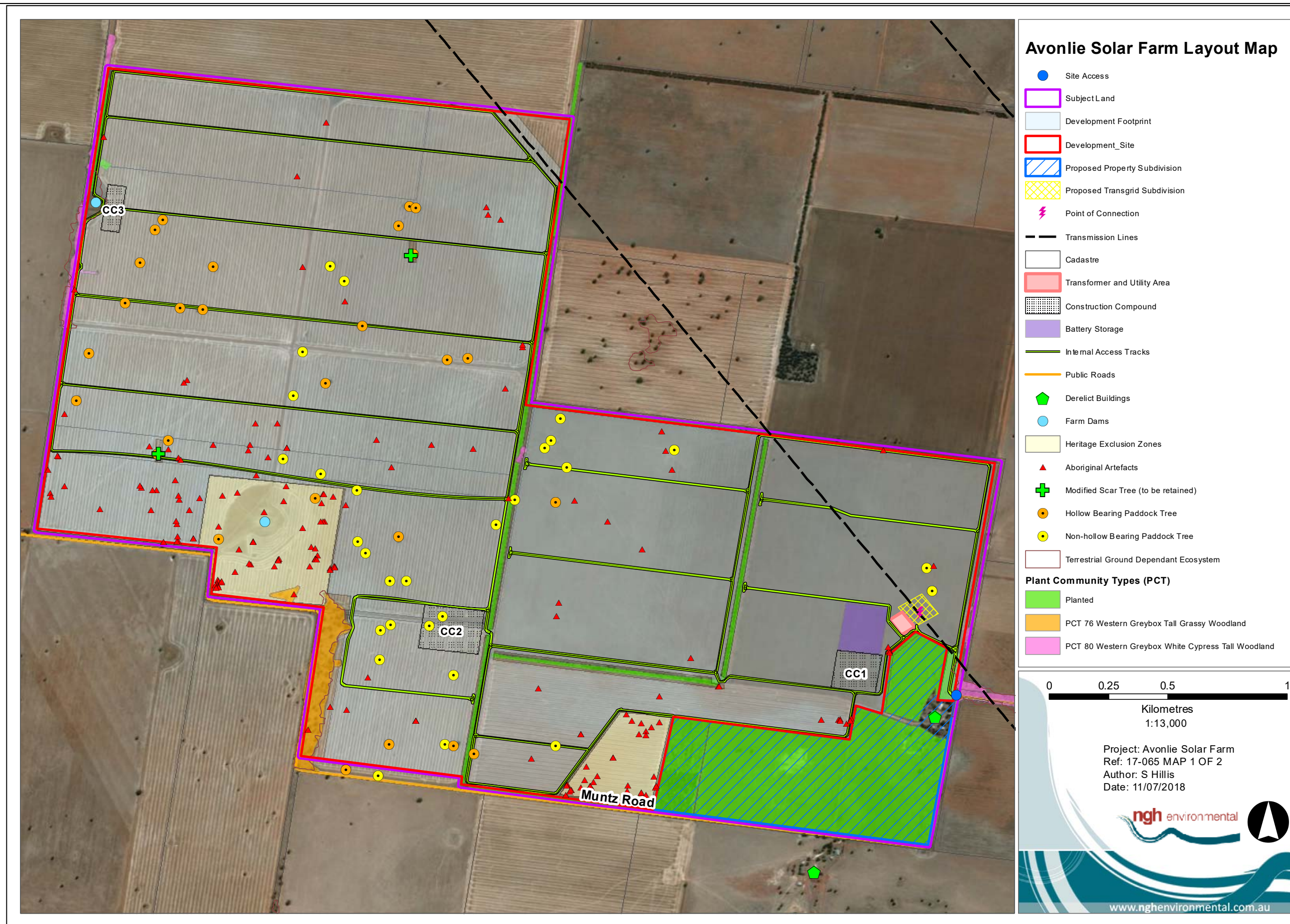


Figure 3-8 Proposal layout and site environmental constraints 1 of 2.



Figure 3-9 Proposal layout and site environmental constraints 2 of 2.

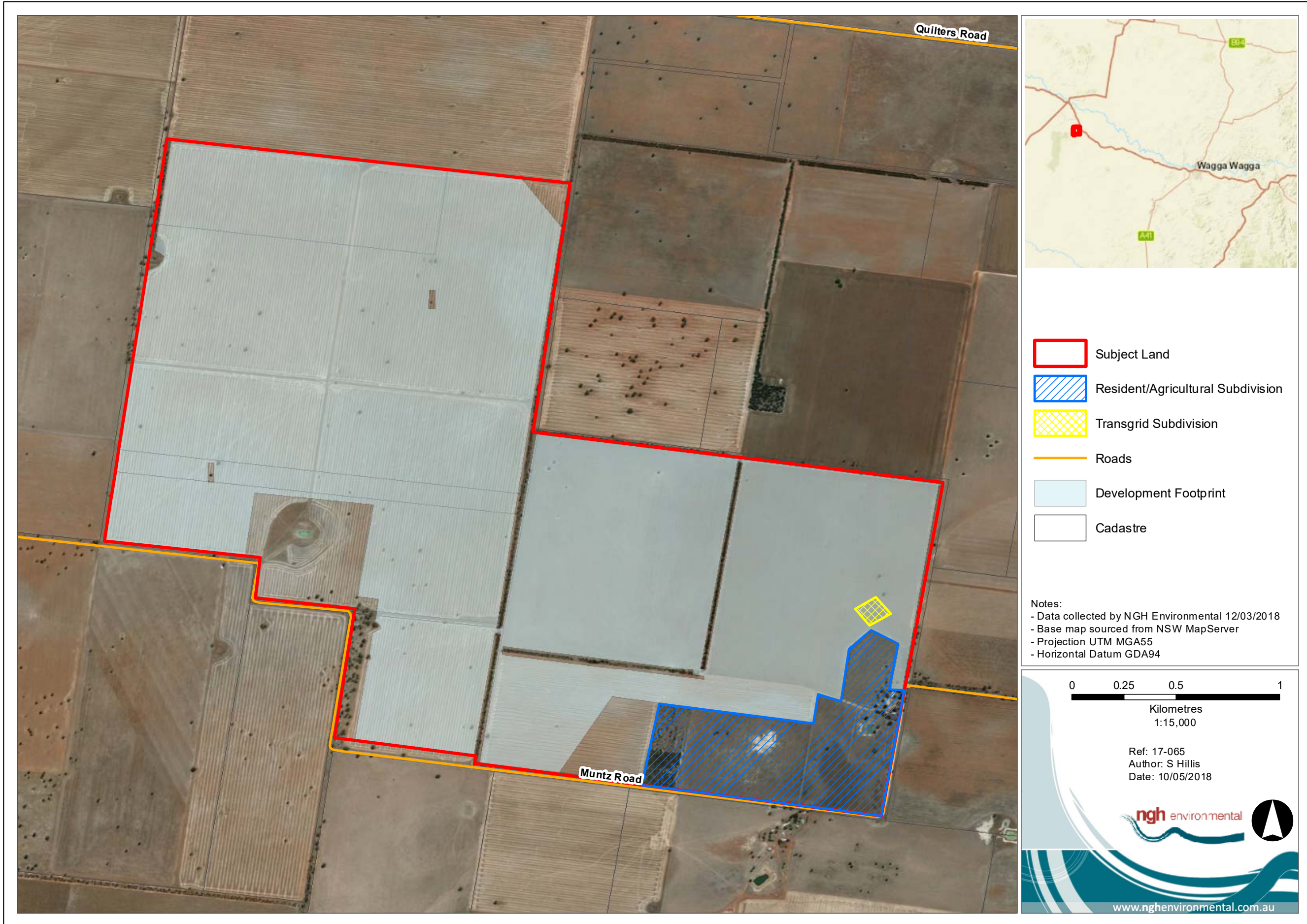


Figure 3-10 Proposed subdivision plan

### 3.5 PROPOSED INFRASTRUCTURE

The proposal involves the construction of a ground-mounted photovoltaic solar array which would generate around 200 MW of renewable energy. The solar farm would connect (via the substation) directly into the existing TransGrid 132 kV transmission network, which passes through the Avonlie property.

The layout of the infrastructure components is shown on Figure 1-2, and the components are described below. The plans and specifications of the components are subject to detailed design and product selection.

#### 3.5.1 Solar arrays

It is expected that the array would comprise approximately 670,000 solar panels mounted in rows on a single axis tracking system. The single axis system, illustrated in Figure 3-11, would be powered by 7,900 tracker motors. Technical drawings for a single axis tracker are provided in Appendix B-1. A single axis tracker would have a typical maximum height of 4 m, based on a 3 m vertical height panel and 2 m high support posts. Row lengths will depend on the detailed design but could be up to 100 m. Spaces between rows (edges of panels) may vary between 3 m and 9 m. The indicative size of each PV panel is 2 m by 1 m, installed in either portrait or landscape orientation.

Approximately 95,000 piles would be driven or screwed into the ground to support the solar array's single axis tracker mounting system and solar modules. The pile depth would be determined following detailed geotechnical site investigation; depths are typically 1.5 - 1.7 m but may be up to 2.4 m. Pile heights will vary according to topography. Technical drawings for a typical piled foundation rack mount are provided in Appendix B-1.



Figure 3-11 Single axis tracking system solar array

#### 3.5.2 Battery Storage Facility

Unlike markets for storable commodities, the electricity market is reliant upon the real-time balance of supply and demand. Electric Energy Storage is the capability of storing electricity or energy to produce electricity and releasing it for use during other periods when the use or cost is more beneficial.

The proposal includes a Battery Storage Facility (BSF), which has been designed to allow the project to respond quickly with the capacity modifications as the market develops. A pilot project of 5-10 MW capacity will be carried out at the time of construction, with overall construction and design to facilitate up to approximately 205MW/205MWh rated capacity provided by banks of lithium-Ion batteries at full capacity. This EIS assesses the overall impact of the full design (buildings, transformers and inverters) with battery capacity from the pilot study only, with additional assessment proposed for any future modification to increase battery capacity within the assessed buildings.

The batteries would be housed in 2 buildings approximately 116 m long by 16 m wide and 6.5m tall and will be built on a concrete slab. There will be up to 16 HVAC (heating, ventilating and air conditioning) units in total to manage the internal temperature of the battery buildings.

The facility would occupy approximately 2.5 ha (200 m x 125 m), enclosed by a 2 m security fence. External areas would provide carparking for up to 6 vehicles and would be either gravelled or sealed. All cabling would be underground or on cable trays. A switchroom is also located externally and will be approximately 47 m long and 5.5 m wide. Indicative plans are provided in Appendix B-1.

Each building would be actively cooled by a number of air-conditioning units as part of the HVAC system, with spare air-conditioning units in storage on-site for replacement. If all air-conditioning units fail or temperatures exceeds pre-set levels, an automatic battery shutdown system would prevent overheating.

The facility would include an integrated fire suppression system involving the storage and release of an inert gas within each battery building, using either electrical detectors/ionisers or a mechanical system in which the heat destroys a seal to release the gas. The BSF would also be surrounded by an Asset Protection Zone including gravel surfacing to minimise the risk of fire escaping from the facility and the risk of external fire affecting the facility.

### **3.5.3 Power Conversion Units (Solar)**

Inverter/transformer stations, also known as Power Conversion Units (PCUs), are located throughout the solar array field to convert the power collected from direct current (DC) energy into grid-compatible alternating current (AC) energy. Indicatively a central inverter design with a PCU capacity of approximately 5 MW would be used, rather than smaller capacity string inverters connected directly to solar panels, because this system is best suited to large scale PV plants. Indicative plans are provided in Appendix B-1.

### **3.5.4 Power Conversion Units (BSF)**

Approximately 96 Twin Skid PCUs with a configuration of 2 inverters and 2 transformers will be installed between the 2 BSF buildings to convert energy between DC energy stored in the BSF and grid-compatible AC energy. Each PCU configuration is approximately 25 m long and 2 m wide, with a 3 m separation. The PCU containers would be set on concrete footings, with the floor level approximately 0.5 m above the ground. Indicative plans are provided in Appendix B-1.

### **3.5.5 Overhead and underground cabling**

Most cabling at the site would be buried and located alongside the access tracks. A short section of overhead electrical cabling would be used to connect the substation to the existing TransGrid 132kV overhead; this will be located within the TransGrid easement

All underground cabling would be installed at a depth of at least 500 mm with the electrical reticulation buried to either 600 mm (low voltage) or 800 mm (high voltage) depth, in accordance with the relevant Australian Standard.



Prior to excavating the cable trench, the topsoil would be stripped and stockpiled for use in rehabilitating the trench line. Depending on the quality of the excavated material, sand may be used in the trench to create a cable bed. Once the cables are installed another layer of sand may be placed above the cable prior to the trench being backfilled with excavated material. Cables would be protected in accordance with AS3000.

### **3.5.6 Transmission network connection**

The solar farm would connect directly to the transmission network which passes through the site. Figure 1-2 shows the location of the substation, potential BSF and connection point to the transmission network.

### **3.5.7 Substation**

A new substation would be constructed on the proposal site within the subdivided portion of land (refer to Figure 1-2 and Figure 3-10) to step up the solar farm electrical output to match the transmission grid voltage (132kV). While the design is yet to be finalised, it is expected that the substation would occupy an area approximately 80 m by 80 m and contain transformers, associated switchgear and control and protection equipment, and may include a control building, switch room and drainage and oil containment system. The substation would be surrounded by a security fence. Gravel hardstand would be placed under and around the substation compound to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards.

### **3.5.8 Site access and internal tracks**

Proposed site access will be provided from Muntz Road, approximately 3.4 km south-west of the Sturt Highway. The proposed access will be designed to accommodate simultaneous entry and exit of the largest vehicles to use the site, a Restricted Access Vehicle (RAV).

A single construction and operation access point would be developed off Muntz Road, which runs east to west to the eastern boundary of the site. Although the final design has not yet been completed, the location and form of the access road intersection would be developed to provide adequate sightlines for vehicles entering and exiting the site, in accordance with Austroads and RMS guidelines. The final intersection designs would be completed in consultation with Narrandera Shire Council following approval of the proposal.

The internal access roads would involve construction of a network of tracks accessing the solar farm infrastructure for maintenance. Approximately 7,550 m of new track would be constructed at the site. The main access and internal tracks would be constructed of engineered fill topped with crushed stone pavement. The crowned driving surface would be nominally 4 m wide, plus shoulders and any required drainage. The locations of proposed internal tracks and carparks are shown on Figure 3-9.

Preliminary plans for the site propose parking for approximately 50 vehicles. The suggested timeline for the proposal indicates that approximately 200 employees would be required during the first month rising to 320 employees during the peak construction period.

The site access road and all internal tracks would be maintained throughout the construction and operation of the solar farm. If required, water trucks would be used to suppress dust on unsealed access roads and tracks during construction. Additional stabilising techniques and/or environmentally acceptable dust control would also be applied if required to suppress dust.

### 3.5.9 Control room, switch room and storage shed

Separate buildings will be required to provide control, switch room and storage facilities for the solar farm. Indicative descriptions of these buildings are provided below, and plans are provided in Appendix B-1. The locations of the buildings at the proposal site are shown on Figure 3-9. The control room, switch room and storage shed will each contain essential fire safety equipment, including fire extinguishers and hose reels.

#### Control room

A single storey building approximately 12 m long and 10 m wide (including timber-decked veranda) would be constructed on concrete footings to house control facilities. The building would have a skillion roof and be clad in fibre cement sheeting. Guttering and a water tank would be installed to collect rainwater. The control room building would contain an office and staff amenities (toilet, kitchen).

#### Switch room

A building approximately 29.5 m long, 5.5 m wide and 4.5 m high would be constructed for the HV switch room, with services, protection and control facilities. The skillion-roofed building would likely be clad in Colorbond sheeting. A communications tower may be installed adjacent to the building, approximately 21.2 m high.

#### Storage shed

A gable roofed storage shed measuring approximately 20 m long, 15 m wide and 6 m high would be constructed at the proposal site. The shed would likely be clad in Colorbond monoclاد sheeting and include steel roller doors and windows with fixed metal louvres. Guttering and a water tank would be installed to collect rainwater. A fire extinguisher and hose reel would be installed at the shed.

### 3.5.10 Security CCTV, lighting and fencing

Continuously operating CCTV cameras (possibly with a pan function) would be installed with night time security lighting (infra-red) on posts up to 3.5 m high adjacent to the perimeter security fencing and around the operation and maintenance buildings. The number of cameras would be sufficient to cover the perimeter of the site and building areas.

The security fencing installed around the site would indicatively be 2 m high, providing adequate access points for project maintenance, land management purposes and for emergency egress. The security fencing would replace the existing property fence.

### 3.5.11 Landscaping and revegetation

The solar array would be mounted above the ground and suitable perennial ground cover would be established and maintained beneath the panels. Groundcover vegetation over approximately 33% of the total site area would be affected by shading, varying according to time of day and time of year. Groundcover species would be selected which are tolerant of these shading conditions and suitable for the soil type and climate at the proposal site.

The 10 m minimum bushfire protection setback from solar farm infrastructure would be applied to any remnant woodland vegetation around the perimeter of the solar farm, in accordance with Planning for Bushfire Protection guidelines (RFS 2006). The setback area would include a 4 m wide (plus shoulders and required drainage) perimeter access track.

Areas disturbed during the construction phase would be stabilised and revegetated with suitable perennial species immediately after construction. Where possible, groundcover species would be selected to facilitate sheep grazing at the site to control grass height and bushfire hazard.

### **3.5.12 Temporary construction facilities**

Temporary facilities established at the site during the construction phase would include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction workers.
- Staff amenities (kitchen and toilet/s).
- Temporary security lighting and CCTV at construction compound.
- A number of fenced construction compounds would be developed, including:
  - Containers for the use of subcontractors.
  - Bunded area for refuelling.
  - Storage area.
  - Generator for construction compound power supply.
  - Skips with wind shield and lid.
  - Parking area.
  - Staff amenities (kitchen and toilet/s).
  - Offices and meeting room.

Chain link fencing up to 2 m high would surround the construction compound. Hardstand in the compound would consist of compacted stone to provide a clean, firm, level and free draining surface suitable for cabins and heavy traffic. Temporary staff amenities would be designed to accommodate the number of workers at the peak of the construction period.

## **3.6 CONSTRUCTION**

### **3.6.1 Construction activities**

The construction phase is expected to last approximately 18 months with a 3 month peak construction period. The main construction activities would include:

- Site establishment and preparation for construction:
  - Fencing.
  - Ground preparation.
  - Construction of the internal track system.
  - Upgrade of existing access points/intersections.
  - Preliminary civil works and drainage.
- Installation of steel post and framing system for the solar panels.
- Installation of underground cabling (trenching) and installation of inverter stations.
- Installation of PV panels.

- Construction of control room, switchroom and storage building.
- Construction of the substation and connections.
- Potential construction of an Energy Storage Facility.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Pending the construction schedule, it is expected some stages of construction will occur concurrently. Temporary construction facilities would be housed in a compound situated near the substation.

### **Battery Storage Facility**

The potential construction and commissioning process for the BSF is expected to last approximately 6 months. The construction of the BSF may be concurrent with construction of the other solar farm infrastructure or, alternatively, may be staged after the commissioning of the solar farm. Construction activities would include:

- Site establishment and preparations.
- Installation of suitable foundation.
- Installation of underground cabling (trenching) and energy storage compliant power conversion units and control systems.
- Delivery of the shipping containers/buildings.
- Augmentation and connection into the site solar substation.
- Removal of any temporary works and/or replacement of hardstand areas.

#### **3.6.2 Site preparation and earthworks**

Soils within the development envelope have been heavily disturbed by farming activities. Ground disturbance resulting from earthworks associated with the proposal would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground.
- Construction of internal access tracks and access points and associated drainage.
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and maintenance building.
- Cable trenches.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing, infra-red lighting and CCTV.

Topsoil under the footprint of the array area will remain in-situ during the construction of the solar farm. Topsoil salvaged from the construction of the access tracks and other works would be securely stored for use in site rehabilitation.

Where required weed treatments will be undertaken prior to earth works commencing in order to reduce the potential for spread of these species within the proposal footprint.

#### **3.6.3 Materials and resources**

Key resourcing requirements for the proposal would include labour, machinery and equipment, steel, electrical components (including PV panels and cables), water, gravel and landscaping materials.

### **Labour, machinery and equipment**

It is anticipated that approximately 200 direct and 320 indirect construction personnel would be required on-site during the peak construction period. Construction supervisors and the construction labour force, made up of labourers and technicians, would be hired locally where possible.

It is anticipated that most workers would use existing accommodation within the local area. It is proposed that bus transfers be provided (where practicable) to minimise traffic volumes and transit risks during construction.

Equipment used during construction would include:

- Earth-moving equipment for civil works (excavators, graders).
- Small piling or drilling rigs for installation of the posts of the solar arrays.
- Diesel generators.
- Trucks (refer to Table 3-3 for types of trucks that would be used).
- Light vehicles.
- Large transit vehicles, including delivery and waste removal vehicles.
- Forklifts and/or manitous.
- Cable trencher or excavator.
- Cable laying equipment.
- Cranes including 50T mobile crane.

### **Materials**

Construction materials will be sourced as locally as possible. Narrandera is the closest town which is a possible source of the bulk of the aggregate material required for construction.

Approximately 53,900m<sup>3</sup> of gravel would be required to surface the access road and internal service track network and battery storage compound, PCU and substation hardstand. Sand may be required for the bedding of underground cables, depending on electrical design and ground conditions. Approximately 10,000m<sup>3</sup> of concrete would be required to construct the inverter, substation, CCTV and battery storage foundations.

Approximately 11.2 megalitres (ML) of non-potable water would be required during construction, mostly for dust suppression, but also for cleaning, concreting and on-site amenities. Water will be sourced from a stand pipe located at the Narrandera Shire depot and trucked to site. Water will be stored on-site in a 20,000L tank.

A small amount of potable (drinking) water (approximately 0.34 ML) would be imported to the site during the construction period.

#### **3.6.4 Transport and access**

A Construction Traffic Management Plan would be prepared following proposal approval to manage haulage traffic during the construction phase.

Traffic Design Group Australia have prepared a Traffic Access (TA) Assessment (Appendix J), which provides recommendations for road treatment and upgrade to accommodate proposed traffic numbers. Details from the report are summarised below.

## Haulage route

Where possible, goods and services for the solar farm would be sourced locally. Items such as solar panels, posts and tracking systems which cannot be sourced locally will likely come by road from either Melbourne or Sydney. Construction traffic approaching from either Narrandera or Wagga Wagga would use the Sturt Highway (A20).

The entry to the site would be located on Muntz Road via Sandigo Road. The proposed access will be able to accommodate simultaneous entry and exit of the largest design vehicle expected to access the site.

The final haulage route and movement number would be further detailed in the Traffic Management Plan that would be prepared by the appointed contractor as part of pre-mobilisation works.

## Proposed road upgrades

### Sandigo Road

It is proposed to provide up to 3 passing areas along the western side of the road for incoming vehicles. Given the relatively straight nature of Sandigo Road, offering good sight distance for vehicles travelling in either direction, a total of 3 passing bays is considered satisfactory (Figure 3-12, Figure 3-13 and Figure 3-14).

### Muntz Road

Muntz Road in its current form is of a satisfactory width to accommodate two-way vehicle flow along the easternmost section. The S-bend in the road approximately 820 m west of the Sandigo Road intersection is considered to be of insufficient width to allow for two-way vehicular flow. It is recommended that the S-bend be widened to allow for 2 AVs to simultaneously pass (Figure 3-12).

It is proposed that four passing bays along the southern side of Muntz Road be provided west of the S-bend to allow passing vehicles. Given the relatively straight nature of Muntz Road past the S-bend, a total of four passing bays is considered satisfactory (Figure 3-12, Figure 3-13 and Figure 3-14).

### Sturt Highway / Sandigo Road intersection

To accommodate additional traffic and simultaneous turning / movement of vehicles on the Sturt Highway / Sandigo Road intersection, a Basic Right Turn (BRT) and Basic Left Turn (BLT) turning treatment is required. Figure 3-15, Figure 3-16 and Figure 3-17 shows the proposed intersection design, which is based on an AV as the design vehicle. The proposed intersection treatment has been appropriately designed in accordance with the Austroads dimensional requirements.

### Sandigo Road / Muntz Road

Movement of vehicles travelling along the access route to / from the site will be via the one-lane section of Sandigo Road. It is proposed to widen Muntz Road on the southern side to allow for inbound AVs to turn into Muntz Road from Sandigo Road, while an AV waits on Muntz Road at a proposed stop line. Accordingly, the proposed intersection has been appropriately designed to cater for the largest design vehicle (Figure 3-18 and Figure 3-19).

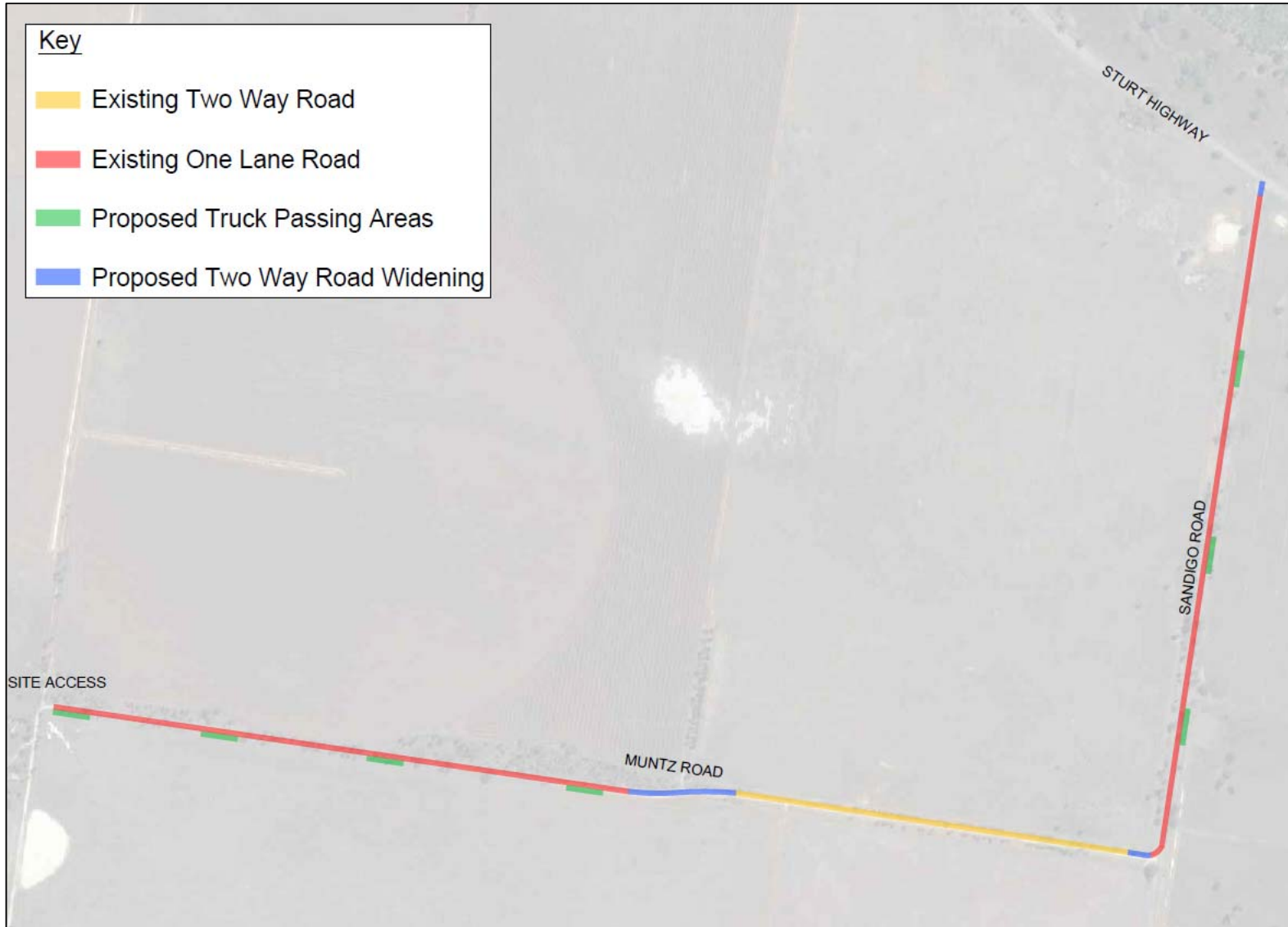


Figure 3-12 Proposed road upgrades

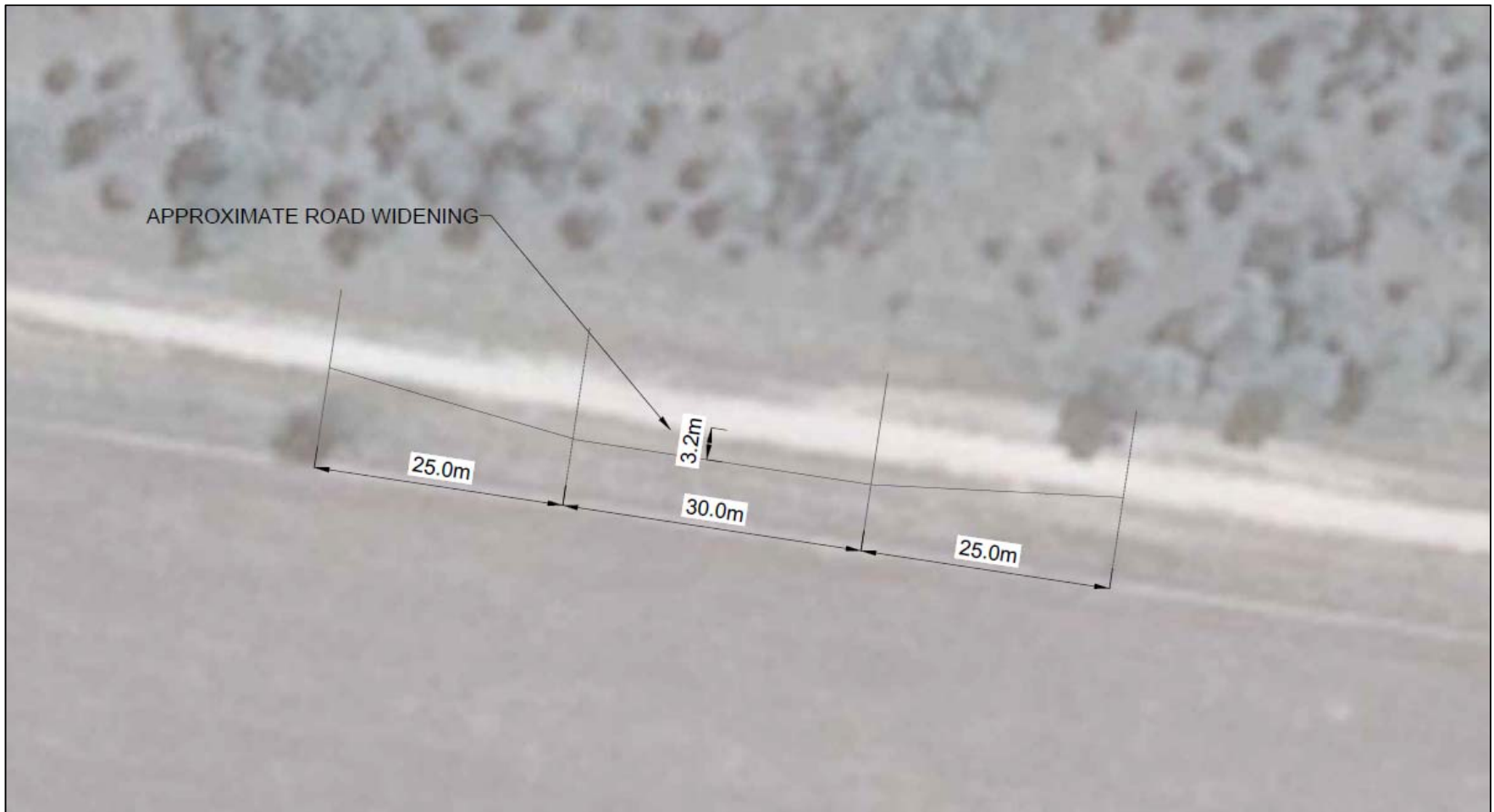


Figure 3-13 Proposed passing lanes on Muntz and Sandigo Roads





Figure 3-14 Proposed passing lanes and AV movements on Muntz and Sandigo Roads

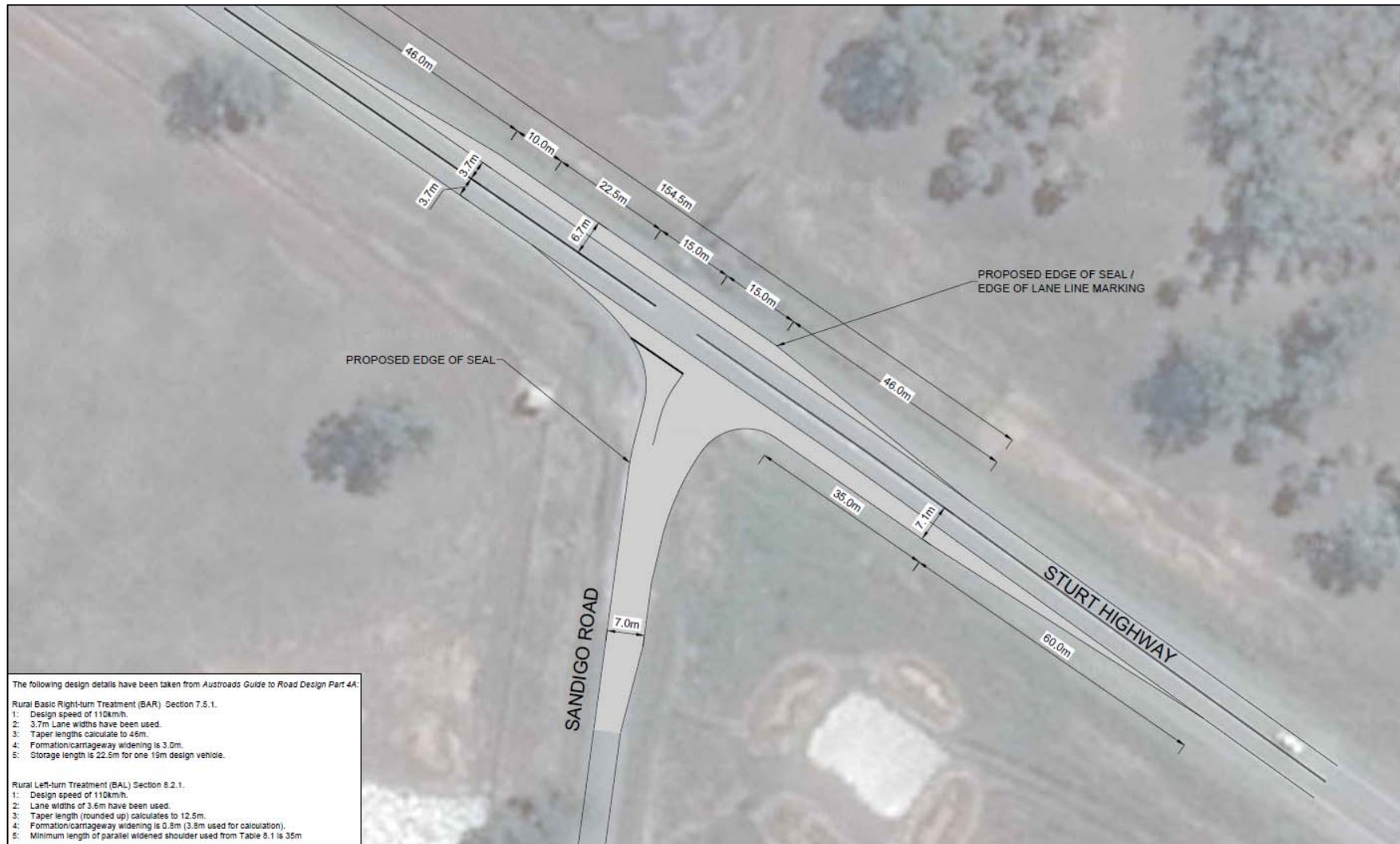


Figure 3-15 Proposed intersection upgrade of Sandigo Road / Sturt Highway



Figure 3-16 Proposed AV left hand turn from Sandigo Road to Sturt Highway



Figure 3-17 Proposed AV right hand turn from Sandigo Road to Sturt Highway



Figure 3-18 Proposed intersection treatment at Muntz and Sandigo Road

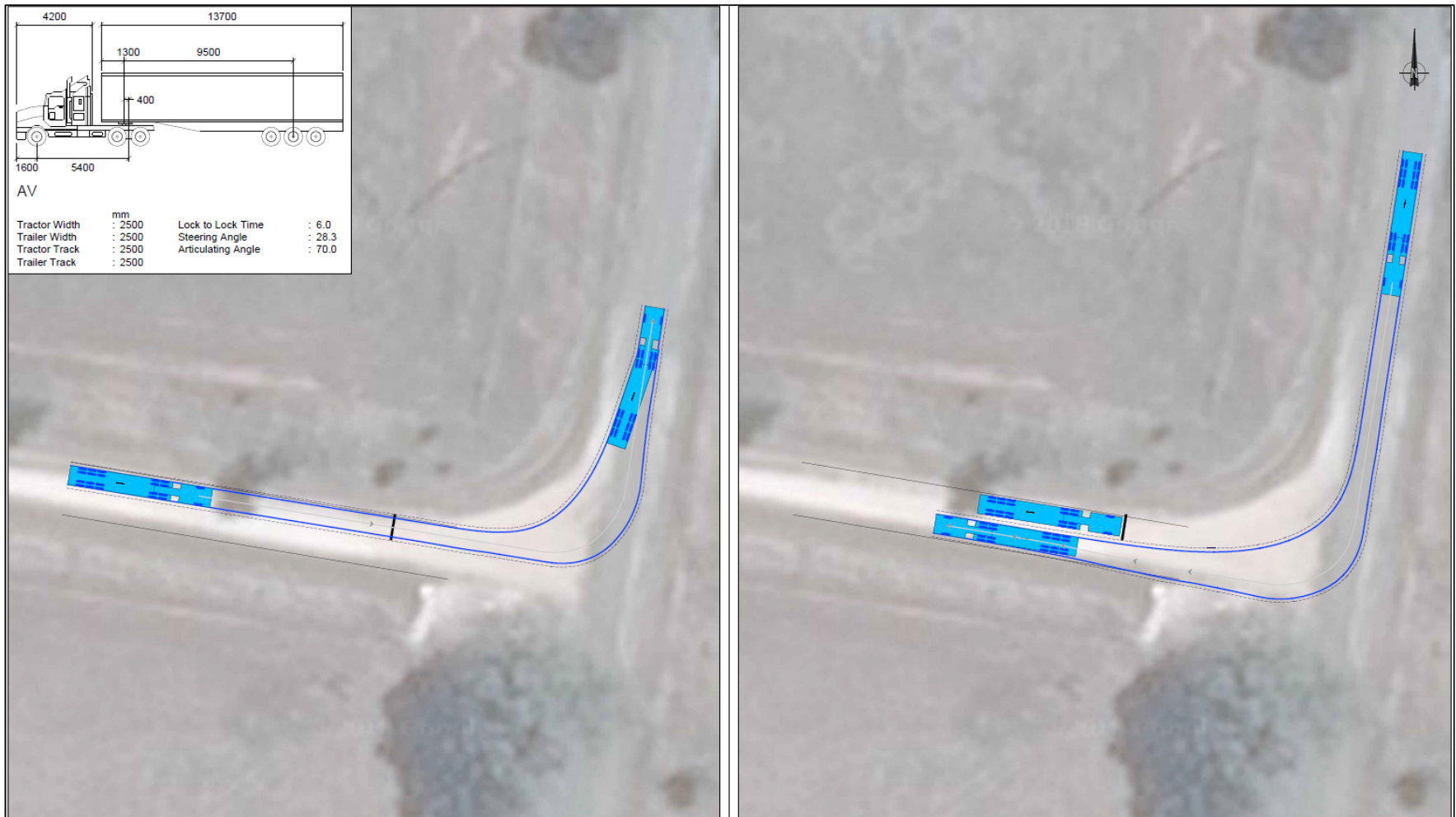


Figure 3-19 Proposed AV turning from Muntz Road to Sandigo Road

### Road condition surveys

The use of the roads by larger vehicles delivering plant to the site would not be dissimilar to the existing use of the road by trucks associated with the surrounding agricultural use.

Prior to construction, a pre-condition survey of the relevant sections of the existing road network would be undertaken, in consultation with Narrandera Shire Council. During construction the sections of the road network utilised by the proposal would be monitored and maintained to ensure continued safe use by all road users, and any faults attributed to construction of the solar farm would be rectified in consultation with Narrandera Shire Council. At the end of construction, a post-condition survey would be undertaken to ensure the road network is left in the consistent condition as at the start of construction.

### Traffic movements

Table 3-3 provides an indication of the total one-way traffic movements during the construction period. Over an entire year, there would be an average of 18 heavy goods vehicle movements and 62 light vehicle movements per day (average daily total 80 movements). During the three-month peak construction period this would rise to a daily average of 32 heavy goods vehicle movements and 268 light vehicle movements (average daily total 300 movements). An additional daily average of 48 heavy goods vehicles and 230 light vehicles (average daily total 278 movements) over 2 months for the construction of the battery storage facility will be required. Three over-dimensional vehicles (or restricted access vehicles) would be required for the transportation of the substation transformer. The BSF and solar infrastructure would potentially be constructed at the same time, but peak solar and peak BSF construction at the same time is unlikely and would be avoided during programming.

Where possible, staff movements would be rationalised using minibus, bus transport, or carpooling. A special convoy and a 50T (or larger) mobile crane may be required for offloading the CPUs. Traffic would largely be confined to standard site working hours.

Table 3-3 Traffic volumes and requirements for the Avonlie Solar Farm

Phase	Purpose	Vehicle	Est no. vehicles
<b>Heavy goods vehicles</b>			
Site Set-Up	Portacabins, generators, water & fuel tanks plus associated machinery	Low loader	28
Road & Hard standings	Stone for access tracks and compounds	Truck and dog	3325
Foundations	Foundation for inverters, substation and battery storage	Mixer truck	1704
Piles and Mounting Frames	Material	Semi-trailer	554
Solar Panel Modules	Material	Semi-trailer	1000
Battery Storage and PCS	Equipment	Semi-trailer	135
Battery Storage Building	Material	Semi-trailer	16
Grid Connection Building	Material & Equipment	Semi-trailer, crane	3
Cabling	Material	Semi-trailer	89
Termination boxes	Material	Flatbed lorry	13
Inverters & Transformers	Equipment	Semi-trailer, crane	84
CCTV & Fencing	Equipment	Semi-trailer	35
Potable water	Staff drinking water	Tanker	19
Screening planting	Material	Semi-trailer	0
Waste Removal	Removal of skips (recycling and septic tank emptying)	Skip lorry, tanker	390
Site Demobilisation	Portacabins, generators, water & fuel tanks plus associated machinery	Low loader	28
Construction Water	Dust Suppression and General	Tanker	936
	<b>Total HGVs</b>		<b>8360</b>
<b>Cars and light vehicles</b>			
	Staff	Cars and minivans	14040
	Battery Storage Staff	Cars and minivans	14040
	Deliveries of small consumables	Vans	936
	<b>Total cars and light vehicles</b>		<b>29016</b>
	<b>Total vehicles</b>		<b>37376</b>

### 3.6.5 Personnel and work hours

At the peak of construction activity, the solar farm is expected to require approximately 320 workers. Construction activities would be undertaken during standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays), or as otherwise agreed by the Secretary. Any construction outside of these normal or agreed working hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g. to make work safe.



## **3.7 OPERATION**

### **3.7.1 Operation activities**

Operation activities would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays as required.
- Routine visual inspections, general maintenance and cleaning operations of the substation.
- Vegetation management, likely using sheep to control grass growth beneath the panels. Groundcover vegetation would be maintained over the site to minimise erosion, dust and weeds (subject to climatic conditions). Groundcover would be monitored and remediation (such as reseeding or soil protection) undertaken as required.
- Site security response (24hr) if required.
- Site operational response (24hr) if required.
- Replacement of equipment and infrastructure as required.
- Maintenance of landscaping and screening plantings as required.
- Pest plant and animal control as required.

### **3.7.2 Materials and resources**

During operation, non-potable water would be required for cleaning panels, landscaping and animal care. Around 1.7 ML per year would be required for cleaning, likely tankered to the site when required. Water for animal care and landscaping would be sourced from irrigation channels as at present under the landowner's farm rights. A steel or concrete tank would be installed at the site to store water for bushfire protection and other non-potable water uses, with a minimum of 20,000 litres reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rainwater collected from tanks beside site buildings.

### **3.7.3 Transport and access**

It is expected that the staff based at the site during the operation phase would primarily use light vehicles (4x4).

Water for solar panel cleaning would be delivered to the site, requiring around 142 tanker visits per year, based on one wash per season using 0.8 litres/panel. Panel washing may not be required as frequently once groundcover has been established at the site.

Traffic associated with the operation and maintenance of the solar farm would also use the routes specified for the construction phase (refer section 3.6.4).

### **3.7.4 Personnel and work hours**

The solar farm would be monitored and operated remotely and would require a small number of maintenance personnel (3-4 full time equivalent staff) to be based at the site. An asset management team likely located in Sydney would undertake the remote operation activities.

The majority of plant maintenance including inverter station, transformer and HV switchgear, PV arrays and the trackers would be conducted by site staff on a rolling basis with activities scheduled consistently throughout the year. There would be some occasions, such as during a major substation shut down, that additional maintenance staff may be required on site. If required, the staff would be accommodated in the operations building at the site and additional traffic would be minimised through carpooling.

Daily operations and maintenance by site staff would be undertaken indicatively during standard working hours of:

- Monday – Friday 7 am to 6 pm
- Saturday 8 am to 1 pm.

Outside of emergencies or major asset inspection or maintenance programs, night works or work on Sundays or public holidays would be avoided. During summer months, the PV panels would produce electricity prior to 7 am and after 6 pm. Tracker units would similarly operate outside standard hours in summer.

### **3.7.5 Lighting**

There would be no permanent night lighting installed within the array but lighting would be included in each inverter station for maintenance purposes. There would also be maintenance lighting installed at the substation that would only be used in case of emergency, and security lighting at the operation and maintenance building. All operational lighting would be designed to reduce disturbance to neighbouring properties and would be utilised only when there are staff on site or during emergency situations. Continuously operating security lighting (infra-red) and CCTV cameras would be installed on posts up to 3.5 m high adjacent to the security fencing and operation and maintenance buildings.

### **3.7.6 Refurbishment and upgrading**

The solar farm operator may replace or upgrade solar panels or other infrastructure within the existing development envelope during the projected 30-year life of the solar farm. If any upgrade works during the life of the solar farm would extend beyond the existing impact footprint or alter the nature or scale of environmental impacts, the proponent would consult DPE regarding the need for further assessment or approval. The proponent would also consult DPE regarding the need for further assessment and approval to continue the operation of the solar farm beyond the 30-year timeframe.

### **3.7.7 Work Health and Safety**

Workplace health and safety would comply with NSW and Commonwealth requirements. This includes the preparation of relevant Plans for the construction, operation and decommissioning phases, compliance and adherence to regulatory requirements, and implementation of appropriate safety requirements.

## **3.8 DECOMMISSIONING AND REHABILITATION**

The Avonlie Solar Farm is expected to operate for up to 30 years. After this period the solar farm would either be upgraded (pending any additional approval requirements) or decommissioned.

Decommissioning would see the site returned to its pre-works state. All above ground infrastructure would be removed to a depth of 500 mm. Key elements of decommissioning would include:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse wherever possible.
- All site amenities and equipment would be removed including buildings, inverter stations and substation, and materials recycled or reused wherever possible.
- Posts and cabling installed within 500 mm of the surface would be removed and recycled, equipment below this depth, such as cabling, would be left in situ.
- Fencing would be removed including small concrete footings.

All areas of soil disturbed during decommissioning would be rehabilitated in consultation with the landowner consistent with post-solar farm land use requirements. Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase. Wherever possible and practicable, materials removed from the site would be either re-used or recycled.

A Rehabilitation and Decommissioning Environmental Management Plan (RDEMP) with an indicative timeline would be prepared and submitted to DPE for approval prior to decommissioning works.

### 3.9 INDICATIVE TIMELINE

An indicative timeline for the proposal is outlined in Table 3-4. The commissioning of the solar farm would likely be phased. It is expected that the solar farm would be commissioned progressively in 1-3 phases before full commissioning at the end of the 18 month construction period. The Energy Storage Facility may be constructed up to 5 years following the commissioning of the solar farm.

Table 3-4 Indicative timeline

Phase	Approximate commencement	Approximate duration
<b>Construction</b>	Autumn 2019	18 months
<b>Operation</b>	Spring 2020	30 years
<b>Decommissioning</b>	Spring 2050	12 months

### 3.10 CAPITAL INVESTMENT

The Avonlie Solar Farm proposal would have an estimated capital investment of \$250 million. A quantity surveyor’s report confirming the capital investment has been provided to DPE.

## 4 PLANNING CONTEXT

### 4.1 PERMISSIBILITY

The proposal is defined as a **solar energy system** and is permissible with consent under clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007*. Consent may be granted under Part 4 of the EP&A Act.

*State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) declares the proposal to be SSD as it is development for the purpose of electricity generating works with a capital cost of greater than \$30 million (clause 20, Schedule 1).

Section 4.12 (formerly section 78A) of the EP&A Act requires a development application for SSD to be accompanied by an EIS prepared in accordance with the EP&A Regulation. This EIS has been prepared in accordance with Part 4 of the EP&A Act and Schedule 2 of the EP&A Regulation.

### 4.2 NSW LEGISLATION

#### 4.2.1 *Environmental Planning and Assessment Act 1979*

##### Objects

Development in NSW is subject to the requirements of the EP&A Act and the EP&A Regulation. Environmental planning instruments prepared under the Act set the framework for development approval in NSW.

The proposal would be assessed under Part 4 of the EP&A Act. The relevant objects of the EP&A Act are:

- a) *to encourage:*
  - i. *The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.*
  - ii. *The promotion and coordination of the orderly and economic use and development of land.*
  - iii. *The protection, provision and coordination of communication and utility services.*
  - vi. *The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.*
  - vii. *Ecologically sustainable development.*

The objects of the EP&A Act have been considered throughout this environmental assessment and natural resources and competing land uses have been considered. The proposal aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The proposal has been located and designed so that it would avoid native vegetation as much as possible and minimise the use of natural and artificial resources while considering the social and economic welfare of the local community. For these reasons it is considered that the proposal is consistent with the objects of the EP&A Act.

**Matters for Consideration**

Section 4.40 (formerly section 89H) of the EP&A Act provides that section 4.15 (formerly 79C) applies to the determination of DAs for SSD. Under section 4.15 of the EP&A Act, the consent authority is required to consider several matters when determining a DA under Part 4. These matters are listed in Table 4-1 and assessed in terms of their relevance to the proposal.

Table 4-1 Matters of consideration

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant environmental planning instruments (EPIs) are discussed in Section 4.2.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority;	There are no draft instruments relevant to the proposal.
Any development control plan;	Narrandera Shire Council has a number of development control plans, however given the location of the development site, these plans do not apply.  In addition, clause 11 of the SRD SEPP provides that development control plans do not apply to SSD.
Any planning agreement that has been entered into under section 7.4 (formerly section 93F), or any draft planning agreement that a developer has offered to enter into under section 7.4 (formerly section 93F);	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration);	Clause 92 of the EP&A Regulation requires consideration of: <ul style="list-style-type: none"> <li>• the Government Coastal Policy, for development applications in certain local government areas; and</li> <li>• the provisions of AS 2601 for development applications involving the demolition of structures.</li> </ul> Neither of these matters are relevant to the proposal.
Any coastal zone management plan (within the meaning of the <i>Coastal Protection Act 1979</i> ), that apply to the land to which the development application relates;  (This provision has now been repealed)	Coastal zone management is not applicable to the proposal.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in Sections 5 and 7 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have been avoided or minimized through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development;	The suitability of the site for the development is assessed in section 2.4.6. Characteristics that make it suitable for development of a solar farm are identified and justified.

Provision	Relevance to the proposal
Any submissions made in accordance with this Act or the regulations; and	The proponent will consider and respond to any submissions made in relation to the proposal in a subsequent report following the public exhibition period.
The public interest.	<p>The many public benefits of the proposal are discussed in Section 2.2. Specifically, these include:</p> <ul style="list-style-type: none"> <li>• Reducing fossil fuel emissions that contribute to climate change.</li> <li>• Meeting NSW and Australian Government policies to increase renewable energy supply.</li> </ul> <p>Providing local employment and regional development opportunities.</p>

#### **4.2.2 Environmental Planning and Assessment Regulation 2000**

Clauses 82 to 85B of the EP&A Regulation addresses public participation in SSD.

The Development Application and accompanying information (including this EIS) will be placed on public exhibition by DPE for a period not less than 30 days.

#### **4.2.3 Narrandera Local Environmental Plan 2012**

The development site is located within the Narrandera LGA and is subject to the provisions of the *Narrandera Local Environmental Plan 2013* (Narrandera LEP). The Narrandera LEP aims:

- a) To protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources.*
- b) To encourage a range of housing, employment, recreation and community facilities to meet the needs of existing and future residents of Narrandera.*
- c) to promote the efficient and equitable provision of public services, infrastructure and amenities.*
- d) to conserve environmental heritage.*

It is considered that the proposal is compatible with the aims of the Narrandera LEP, especially to promote the efficient and equitable provision of infrastructure.

#### **Land zoning**

The development site is zoned RU1 - Primary Production under the Narrandera LEP. Electrical generation is not listed among developments that are permitted within the zone.

However, the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) takes precedence over an LEP and permits solar energy systems with consent in the RU1 zone.

The SRD SEPP provides for the declaration of SSD and declares that the Independent Planning Commission (IPC) is the consent authority for certain SSD (see below).

The Narrandera LEP states that the consent authority must have regard to the objectives for development in a zone when determining a development application. The objectives of the RU1 zone are:

- a) To encourage sustainable primary production by maintaining and enhancing the natural resource base.*
- b) To encourage diversity on primary industry enterprises and systems appropriate for the area.*
- c) To minimise the fragmentation and alienation of resource lands.*

- d) *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

The proposal would allow for diversity in land use appropriate to the area, and it would not fragment resource lands. Being fully reversible and involving limited ground disturbance, it would not remove the potential to use the land for primary production at the end of the life of the proposal.

### Terrestrial Biodiversity

The objective of this clause is to maintain terrestrial biodiversity by:

- a) *protecting native fauna and flora, and*
- b) *protecting the ecological processes necessary for their continued existence, and*
- c) *encouraging the conservation and recovery of native fauna and flora and their habitats.*

This clause applies to land identified as “Biodiversity” on the Terrestrial Biodiversity Map (Figure 4-1). Before determining a development application for development on land to which this clause applies, the consent authority must consider:

- a) *whether the development is likely to have:*
  - I. *any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and*
  - II. *any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and*
  - III. *any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and*
  - IV. *any adverse impact on the habitat elements providing connectivity on the land, and*
- b) *any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.*

Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- a) *the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or*
- b) *if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or*
- c) *if that impact cannot be minimised—the development will be managed to mitigate that impact.*

Areas mapped as biodiversity on the Terrestrial Biodiversity Map will be retained or subdivided from the development footprint and retained for use by the Landowner.



Figure 4-1 Narrandera LEP Terrestrial Biodiversity Mapping for the Avonlie Solar Farm



#### 4.2.4 State Environmental Planning Policy (Infrastructure) 2007

The ISEPP was introduced to facilitate the effective delivery of infrastructure across the State by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW.

Solar energy systems are defined in ISEPP clause 33 as:

*'solar energy system means any of the following systems:*

- a) a photovoltaic electricity generating system,*
- b) a solar hot water system,*
- c) a solar air heating system.'*

Part 3 Division 4 of ISEPP relates to electricity generating works and solar energy systems. Clause 34(7) states that *'except as provided by subclause (8), development for the purpose of a solar energy system may be carried out by any person with consent on any land'*. Clause 34(8) excludes certain solar energy systems in residential zones from needing consent. Given the development site is not located in a residential zone and would produce more than 100 KW, clause 34(7) applies to the proposal.

#### 4.2.5 State Environmental Planning Policy (State and Regional Development) 2011

The aims of the SRD SEPP are to identify development that is SSD.

##### State Significant Development (SSD)

Clause 8 of the SRD SEPP provides that development is declared to be SSD for the purposes of the EP&A Act if:

- *the development is not permissible without consent under Part 4 of the EP&A Act; and*
- *the development is specified in Schedule 1 or 2 of the SRD SEPP.*

Clause 20 of Schedule 1 of the SRD SEPP includes:

*"Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*

- (a) has a capital investment value of more than \$30 million.*

The proposed Avonlie Solar Farm has an estimated capital investment value of \$250 million, therefore the proposal is classified as SSD under Part 4 of the EP&A Act.

Clause 8A of the SRD SEPP declares the IPC to be the consent authority for certain SSD projects. For other projects, the consent authority is the Minister for Planning.

#### 4.2.6 State Environmental Planning Policy No. 55 - Remediation of Land

SEPP No. 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. The SEPP applies to the whole of the State.

Clause 7 of SEPP No. 55 requires that the remediation of land be considered by a consent authority in determining a development application.

A search of the NSW EPA contaminated land public record was undertaken for contaminated sites within the Narrandera LGA in May 2018. There were no records returned for the LGA. The online *List of NSW contaminated sites notified to EPA* was also searched in May 2018. There are 2 sites listed for Narrandera, both being petrol stations in town.

The risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site is considered to be low, and no evidence of contamination was observed during the site assessment.

#### 4.2.7 State Environmental Planning Policy No 33—Hazardous and Offensive Development

This SEPP defines and regulates the assessment and approval of potentially hazardous or offensive development. The SEPP defines ‘potentially hazardous industry’ as:

*“...development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*

*(a) to human health, life or property, or*

*(b) to the biophysical environment,*

*and includes a hazardous industry and a hazardous storage establishment”*

‘Potentially offensive industry’ defined as:

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

SEPP 33 provides for systematic assessment of potentially hazardous and offensive development for the purpose of industry or storage. For development proposals classified as ‘potentially hazardous industry’ the policy requires a preliminary hazard analysis (PHA) to determine risks to people, property and the environment.

A checklist and a risk screening procedure developed by DPE is used to help determine whether a development is considered potentially hazardous industry (DOP, 2011). Appendix 3 of the *Applying SEPP 33* guidelines lists industries that may fall within SEPP 33; the lists do not include solar farms and energy storage facilities. The hazardous development status of the proposal is assessed in Section 7.7.

#### 4.2.8 State Environmental Planning Policy (Rural Lands) 2008

The aims of the *State Environmental Planning Policy (Rural Lands) 2008* (Rural Lands SEPP) are:

- (a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,*
- (b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State,*
- (c) to implement measures designed to reduce land use conflicts,*
- (d) 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,*

- (e) *to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.*

The Rural Lands SEPP rural planning principles, listed under clause 7, are:

- (a) *the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,*
- (b) *recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,*
- (c) *recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,*
- (d) *in planning for rural lands, to balance the social, economic and environmental interests of the community,*
- (e) *the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,*
- (f) *the provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,*
- (g) *the consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,*
- (h) *ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.*

It is considered that the proposal is consistent with the aims and planning principles of the Rural Lands SEPP. Part 4 of the Rural Lands SEPP relates to state significant agricultural land. Given the development site is not identified in schedule 2, it is not identified as state significant agricultural land and Part 4 does not apply.

#### **4.2.9 State Environmental Planning Policy No. 44 - Koala Habitat Protection**

Aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

- (a) *by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and*
- (b) *by encouraging the identification of areas of core koala habitat, and*
- (c) *by encouraging the inclusion of areas of core koala habitat in environment protection zones.*

An assessment of the likelihood of the Koala inhabiting the site and survey are detailed within the Biodiversity Assessment in Appendix D, and the determination is that the habitat is not critical to the survival of the Koala, and Assessment of Significance is not required.

#### **4.2.10 Protection of the Environment Operations Act 1997**

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the NSW EPA.

Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works. General electricity works is a scheduled activity and requires an EPL where the activity has the capacity to generate more than 30MW of electrical power. General electricity works is defined as:

*...the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.*

The works would generate more than 30MW of electrical power, however electricity generation would be from solar power which is not considered a scheduled activity. Accordingly, an EPL is not required under the POEO Act for the proposal.

Section 143 and 145 of the POEO Act also creates offences relating to pollution and the transport and disposal of waste and imposes a duty on the occupier of a site to notify certain 'pollution incidents'. The proponent must comply with the POEO Act in carrying out the proposal.

#### **4.2.11 Roads Act 1993**

The *Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads.

Any work within the road reserve, such as upgrades that interfere with the structure of the road, require consent from the roads authority under section 138 of the Roads Act. Narrandera Council is the roads authority for Muntz Road and Sandigo Road, and NSW Roads and Maritime Services is the roads authority for Sturt Highway.

Given the proposal would involve work within the road reserve for Muntz Road and Sandigo Road, and the intersection of the Sturt Highway, section 138 consent is required.

#### **4.2.12 Water Management Act 2000**

The *Water Management Act 2000* (WM Act), currently administered by the NSW Department of Industry (Water), is progressively being implemented throughout NSW to manage water resources, superseding the *Water Act 1912*. The aim of the WM Act is to ensure that water resources are conserved and properly managed for sustainable use benefiting both the present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

Water will be sourced from a Narrandera Council standpipe, as previously agreed with the Council (Appendix C-1). As such, any water sources specified under the WM Act is not required.

#### **4.2.13 Fisheries Management Act 1994**

The *Fisheries Management Act 1994* (FM Act) sets out to conserve fish stocks and key fish habitats, threatened species, populations and ecological communities of fish and marine vegetation and biological diversity. Further, it aims to promote viable commercial fishing, aquaculture industries and recreational fishing opportunities. Threatened species, populations and ecological communities and key threatening processes are listed in the FM Act's Schedules.

A permit under sections 201, 205 or 219 of the FM Act is not required for SSD under the provisions of Section 4.41 of the EP&A Act.

#### **4.2.14 Heritage Act 1977**

This Act aims to conserve heritage values. The Act defines 'environmental heritage' as those places, buildings, works, relics, moveable objects and precincts listed in the Local or State Heritage Significance. A property is a heritage item if it is listed in the heritage schedule of the local Council's Local Environmental

Plan or listed on the State Heritage Register, a register of places and items of particular importance to the people of NSW.

No relics or other items protected under the Act were located on the development site, nor within 10 km of the development site. The proposal would not impact directly or indirectly on any items of heritage significance.

Section 146 of the Act requires any person who believes they have discovered or located a relic (in any circumstances) to notify the NSW Heritage Council.

#### 4.2.15 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) establishes a new regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments. The BC Act contains provisions relating to flora and fauna protection, threatened species and ecological communities listing and assessment, a biodiversity offsets scheme (BOS), a single biodiversity assessment method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The Act is supported by the *Biodiversity Conservation Regulation 2017*.

Section 7.9(2) states that SSD development applications must be accompanied by a Biodiversity Development Assessment Report (BDAR) prepared in accordance with the BAM, unless the Secretary and Chief Executive of OEH have determined that the proposed development is not likely to have any significant impact on biodiversity values. As no such determination has been made, and a BDAR has been prepared as part of this EIS (Appendix D).

#### 4.2.16 Biosecurity Act 2015

The objects of this Act are the following:

- (a) to provide for managing the following:
  - I. biosecurity risks;
  - II. the risk of contagion of a listed human disease or any other infectious human disease;
  - III. the risk of listed human diseases or any other infectious human diseases entering Australian territory or a part of Australian territory, or emerging, establishing themselves or spreading in Australian territory or a part of Australian territory;
  - IV. risks related to ballast water;
  - V. biosecurity emergencies and human biosecurity emergencies;
- (b) to give effect to Australia's international rights and obligations, including under the *International Health Regulations*, the *SPS Agreement*, the *Ballast Water Convention*, the *United Nations Convention on the Law of the Sea* and the *Biodiversity Convention*.

The proponent as a land manager will comply with the general biosecurity duties under the Act through management of on-site weeds and pests.

Prior to commencement of each phase, a Weed Management procedure would be developed as part of the Biodiversity Management Plan for the proposal to prevent and minimise the spread of weeds. This would include management protocol for declared priority weeds under the *Biosecurity Act 2015* during construction, operation and decommissioning stages, and weed hygiene protocol in relation to plant, machinery, and fill.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can also potentially increase the risk of pest animals at the development site (mostly cat and fox). A Pest Management Plan will be developed and implemented by the proponent.

#### 4.2.17 Conveyancing Act 1919

The purpose of the *Conveyancing Act* is to amend and consolidate the law of property and to simplify and improve the practice of conveyancing, and for such purposes to amend certain Acts relating thereto.

When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under s.7A *Conveyancing Act 1919* is required when the total of the original term of the lease, together with any option of renewal, is more than five years.

The Avonlie Solar Farm will require the subdivision of Lot 30 DP 754538 into:

- 1 ha of land for the purpose of the on-site substation, transferred in freehold to TransGrid,
- Approximately 261 ha of land for the purposes of the lease for the proposal; and
- Approximately 47 ha of land for the continuing agricultural purposes of the Landowner.

#### 4.2.18 Hazardous Waste (Regulation of Exports and Imports) Act 1989

The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Hazardous Waste Act) regulates the export, import and transit of hazardous waste to ensure human beings and the environment are protected from the harmful effects of hazardous wastes. Pursuant to section 40 of the Hazardous Waste Act, "A person must not export hazardous waste unless:

- (a) the person is the holder of an export permit authorising the person to export the waste; or
- (b) the person is the holder of a transit permit authorising the person to export the waste; or
- (c) the export has been ordered under section 34 or 35A."

Presently, there are few facilities to recycle lithium-ion batteries in Australia. Therefore, spent batteries are likely to be exported and will require an export permit under Section 40 of the Hazardous Waste Act. The Proponent will coordinate this activity and the associated commercial arrangements with the selected battery supplier.

#### 4.2.19 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The proposal's resource management options would be considered against a hierarchy of the following order:

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

### 4.3 COMMONWEALTH LEGISLATION

#### 4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Commonwealth Department of the Environment and Energy (DEE). Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minister.

The EPBC Act identifies eight MNES:

- World Heritage properties.
- National heritage places.
- Ramsar wetlands of international significance.
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).

When a person proposes to take an action that they believe may be a ‘controlled action’ under the EPBC Act, they must refer the proposal to the DEE for a decision about whether the proposed action is a ‘controlled action’.

A search of the Commonwealth Protected Matters Search Tool on 13 November 2017 indicated that there are no World Heritage Properties or National Heritage Places within the development site. Search results listed four Wetlands of International Importance that are either known to occur or have potential to occur in the area, however these are not relevant to the site or proposal. An Australian telecommunications commission occurs within 10 km of the proposal on Commonwealth Land. The proposal is not likely to have a significant impact on the environment of the Commonwealth land. Section 6.2 discusses the results of searches in relation to threatened species, ecological communities and migratory species. Table 4-2, Table 4-3 and Table 4-4 summarise the results of the searches.

Table 4-2 Summary of Matters of National Environmental Significance (10 km search radius)

Matters of National Environmental Significance	Addressed in this EIS
<b>World Heritage Properties</b>	NA
<b>National Heritage Places</b>	NA
<b>Wetlands of International Significance</b>	NA
<b>Great Barrier Reef Marine Park</b>	NA
<b>Commonwealth Marine Areas</b>	NA
<b>Threatened Ecological Communities</b>	Section 6.2 and Appendix D
<b>Threatened Species</b>	Section 6.2 and Appendix D
<b>Migratory Species</b>	Section 6.2 and Appendix D

Table 4-3 Summary of Other Matters Protected by the EPBC Act (10 km search radius)

Other Matters Protected by the EPBC Act	Addressed in this EIS
<b>Commonwealth Lands</b>	NA

Other Matters Protected by the EPBC Act	Addressed in this EIS
Commonwealth Heritage Places	NA
Listed Marine Species	NA
Whales and Other Cetaceans	NA
Critical Habitats	NA
Commonwealth Reserves	NA

Table 4-4 Summary Extra Information (10 km search radius)

Extra Information	Addressed in this EIS
Place on the RNE	NA
State and Territory Reserves	NA
Regional Forest Agreements	NA
Invasive Species	Section 6.2
Nationally Important Wetlands	NA

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in Section 6.2 and Appendix D. A significant impact to any of these entities is considered highly unlikely and the proposed activity is considered highly unlikely to be a controlled action.

No other matter of national environmental significance would be affected by the proposed activity.

#### **4.3.2 Native Title Act 1993**

The *Native Title Act 1993* provides a legislative framework for the recognition and protection of common law native title rights. Native title is the recognition by Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. Where that traditional connection to land and waters has been maintained and where government acts have not removed it, the law recognises the persistence of native title.

People who hold native title have a right to continue to practise their law and customs over traditional lands and waters while respecting other Australian laws. This could include visiting to protect important places, making decisions about the future use of the land or waters, and hunting, gathering and collecting bush medicines. Further, when a native title claimant application is registered by the National Native Title Tribunal, the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a project on the area claimed.

Native title may exist in areas such as:



- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral lease.
- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the National Native Title Tribunal Register was carried out on in May 2018. There were no records of Native Title claims, applications or determinations within the subject land. The development site is located on freehold land and not subject to any native title claims.

### 4.3.3 Renewable Energy (Electricity) Act 2000

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

- To encourage the additional generation of electricity from renewable sources.
- To reduce emissions of GHGs in the electricity sector.
- To ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth government's renewable energy target scheme. This includes solar energy.

Certificates for the generation of electricity are issued using eligible renewable energy sources. This requires purchasers (called liable entities) to surrender a specified number of certificates for the electricity that they acquire. In January 2011, renewable energy certificates were reclassified as either large-scale generation certificates or small-scale technology certificates following changes to the scheme.

The proposal is the subject of application to the Clean Energy Regulator under the RE Act and would receive large scale generation certificates.

## 4.4 OTHER RELEVANT POLICIES AND MATTERS

### 4.4.1 Ecologically Sustainable Development (ESD)

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*.

In NSW, the concept has been incorporated in legislation such as the EP&A Act and EP&A Regulation. For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline principles which can be used to achieve ESD. These principles are presented below along with a description of how the proposal and this EIS have considered each principle.

- a) *The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
  - an assessment of the risk-weighted consequences of various options.*

The precautionary principle has been adopted in the assessment of expected impacts. All potential impacts have been considered and mitigated where a risk has been identified. Mitigation is commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty.

- b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Potential impacts of the proposal are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Importantly, the proposal provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing carbon emissions intensity of electricity generation.

- c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

The impacts of the proposal on biodiversity, including EPBC listed species, have been assessed in detail in Appendix D and summarised in Section 6.2. This has included avoidance of higher conservation value areas where possible and management measures to minimise, manage and offset residual impacts. The impacts are considered to be justified by this assessment.

- d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:*
- i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
  - ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
  - iii. environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

Attributes of the development site such as existing native vegetation, soil and hydrology have been valued in terms of their broader contribution to the catchment and catchment processes. Pollution risks have been assessed and would place any cost of remediation solely upon the proponent.

The aims, structure and content of this EIS have incorporated the principles of ESD. The mitigation measures in Section 8.2 set out an auditable environmental management commitment by the proponent.

Based on the social and environmental benefits generated by the proposal at a local and regional level, and the assessed impacts on the environment and their ability to be managed, it is considered that the proposal would be ecologically sustainable within the context of ESD and is justifiable.

## 4.5 SUMMARY OF LICENCES / APPROVALS

Table 4-5 lists licences that have been identified as relevant to the proposal.

Table 4-5 Summary of licences required

Instrument	Licence or approval requirement
<b>EP&amp;A Act, Part 4</b>	State significant development applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.
<b>Roads Act, Section 138</b>	Any works to public or classified roads require consent under this Act from the roads authority. Narrandera Shire Council is the roads authority for Muntz Road and Sandigo Road and NSW Roads and Maritime Services is the roads authority for the Sturt Highway.
<b>Local Government Act, Section 68</b>	Approval is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Narrandera Shire Council has already been granted for use of a standpipe.

Note, if it is determined that additional licences or approvals are required, the proponent will obtain these prior to commencement of relevant activities.

## 5 STAKEHOLDER CONSULTATION

### 5.1 AGENCY CONSULTATION

#### *Secretary's environmental assessment requirements (SEARs)*

As the proposal is classified as State Significant Development (SSD), a scoping study was prepared, and SEARs were requested. These were provided by DPE on 9 February 2018 (refer Appendix A). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

The following sections provide a summary of the SEARs from the various agencies and cross reference where specific issues are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice. This additional consultation with agencies is also summarised below.

#### Department of Planning and Environment

Issue summary	Addressed in EIS
<b>General Requirements</b>	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> .	Section 1 and Appendix A.
In particular, the EIS must include:	Page xvii.
<ul style="list-style-type: none"> <li>• a stand-alone executive summary;</li> <li>• a full description of the development, including:               <ul style="list-style-type: none"> <li>– details of construction, operation and decommissioning;</li> <li>– a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); and</li> <li>– a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.</li> </ul> </li> </ul>	Section 3, Appendix B.
<ul style="list-style-type: none"> <li>• a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);</li> </ul>	Section 2.
<ul style="list-style-type: none"> <li>• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:               <ul style="list-style-type: none"> <li>– a description of the existing environment likely to be affected by the development;</li> </ul> </li> </ul>	Section 3.1.
<ul style="list-style-type: none"> <li>– an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments (including the proposed Sandigo Solar Farm), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;</li> </ul>	Section 6.1, Section 6.2, Section 6.3, Section 6.4, Section 6.5, Section 6.6, Section 7.1, Section 7.2, Section 7.3, Section 7.4, Section 7.5, Section 7.6, Section 7.7, Section 7.8, Section 7.9.
<ul style="list-style-type: none"> <li>– a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and</li> </ul>	Section 8.2.
	Section 8.2.

<ul style="list-style-type: none"> <li>– a description of the measures that would be implemented to monitor and report on the environmental performance of the development.</li> <li>• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and</li> <li>• the reasons why the development should be approved having regard to:             <ul style="list-style-type: none"> <li>– relevant matters for consideration under the <i>Environmental Planning and Assessment Act 1979</i>, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development;</li> <li>– the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and</li> <li>– feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.</li> </ul> </li> </ul> <p>While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development.</p> <p>In addition to the matters set out in Schedule 1 of the <i>Environmental Planning and Assessment Regulation 2000</i>, the development application must be accompanied by:</p> <ul style="list-style-type: none"> <li>• a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the <i>Environmental Planning and Assessment Regulation 2000</i>), including details of all the assumptions and components from which the capital investment value calculation is derived; and</li> <li>• the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the <i>Environmental Planning and Assessment Regulation 2000</i>).</li> </ul>	<p>Section 8.</p> <p>Section 8.2.</p> <p>Section 4.4.1.</p> <p>Section 6.5.1, Section 6.5.2.</p> <p>Section 2.4.</p> <p>Section 4.</p> <p>Development Applications and DA Supplement Page.</p>
<p><b>Biodiversity</b></p> <p>Include an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the <i>Biodiversity Conservation Act 2016 (NSW)</i>, a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the <i>Biodiversity Conservation Act 2016 (NSW)</i>.</p>	<p>Section 6.2, Appendix D.</p>
<p><b>Heritage</b></p> <p>Include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community</p>	<p>Section 6.3 and Appendix E. Section 7.8.</p>
<p><b>Land</b></p> <p>Include:</p> <ul style="list-style-type: none"> <li>• an assessment of the impact of the development on agricultural land (including possible cumulative impacts on agricultural enterprises and landholders) and flood prone land, an assessment of any impacts to Crown lands, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries including but not limited to Wrights Pit, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and biosecurity risk) during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivision; and</li> <li>• measures to remediate the land following decommissioning in accordance with <i>State Environmental Planning Policy No 55 - Remediation of Land</i>.</li> </ul>	<p>Section 6.5, Section 7.1.</p>

<p><b>Visual</b></p> <p>Include an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.</p>	<p>Section 6.4 and Appendix F.</p>
<p><b>Noise</b></p> <p>Include an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Noise Policy for Industry 2017</i> and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.</p>	<p>Section 6.6 and Appendix G.</p>
<p><b>Transport</b></p> <p>Include an assessment of the site access routes (including Sturt Highway, Sandigo Boree Creek Road, Muntz Road, Strontian Road and Quilters Road), site access points, any potential rail safety issues and likely transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction (including cumulative impacts from nearby developments), and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);</p>	<p>Section 7.3.</p>
<p><b>Water</b></p> <p>Include:</p> <ul style="list-style-type: none"> <li>• an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Sandy Creek, drainage channels, wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;</li> <li>• details of water requirements and supply arrangements for construction and operation; and</li> <li>• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils &amp; Construction</i> (Landcom 2004);</li> </ul>	<p>Section 7.2.</p> <p>Section 7.1.5.</p>
<p><b>Hazards and Risks</b></p> <p>Include:</p> <ul style="list-style-type: none"> <li>• a preliminary risk screening in accordance with <i>State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33</i> (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with <i>Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis</i> (DoP, 2011) and <i>Multi-Level Risk Assessment</i> (DoP, 2011).</li> <li>• an assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure (including the proposed transmission line and substation) against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) <i>Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields</i>.</li> <li>• a consideration of the existence of Naturally Occurring Asbestos (NOA).</li> </ul>	<p>Section 7.7.1.</p> <p>Section 7.7.</p> <p>Section 7.1.3.</p>
<p><b>Consultation</b></p> <p>During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers,</p>	<p>Section 5.1.</p>

community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Narrandera Shire Council. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS. If a development application and EIS for the development is not submitted within 2 years of the issue date of these SEARs, you must consult further with the Secretary in relation to the preparation of the EIS.	Section 5.2, 4.2. Appendix C.  Section 5.
<b>Socio-Economic –</b> Include an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	Section 7.5.

Details of additional correspondence between NGH Environmental and the DPE Hazards Team is detailed below:

- Phone call and subsequent email to Lilia Donkova on 8 May 2018 detailing battery storage and on-site hazards. The purpose of the email was to acquire advice on requirements around a Preliminary Hazards Assessment.
- Final response received on 24 May by Lilia. It was determined based on the location of the development, the location and the capacity of the battery storage (only 10 MV) and the surrounding land uses, the information on hazards and risks was adequate for public exhibition, subject to number of clarifications (Appendix C.1).

### Office of Environment and Heritage

Issue summary	Addressed in this EIS
<p><b>Biodiversity</b></p> <p>A Biodiversity Development Assessment Report (BDAR) prepared by applying the Biodiversity Assessment Methods to all biodiversity values on-site is required.</p> <p>The BDAR must document the application of the avoid, minimise and offset frameworks and include details of the measures proposed to address offset obligations as follows:</p> <ul style="list-style-type: none"> <li>• Total number and classes of biodiversity credits required to be retired for the development</li> <li>• Number and classes of like-for-like biodiversity credits proposed to be retired</li> <li>• Number and classes of biodiversity credits proposed to be retired in accordance with the variation rules</li> <li>• Any proposal to fund a biodiversity conservation action</li> <li>• Any proposal to make a payment to the Biodiversity Conservation Fund.</li> </ul> <p>The EIS must detail the value of paddock trees habitat to all threatened species known or likely to occur in the area, and assess the impact of clearing (in particular, for the Superb Parrot <i>Polytelis swainsonii</i>).</p> <p>The EIS should clearing state why potentially occurring threatened species are not considered in the assessment of significance, notably the White-fronted Chat (<i>Epthianura albifrons</i>) and the Grey-crowned Babbler (<i>Pomatostomus temporalis</i>).</p> <p>OEH supports the retention of boundary vegetation. If the final design impacts on this vegetation, the EIS should include an assessment of the nature and extent of this vegetation.</p>	<p>Section 6.2, Section 6.2.1.</p> <p>Appendix D.</p> <p>Section 6.2.2, Section 4.2.</p> <p>Appendix D.</p>
<p><b>Aboriginal Cultural Heritage</b></p>	<p>Section 6.3.</p> <p>Appendix E</p>

Issue summary	Addressed in this EIS
<p>The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document in an Aboriginal Cultural Heritage Assessment Report (ACHAR).</p> <p>Consultation with Aboriginal people must be undertaken and documented. The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.</p> <p>Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR and must demonstrate attempts to avoid impact upon cultural heritage values and identify conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts.</p> <p>The assessment must include a surface survey, with results to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record, and results documented in the ACHAR.</p> <p>The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal materials are uncovered during construction to formulate appropriate measures to manage impact.</p>	
<p><b>Historical Heritage</b></p> <p>The EIS must provide a heritage assessment including an assessment of impacts to state and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage values, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts are identified, the assessment shall:</p> <ul style="list-style-type: none"> <li>• Outline the proposed mitigation and management measures</li> <li>• Be undertaken by a suitably qualified heritage consultant</li> <li>• Include a statement of heritage impact for all heritage items</li> <li>• Consider impacts including vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscapes and vistas, and archaeological noise treatment</li> <li>• Where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological text excavations and include the results of these text excavations.</li> </ul>	<p>Section 7.8.</p> <p>Section 7.8.1.</p> <p>Section 7.8.2.</p> <p>Section 7.8.3.</p>
<p><b>Flooding</b></p> <p>The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005:</p> <ul style="list-style-type: none"> <li>• Flood prone land</li> <li>• Flood planning areas, the area below the flood planning level</li> <li>• Hydraulic categorisation (floodways and flood storage areas)</li> <li>• Flood hazard.</li> </ul> <p>The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.</p> <p>The EIS must model the effect of the proposed development on the flood behaviour under current flood behaviours for a range of design events.</p> <p>Modelling in the EIS must consider and document:</p> <ul style="list-style-type: none"> <li>• Existing council flood studies in the area and examine consistency to the flood behaviours documented in these studies</li> <li>• The impact on existing flood behaviours for a full range of flood events including up to the probable maximum flood</li> <li>• Impacts on the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments of land</li> <li>• Relevant provisions of the NSW Floodplain Development Manual 2005.</li> </ul>	<p>Section 7.2.</p> <p>Section 7.2.1.</p> <p>Section 7.2.1 and Appendix I.</p>



Issue summary	Addressed in this EIS
<p>The EIS must address the impacts of the proposed development on flood behaviour, including:</p> <ul style="list-style-type: none"> <li>• Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure</li> <li>• Consistency with Council Floodplain Risk Management Plans, and any Rural Floodplain Management Plans</li> <li>• Compatibility with the flood hazard of the land</li> <li>• Compatibility with the hydraulic function of flow conveyance in floodways and storage in flood storage areas of the land</li> <li>• Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site</li> <li>• Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses</li> <li>• Any impact on existing community emergency management arrangements for flooding, discussed with SES and Council</li> <li>• Whether the proposal incorporates significant measures to manage risk to life from flood, discussed with SES and Council.</li> <li>• Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk, to be discussed and have the support of Council and SES.</li> <li>• Any impacts the development may have on the social and economic costs to the community as a consequence of flooding.</li> </ul> <p>Further correspondence has been undertaken with OEH through emails and phone calls regarding the flood assessment of the development site.</p>	<p>Section 7.2.1.</p> <p>Section 7.2.2.</p> <p>Section 7.2.3.</p> <p>Section 5.1.</p>

Details of additional correspondence between NGH Environmental and the Office of Environment and Heritage (OEH) is detailed below:

- NGH Environmental emailed Simon Stirrat at OEH on 8<sup>th</sup> March 2018 regarding the SEARs requirements about flood assessment for the activities and infrastructure of the proposal. A reply was received from Simon Stirrat on 12<sup>th</sup> March 2018 with advice that the lower level of flooding assessment could be justified since the sites are located in an area of low flood hazard and the lower level of flood risks due to the nature of the development. Overland flow paths that become active after rainfall would need to be identified to allow for the appropriate locating of infrastructure to avoid flood risks and minimise impacts. A simple modelling approach would suffice but all flood related criteria in the SEARs should be addressed in an appropriate manner (Appendix C.1).

### Environment Protection Authority

Issue summary	Addressed in this EIS
Based on the information provided the proposed activity is not scheduled under the POEO Act and the proposed works do not require an Environment Protection Licence.	N/A

### DPE – Resources and Geoscience

Issue summary	Addressed in this EIS
The EIS requires an assessment of the impact of the development on existing land uses, including the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities) during operation and decommissioning.	Section 6.5, Section 6.5.1.

Issue summary	Addressed in this EIS
<p>Required to consult with the operators and or title holders to establish if the proposal is likely to have a significant impact on current or future extraction of minerals, petroleum or extractive materials (including limiting access to or impeding assessment of), and any way the proposed development may be incompatible with any existing approved uses, or current or future extraction or recovery.</p> <p>Include a mineral, coal and petroleum titles search through the MinView Application, with results shown on a map.</p> <p>EIS should identify Wrights Pit in text and on maps in relation to the project proposal and address land use compatibility considerations.</p> <p>Should biodiversity offset be considered, LUTA requests consultation to ensure there are no potential sterilisation impacts to resources.</p>	

## Department of Industry

Issue summary	Addressed in this EIS
<p><b>Land</b></p> <p>An assessment of the impact of the development of agricultural land and flood prone land, assessment of any impact to Crown Lands, a soil survey to consider the potential for erosion to occur, and assessment of compatibility of development with the existing land uses on the site and adjacent land during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivisions.</p> <p>Measures to remediate the land following decommissioning in accordance with SEPP No. 55 – Remediation of Land.</p> <p>Assessment of rehabilitation and decommissioning/closure management that outlines rehabilitation objectives and strategies to guide the return of the land to agricultural production.</p>	Section 6.5, Section 7.1.
<p><b>Water</b></p> <p>An assessment of the likely impacts of the development on surface water and groundwater resources, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate impacts.</p> <p>Details of water requirements and supply arrangement for construction and operation, including details of licensing and approval requirements and proposed new/modified water management infrastructure.</p> <p>A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soil and Construction (Landcom 2004).</p>	Section 7.2.  Section 7.1.5.

## Safework NSW

Issue summary	Addressed in this EIS
<p>The Principal Contractor must have a Work Health Safety Management Plan which includes:</p> <ul style="list-style-type: none"> <li>Names, positions and responsibilities of all relevant personnel</li> <li>Arrangements for consultation, co-operation and coordinates of activities in relation to compliance</li> <li>Arrangements for managing any work health and safety incidents</li> <li>Any site-specific health and safety rules and arrangements for informing staff</li> <li>Arrangement for the collection and assessment, monitoring and review of safe method statements.</li> </ul>	Section 3.7.7.
<p>Site requirements include:</p>	Section 3.7.7.

Issue summary	Addressed in this EIS
<ul style="list-style-type: none"> <li>Signage with 24-hour contact details</li> <li>Adequate site amenities</li> <li>Emergency response</li> <li>Controls to prevent contact with overhead powerlines</li> <li>Consideration of natural occurring asbestos.</li> </ul>	

**Local Land Services**

Issue summary	Addressed in this EIS
Avoidance of Western Grey Box Tall Grassy Woodland on western boundary.	Section 6.2.
Loss of hollow-bearing paddock trees, and justification for not using alternative adjacent property.	

**Fire and Rescue NSW**

Issue summary	Addressed in this EIS
<p>The following matters are recommended to be addressed:</p> <ul style="list-style-type: none"> <li>- A comprehensive Emergency Response Plan (ERP) is developed for the site.</li> <li>- The ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents.</li> <li>- The ERP details appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. Such measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and safe methods for shutting down and isolating the PV system.</li> <li>- Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.</li> <li>- 2 copies of the ERP be stored in a prominent 'Emergency Information Cabinet' which is in a position directly adjacent the site's main entry points.</li> <li>- Once constructed and prior to operation, the operator of the facility must contact the relevant Local Emergency Management Committee (LEMC).</li> </ul>	<p>Section 7.7.2, Section 7.7.5, Section 7.1.5, Section 7.2.3.</p>

**NSW Rural Fire Services**

Issue summary	Addressed in this EIS
<p>Incorporate a Bush Fire Hazard Assessment Report prepared by a suitably qualified person which includes site-specific recommendations for the proper design of:</p> <ul style="list-style-type: none"> <li>- Asset protection zones.</li> <li>- Measures to prevent fire occurring within the site from developing into a bush/grass fire risk to the surrounding area.</li> <li>- Water supply for firefighting purposes.</li> <li>- Land and vegetation management.</li> <li>- Emergency management procedures, including the development of a Fire Management Plan in consultation with the Local NSW RFS District Fire Control Centre.</li> <li>- Vehicular access and defendable space around the solar array.</li> </ul>	<p>Section 7.7.2.</p>

Issue summary	Addressed in this EIS
<p>Protection for the facilities from bush fires can be achieved through a combination of strategies which will:</p> <ul style="list-style-type: none"> <li>• Minimise the impact of radiant heat and direct flame contact by separating development from bush fire hazards.</li> <li>• Minimise the vulnerability of buildings to ignition and fire spread from flames, radiation and embers.</li> <li>• Enable appropriate access and egress for the public and firefighters.</li> <li>• Provide adequate water supplies for bush fire suppression operations.</li> </ul>	Section 7.7.3, Section 7.7.5.

### Narrandera Shire Council

Issue summary	Addressed in this EIS
Traffic movement of heavy vehicles and their impact upon road safety, local traffic movement and the condition of local roads.	Section 7.3.
Accommodation for workers during the expected 18 month construction phase.	Section 7.5.1.
Management of large quantities of unsorted waste generated, and the processing capability of local landfill facilities, during the construction phase.	Section 7.6.

Details of additional correspondence between NGH Environmental and the Narrandera Shire Council is detailed below (Appendix C.1):

- Email to Helen Ryan 10<sup>th</sup> April 2018 regarding the approach taken to address requirements h to j from the DPE in the SEARs on flood impact. A reply from Helen Ryan on 23<sup>rd</sup> April 2018 noted that the approach that NGH Environmental had suggested was suitable.
- Email received from Mandy Semmler 14<sup>th</sup> December 2017 was with the GIPA 17-10 file attached.
- Email and letter to Helen Ryan 14 May 2018 seeking support of the proposed subdivision.
- Email and letter of support from Helen Ryan on 4 June 2018 supporting the proposed subdivision.

### TransGrid

RES is currently in discussion with TransGrid and had no further comments from the SEARs.

### Murrumbidgee State Emergency Service (SES)

Details of additional correspondence between NGH Environmental and the Murrumbidgee State Emergency Services (SES) is detailed below:

- Email to [mer.admin@one.ses.nsw.gov.au](mailto:mer.admin@one.ses.nsw.gov.au) 10<sup>th</sup> April 2018 regarding consultation requirements with SES as criteria in the SEARs.
- Email to Jon Gregory and Maria De Deuge at NSW SES in April 2018 regarding a brief description of the solar infrastructure and findings in relation to flooding on-site. This correspondence also included consultation requirements with SES regarding flooding as criteria in the SEARs.
- Response from Maria De Deuge (Planning and Research Officer) stating NSW SES generally does not provide comment on individual development applications or provide detailed advice or support to individuals or consultants in relation to development proposals. NSW

SES recommend consideration of flooding issues is undertaken in accordance with the requirements of NSW Government's Flood Prone Land Policy as set out in the Floodplain Development Manual 2005 (FDM) and relevant planning directions (Appendix C.1).

## 5.2 ABORIGINAL COMMUNITY CONSULTATION

The consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the *National Parks and Wildlife Regulation 2009* following the consultation steps outlined in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* guide provided by OEH. The guide outlines a four-stage process of consultation as follows:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix A. A summary of actions carried out in following these stages are as follows.

**Stage 1.** Letters outlining the proposal and the need to carry out an Aboriginal cultural heritage assessment were sent to the Narrandera Local Aboriginal Land Council (Narrandera LALC) and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspaper, the *Wagga Daily Advertiser* on the 11<sup>th</sup> of November 2017 and the *Narrandera Argus* on the 9<sup>th</sup> of November 2017 seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by OEH in correspondence to NGH Environmental. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, three groups contacted the consultant to register their interest in the proposal. The groups who registered interest were the Narrandera LALC, Bundyi Aboriginal Cultural Knowledge (Bundyi ACK) and Warrabinya Cultural Heritage and Assessment Group (Warrabinya) (collectively, the registered Aboriginal parties (RAPs)). No other party registered their interest.

**Stage 2.** On the 7<sup>th</sup> of December 2017, an Assessment Methodology document for the Avonlie Solar Farm was sent to the Narrandera LALC, Bundyi ACK and Warrabinya. This document provided details of the background to the proposal, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the proposal. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties.

**Stage 3.** The *Assessment Methodology* outlined in Stage 2 included a written request to provide any information that may be relevant to the cultural heritage assessment of the study area. It was noted that sensitive information would be treated as confidential. No response regarding cultural information was received.

At this stage, the fieldwork was organised, and all of the RAPs were asked to participate in the fieldwork. The fieldwork was carried out over 5 days from the 26<sup>th</sup> of February 2018 to the 2<sup>nd</sup> March 2018 by two archaeologists from NGH Environmental and representatives from the Narrandera LALC, Bundyi ACK and Warrabinya.

Following the fieldwork maps with two proposed exclusion areas were sent to Narrandera LALC, Bundyi ACK and Warrabinya. The two exclusion areas proposed encompassed high-density areas of artefacts, including a number of grindstone fragments.

**Stage 4** In May 2018 a draft version of the *Aboriginal Cultural Heritage Assessment Report* for the proposal was forwarded to the RAPs inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document.

### 5.2.1 Aboriginal Community Feedback

Community consultation occurred throughout the project. The draft report was provided to each of the RAPs and feedback was sought on the recommendations, the assessment and any other issues that may have been important.

In response to the results of the survey and the initial proposed exclusion areas, Mark Saddler provided a report detailing the locations that he recorded during the survey. A search of the AHIMS database subsequent to the survey indicates that Mr Saddler recorded and registered 15 Artefact sites, seven Modified Tree sites and one Aboriginal Ceremony and Dreaming site within or immediately adjacent to the proposal area.

In discussion with the RAPs in relation to the initial results from the fieldwork, it was proposed that some areas be excluded from the proposal to avoid disturbance of the main artefact concentrations. An indicative map of exclusion areas was provided to the RAPs for comment, with two responding that they agreed with the areas. Subsequently the proponent advised that for safety reasons a firebreak was required on the perimeter fencing which may impact the boundary of the exclusion areas. This was also communicated to the RAPs and Mr Saddler of Bundyi ACK advised that this was fine as long as the firebreak construction was monitored, and artefacts collected prior to the firebreak being installed.

## 5.3 COMMUNITY CONSULTATION

The proponent has undertaken consultation with the local community in addition to any requirements of the SEARs in line with DPE's *Guidelines for Major Project Community Consultation* (October 2007) and the Australian Renewable Energy Agency's (ARENA's) *Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry* (ARENA n.d.). The following section describes the consultation undertaken.

### 5.3.1 Community consultation plan

Effective engagement requires an understanding of community stakeholders and prioritisation of potential impacts. It also relies on the community understanding the project and specific issues of interest to them, in order to contribute effectively. The focus of the consultation process for the Avonlie Solar Farm has been on providing this understanding and engagement.

A Community Consultation Plan (CCP) was developed early in the planning stages of the proposal. It is provided in Appendix C.

The aims of the plan are to:

1. Identify effective methods to inform the community about the Avonlie Solar Farm.
2. Facilitate engagement with the community, including input into the environmental assessment and project development.

The plan identifies:

- Community stakeholders for the proposal.
- Issues / risks related to the engagement of each stakeholder group.
- A consultation strategy for each stakeholder group.
- A set of activities against the project development time line to facilitate consultation.

Stakeholders were identified as those potentially being impacted by the solar farm proposal or having an interest in the proposal. The CCP sets out consultation requirements with interested parties including adjacent neighbours, near neighbours, local businesses, any special interest groups and representative bodies. The plan also includes strategies for consultation with the local community and the broader community within the region.

The proposal has been developed iteratively in response to agency and community input. Measures to reduce adverse impacts and promote positive impacts have been incorporated in the EIS. The CCP further aims to ensure that there is ongoing effective liaison with the community.

### **5.3.2 Community consultation activities to date**

In line with the CCP, a range of community engagement tools have been used with regards to the proposal. These include:

- Development of a project website to provide information and updates <http://www.avonlie-solarfarm.com/>. The website went live in January 2018 and is updated regularly. An online feedback form can be filled in to submit suggestions.
- Establishment of a dedicated email address for feedback: [info@avonlie-solarfarm.com](mailto:info@avonlie-solarfarm.com).
- Direct engagement with neighbours through phone calls, letters and face to face meetings. Initial face to face meetings with neighbours within 3 km of the development site were held on 16 January 2018.
- Direct engagement with near neighbour (Receptor 1, Figure 3-5) to organise a visual montage from the front of their property.
- Community information sessions were hosted by RES. The first session was held in Sandigo at the Sandigo Community Hall on Tuesday 20 March 2018. The second session was held in Narrandera at the Narrandera Shire Library on Wednesday 21 March 2018.
- Presentation to Narrandera Shire Council on 17 April 2018 to Councillors and other council members.
- Ongoing updates to neighbours via telephone and email.

### **5.3.3 Results of community consultation**

Between October 2017 and January 2018, all residents within 3 km were contacted by phone to discuss the proposed solar farm. Residents that requested an informal meeting were met at different locations on 16 January 2018 to further discuss the proposal.

Additional emails and phone conversations were undertaken in February and March 2018 inviting residents to visit the webpage and attend the Avonlie Solar Farm Open Day.

All potentially affected residents were happy with the proposal, with no real objections or concerns. One neighbour (Receptor 1) requested a visual montage from the front of their property, which was undertaken by Moir Landscapes and was viewed at the Open Day and sent via email to the affected resident.

Generally, questions raised by the community centred around the following:

- Visual amenity of the solar panels.

- Fire risk and insurance implications.
- Neighbouring fence lines and access implications.

No issues or objections were raised at the 2 Open Day events.

A presentation was given at a Councillors Meeting on 17 April 2018, outlining the proposal. Questions raised by Councillors included:

- Where does the power go?
- Direct vs indirect employment?
- Feedback from locals/neighbours?
- Weed control?
- Road upgrades?
- Transport movements?
- How was the area chosen?

No feedback forms were received at the open days or submitted online. While uptake levels of community engagement activities for the proposal have been relatively low, it is considered that this reflects a low level of concern about the proposal. The issues identified through the consultation process have been addressed in the EIA and proposal design.

A letter of support for the proposed subdivision was sent to Narrandera Shire Council on 14 May 2018. A response was received via email on 4 June 2018 in support of the proposed subdivision (Appendix C-1)

#### **5.3.4 Continued engagement**

Engagement activities will continue throughout the determination period, as set out in the CCP.

The CCP will be reviewed regularly, as well as at key transition phases between different stages of project development (e.g. prior to construction or operation). The Plan will continue to guide engagement activities at all stages of the project, ensuring that engagement is appropriate and in line with good practice.



## 6 ENVIRONMENTAL IMPACT ASSESSMENT

### 6.1 IMPACT ASSESSMENT APPROACH

Following the preparation of the Preliminary Environmental Assessment, a risk assessment was undertaken to characterise the likely adverse environmental risks associated with the construction, operation, upgrade and decommissioning of the solar farm. The aim of the risk assessment was to ensure that all relevant risks were identified, investigated and mitigated as part of the EIS submission, relative to the degree of environmental risk they represented.

The environmental impact assessment below addresses all impacts likely to be attributed to the proposal (including the solar farm and transmission infrastructure). This includes consideration of:

- Direct impacts - impacts directly attributable to the construction, operational and decommissioning phases such as:
  - Disturbances to native vegetation, soil, water and air quality.
  - Potential to impact on cultural features and values.
  - Noise generated by equipment and traffic movements.
  - Public safety, pollution risks and hazards.
- Indirect impacts – follow-on or cascading impacts such as:
  - Impacts on the local economy.
  - Potential to impact existing and future land uses.
- Cumulative impacts - the combined potential effects of different impact types as well as the potential interaction with other proposals. For example:
  - The combined impact of construction noise, traffic and visual impacts for nearby receptors.
  - The combined effects of the construction phase coinciding with other large infrastructure works that may be planned in the area.

The risk rating is a factor of the **consequence** of an impact occurring and the **likelihood** of the impact occurring. Depending on the combination of consequence and likelihood, the overall risk rating could be low to extreme (refer Table 6-1). High to extreme risks (termed ‘key risks’) have warranted a higher level of investigation. Risks identified as low to medium are discussed in less detail.

Table 6-1 Risk assessment rating matrix.

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Catastrophic
Remote	Low	Low	Low	Medium	Medium
Unlikely	Low	Low	Medium	High	High
Possible	Low	Medium	High	Very High	Very High
Likely	Medium	High	Very High	Very High	Extreme
Almost certain/ inevitable	Medium	High	Very High	Extreme	Extreme

Table 6-2 summarises the results of the risk assessment. Fourteen environmental risks were investigated. The unmitigated risk rating is the risk rating prior to assessment and is therefore precautionary. It considers a ‘worst case’ in the absence of specific information and helps determine the level of assessment required.

Table 6-2 Risk analysis of adverse environmental issues.

Environmental risk	Likelihood	Consequence	Risk rating (unmitigated)
Biodiversity	Likely	Moderate	Very High
Aboriginal heritage	Possible	Moderate	High
Visual	Possible	Moderate	High
Noise	Possible	Moderate	High
Land use	Likely	Moderate	Very High
Soils and water	Possible	Minor	Medium
Transport	Unlikely	Moderate	Medium
Hazards	Unlikely	Moderate	Medium
Resource Use and Waste Generation	Possible	Minor	Medium
Historic Heritage	Unlikely	Minor	Low
Climate	Unlikely	Minor	Low
Socioeconomic	Possible	Minor	Medium
Cumulative impacts	Possible	Minor	Medium

In summary, the following environmental risks were considered to be key issues for the EIS:

- Biodiversity
- Aboriginal cultural heritage
- Visual impacts
- Land use
- Noise impacts

Biodiversity, Aboriginal cultural heritage and visual impacts were investigated by specialists. Summaries of these reports are included in section 6. The full reports are attached as Appendices. Land use has been assessed in section 6.5 and addresses guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI 2013) and *The land and soil capability assessment scheme* (OEH 2012). A quantitative noise assessment is included in section 6.6 and was conducted in accordance with construction and operation guidelines. Lower risk issues are addressed in section 7.

## 6.2 BIODIVERSITY (FLORA AND FAUNA)

### SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

#### **Biodiversity –**

Include an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW).

### OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

#### **Biodiversity -**

A Biodiversity Development Assessment Report (BDAR) prepared by applying the Biodiversity Assessment Methods to all biodiversity values on-site is required.

The BDAR must document the application of the avoid, minimise and offset frameworks and include details of the measures proposed to address offset obligations as follows:

- Total number and classes of biodiversity credits required to be retired for the development.
- Number and classes of like-for-like biodiversity credits proposed to be retired.
- Number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.
- Any proposal to fund a biodiversity conservation action.
- Any proposal to make a payment to the Biodiversity Conservation Fund.

The EIS must detail the value of paddock trees habitat to all threatened species known or likely to occur in the area, and assess the impact of clearing (in particular, for the Superb Parrot *Polytelis swainsonii*).

The EIS should clearing state why potentially occurring threatened species are not considered in the assessment of significance, notably the White-fronted Chat (*Epthianura albifrons*) and the Grey-crowned Babbler (*Pomatostomus temporalis*).

OEH supports the retention of boundary vegetation. If the final design impacts on this vegetation, the EIS should include an assessment of the nature and extent of this vegetation.

### LOCAL LAND SERVICES REQUIREMENTS

The EIS must also address the following specific issues:

Avoidance of Western Grey Box Tall Grassy Woodland on western boundary.

Loss of hollow-bearing paddock trees, and justification for not using alternative adjacent property.

#### 6.2.1 Approach

A specialist Biodiversity Development Assessment Report (BDAR) was prepared by NGH Environmental to investigate and assess the potential impacts of the proposal on biodiversity. The aim of this BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016*. This BDAR forms part of an Environmental Impact Statement (EIS) for a State Significant Development (SSD), prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Biodiversity Assessment Methodology (BAM) is the current assessment methodology for SSD under the NSW Biodiversity Offsets Scheme prescribed by the NSW *Biodiversity Conservation Act 2016*. The BAM is established for accessing certain impacts on threatened species and threatened ecological communities and their habits. This report follows the BDAR format required by the BAM.

The full report is included in Appendix D and the report is summarised below.

The assessment approach involved literature reviews, database searches, and field surveys conducted in accordance with relevant survey guidelines.

The following methods were adopted during the surveys on 15 November 2017, 28 February 2018, 2 and 6 March 2018, and 4 and 7 May 2018:

- *Random meander and targeted searches for threatened flora species.*
- *Biometric vegetation plots.* A total of 13 biometric plots were completed.
- *Fauna habitat assessment.* Trees within the development site were inspected for hollows, and the number, size and occupancy of the hollows, as well as the species, diameter at breast height and height of the hollow-bearing trees were all recorded.
- *Fauna surveys* were conducted with the aim of identifying occurrence or nest trees of threatened fauna species.

The aims of the site surveys were as follows:

1. Determine vegetation communities present within the development site, their condition and extent.
2. Identify potential EECs within the development site and determine their condition and extent.
3. Conduct searches for threatened flora and fauna species predicted to occur in the development site.
4. Assess the availability and extent of flora and fauna habitat, particularly threatened species habitat, such as hollow-bearing trees.

A BAM Calculator Assessment was completed and the calculator ID is 00010724/BAAS18074/18/00010725.

## **6.2.2 Existing environment**

### **Site description**

The development site is agricultural land comprising several large paddocks which are generally flat, largely cleared and cultivated for pastures and grazing. Scattered paddock trees remain within the paddocks and planted windbreaks occur throughout the site comprised of local and non-local native species. Remnant vegetation occurs on the South-western Corner of the development site and along Muntz Road and Sandigo Road.

### **Native vegetation**

A search was undertaken of the OEH Vegetation Information System (VIS) database and the NSW Seed Mapping Portal to access existing vegetation mapping information within the development site.

This identified two PCT's within and surrounding the development site:

- PCT76: *Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregion* occurring on the South-Western corner of the development site; and
- PCT 80: *Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion* occurring along Muntz Rd and Sandigo Rd.

Patches of planted woody vegetation are also shown occurring within the development site in linear plantings and a large patch in the South-Eastern corner of the development site.

#### **Cleared areas (Non-indigenous vegetation)**

563ha of the development site occurs as cropped land. These areas are dominated by exotic vegetation such as Wheat (*Triticum aestivum*) and Barley (*Hordeum* sp.)

#### **6.2.3 Threatened species**

The BAM Calculator predicted the following species credit species to occur at the development site.

Table 6-3 Candidate species credit species requiring assessment

Species Credit Species	Habitat components and geographic restrictions. <sup>1</sup>	Sensitivity to gain class	NSW listing status	National listing status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
<b>FAUNA</b>							
<u><i>Calyptorhynchus lathamii</i></u> Glossy Black-Cockatoo (Breeding)	Outside Narrandera, Leeton and Griffith LGAs. Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground.	High	Vulnerable	Not Listed	Suitable Hollow Bearing Trees (HBTs) present within development site.	Included	Within Narrandera LGA. Habitat components on site
<u><i>Crinia sloanei</i></u> Sloane's Froglet	Semi-permanent/ephemeral wet area containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet area Swamps Within 500 m of swamps or Waterbodies	Moderate	Vulnerable	Not Listed	Two farm dams within the development site, but excluded from the development footprint	Excluded	No Waterbodies or swamps within development footprint
<u><i>Haliaeetus leucogaster</i></u> White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	High	Vulnerable	Not Listed	Absent - Over 2km to nearest watercourse. (Sandy creek)	Excluded	No suitable habitat in development site
<u><i>Hamirostra melanosternon</i></u> Black-breasted Buzzard (Breeding)	Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts	Moderate	Vulnerable	Not Listed	Absent - Over 2km to nearest watercourse (Sandy creek)	Excluded	No suitable habitat in development site
<u><i>Lathamus discolor</i></u> Swift Parrot (Breeding)	Mapped Important Areas (OEH)	Moderate	Endangered	Critically Endangered	Development site not within mapped important areas	Excluded	Excluded – not within mapped important areas

Species Credit Species	Habitat components and geographic restrictions. <sup>1</sup>	Sensitivity to gain class	NSW listing status	National listing status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
<i>Lophochroa leadbeateri</i> Major Mitchell's Cockatoo (Breeding)	Living or dead tree with hollows greater than 10cm diameter	High	Vulnerable	Not Listed	Suitable Hollow Bearing trees present in development site	Included	Habitat components on site
<i>Petaurus norfolcensis</i> Squirrel Glider	Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart).	High	Vulnerable	Vulnerable	Remnant vegetation along Muntz Rd.	Included	Survey required
<i>Phascolarctos cinereus</i> Koala (Breeding)	Areas identified via survey as important habitat based on density of Koalas and quality of habitat	High	Vulnerable	Vulnerable	Survey required to identify	Included	Survey required
<i>Polytelis swainsonii</i> Superb Parrot (Breeding)	Living or dead <i>E. blakelyi</i> , <i>E. melliodora</i> , <i>E. albens</i> , <i>E. camaldulensis</i> , <i>E. microcarpa</i> & <i>E. polyanthemos</i> with hollows greater than 5cm diameter; greater than 4m above ground or trees with a DBH of greater than 30cm.	High	Vulnerable	Vulnerable	Suitable Hollow Bearing Trees present in development site	Included	Habitat components on site
<i>Tyto novaehollandiae</i> Masked Owl	Living or dead trees with hollows greater than 20cm diameter.	High	Vulnerable	Not listed	Suitable hollow bearing trees present in the development site	Included	Habitat components on site
<b>FLORA</b>							
<i>Austrostipa wakoolica</i> A spear-grass	South of Narrandera	Moderate	Endangered	Endangered	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution

Species Credit Species	Habitat components and geographic restrictions. <sup>1</sup>	Sensitivity to gain class	NSW listing status	National listing status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
<i>Brachyscome papillosa</i> Mossgiel Daisy	South and West of Coolamon-Ardlethan Road, West of Lockhart and north of Rand	High	Vulnerable	Vulnerable	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution
<i>Caladenia arenaria</i> Sand-hill Spider Orchid	West of Lockhart and north of Rand	High	Endangered	Endangered	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution
<i>Diuris sp. (Oaklands, D.L. Jones5380)</i> Oaklands Diuris	None	High	Endangered	Not Listed	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution
<i>Eleocharis obicis</i> Spike-Rush	Semi-permanent/ephemeral wet areas Periodically waterlogged sites (including table drains and farm dams)	High	Vulnerable	Vulnerable	None	Excluded	No ephemeral wet or waterlogged areas within development footprint
<i>Lepidium monoplacoides</i> Winged Peppergrass	Semi-permanent/ephemeral wet areas Land containing seasonally damp or waterlogged sites	High	Endangered	Endangered	None	Excluded	No ephemeral wet or waterlogged areas within development footprint
<i>Swainsona murrayana</i> Slender Darling Pea	Western half of sub-CMA	Moderate	Vulnerable	Vulnerable	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution
<i>Swainsona sericea</i> Silky Swainson-pea	None	High	Vulnerable	Not Listed	Suitable habitat within Zone 1 & 2.	Included	Within Geographic Distribution



The following ecosystem credit species were returned by the calculator as being associated with the PCTs present on the development site (Table 6-4). These species are assumed to occur on site and generate credits. The Grey Crowned Babbler and White-fronted Chat were observed on site during the field surveys.

Table 6-4 Ecosystem Credit Species

Ecosystem credit species	Vegetation type(s)	NSW Listing Status	National Listing Status
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion 158 – Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Vulnerable	Not Listed
<i>Calyptorhynchus lathami</i> Glossy Black Cockatoo	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Chthonicola saqittata</i> Speckled Warbler	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Epthianura albifrons</i> White-fronted Chat	158– Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Vulnerable	Not listed
<i>Falco hypoleucos</i> Grey Falcon	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion 158 - Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Endangered	Not listed
<i>Grus rubicunda</i> Brolga	158– Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Vulnerable	Not listed
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Hamirostra melanosternon</i> Black-breasted Buzzard	158– Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Vulnerable	Not listed
<i>Lathamus discolor</i> Swift Parrot	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Endangered	Critically Endangered
<i>Lophochroa leadbeateri</i> Major Mitchell's Cockatoo	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion 158– Old Man Saltbush – mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (North Western NSW).	Vulnerable	Not listed

Ecosystem credit species	Vegetation type(s)	NSW Listing Status	National Listing Status
<i>Melanodryas cucullata cucullata</i> Hooded Robin (south-eastern form)	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Petroica boodang</i> Scarlet Robin	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Petroica phoenicea</i> Flame Robin	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Phascolarctos cinereus</i> Koala (Foraging)	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Vulnerable
<i>Polytelis swainsonii</i> Superb Parrot (Foraging)	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Vulnerable
<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler (eastern subspecies)	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed
<i>Stagonopleura guttata</i> Diamond Firetail	PCT80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Vulnerable	Not listed

#### 6.2.4 Site surveys

Targeted surveys were undertaken over a number of days. A general biodiversity survey was undertaken on 15 November 2017. Threatened Fauna Surveys and Nocturnal Surveys were undertaken on 28 February, 2 & 6 March and 4 & 7 May 2018. Threatened Flora surveys were undertaken on 28 February 2018.

Based on site survey and GIS modelling, approximately 80 ha of native vegetation occurs within the development site and along Muntz Rd and Sandigo Rd. This is comprised of:

- 8 ha of remnant Grey Box (*Eucalyptus microcarpa*) on the Western side of the development site.
- 14 ha of remnant Grey Box/White Cypress Woodlands along Muntz Road and Sandigo Road.
- 16 ha of planted native vegetation in the form of windbreaks along fence lines
- 42 ha of planted Old Man Saltbush (*Atriplex nummularia*) used as fodder for sheep and cattle.

Two Plant Community Types (PCT) were identified in the development site (Figure 6-1 and Figure 6-2). These are:

- PCT 76 - Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregion
- PCT 80 - Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion.

These vegetation communities form part of the Endangered Ecological Community (EEC): Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregion. Sections of this community along Muntz Rd and Sandigo-Boree Creek Rd met the criteria for the EPBC listed community.

56 paddock trees also occur throughout the development site.

#### 6.2.5 Results

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- Up to 1ha of Western Grey Box – White Cypress Pine tall woodland;
- 0.9ha of Planted Old Man Saltbush – mixed chenopod shrubland; and
- 49 Paddock trees over exotic vegetation.

Two ecosystem credit species, Grey crowned Babbler *Pomatostomus temporalis temporalis* (Vulnerable, BC Act) and White Fronted Chat *Epthianura albifrons* (Vulnerable, BC Act) were detected during the site survey. These species are accounted for in the ecosystem credit requirements of the development determined by the PCT and do not require targeted surveys.

Seven species credit species, comprising five flora species and two fauna species were unable to be surveyed for during the recommended survey time and were assumed to occur on site due to being within the geographic distribution and habitat components present on-site. These include:

- 0.7 ha of suitable habitat for the Sand-hill Spider Orchid (*Caladenia Arenaria*), Oaklands Diuris (*Diuris* sp.), Pine Donkey Orchid (*Diuris tricolor*), Spear Grass (*Austrostipa wakoolica*) and Mossgiel Daisy (*Brachyscome papillosa*) occurs along Muntz Rd and Sandigo Rd that would be impacted by the development.

- 25 hollow bearing trees that could provide nesting opportunities for the Superb Parrot (*Polytelis swainsonii*) and Major Mitchell Cockatoo (*Lophochroa leadbeateri*) would be removed by the development.

Credits were calculated from the BAM Calculator for these entities and generated the following credits:

Table 6-5 PCTs and Vegetation Zones that require offsets

Zone ID	PCT ID	Zone	Impact Area (ha)	Vegetation integrity score	Vegetation Integrity Loss	Ecosystem credits required
<b>Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion</b>						
1	80	Good	0.4	51.8	51.8	10
2	80	Good_ immature overstory	0.3	39.6	39.6	6
3	80	Moderate_ grazed understory	0.1	36	36	2
4	80	Low	0.1	20.9	20.9	1
5	80	Planted	0.1	37.2	37.2	2
		<b>Subtotal:</b>	<b>1ha</b>		<b>Subtotal:</b>	<b>21</b>
<b>Old Man Saltbush - mixed chenopod shrubland of the semi-arid hot (persistently dry) and arid climate zones (north-western NSW)</b>						
6	158	Planted	0.9	34.1	34.1	15
		<b>Subtotal:</b>	<b>0.9ha</b>		<b>Subtotal:</b>	<b>15</b>
			<b>1.9ha</b>		<b>TOTAL:</b>	<b>36</b>

Table 6-6 Paddock trees that require offsets

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Credits Required	Ecosystem credits required
Class 2 (>20cm DBH and < 50cm DBH)	No	4	0.5	2
Class 2 (>20cm DBH and < 50cm DBH)	Yes	0	0	0
Class 3 >50cm DBH	No	23	0.75	17.25
Class 3 >50cm DBH	Yes	22	1	22
			<b>TOTAL</b>	<b>41.25</b>

Table 6-7 Credit species that require offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
A Spear Grass ( <i>Austrostipa wakoolica</i> )	2	0.7	16
Mossgiel Daisy ( <i>Brachyscome papillosa</i> )	2	0.7	16

Sand-hill Spider Orchid ( <i>Caladenia Arenaria</i> )	3	0.7	25
Oaklands Diuris ( <i>Diuris</i> sp.)	3	0.7	25
Pine Donkey Orchid ( <i>Diuris tricolor</i> )	1.5	0.7	12
Superb Parrot ( <i>Polytelis swainsonii</i> )	2	0.1	2
Major Mitchell Cockatoo	2	0.1	2
		<b>TOTAL</b>	<b>98</b>

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Policy Scheme under the BC Act.

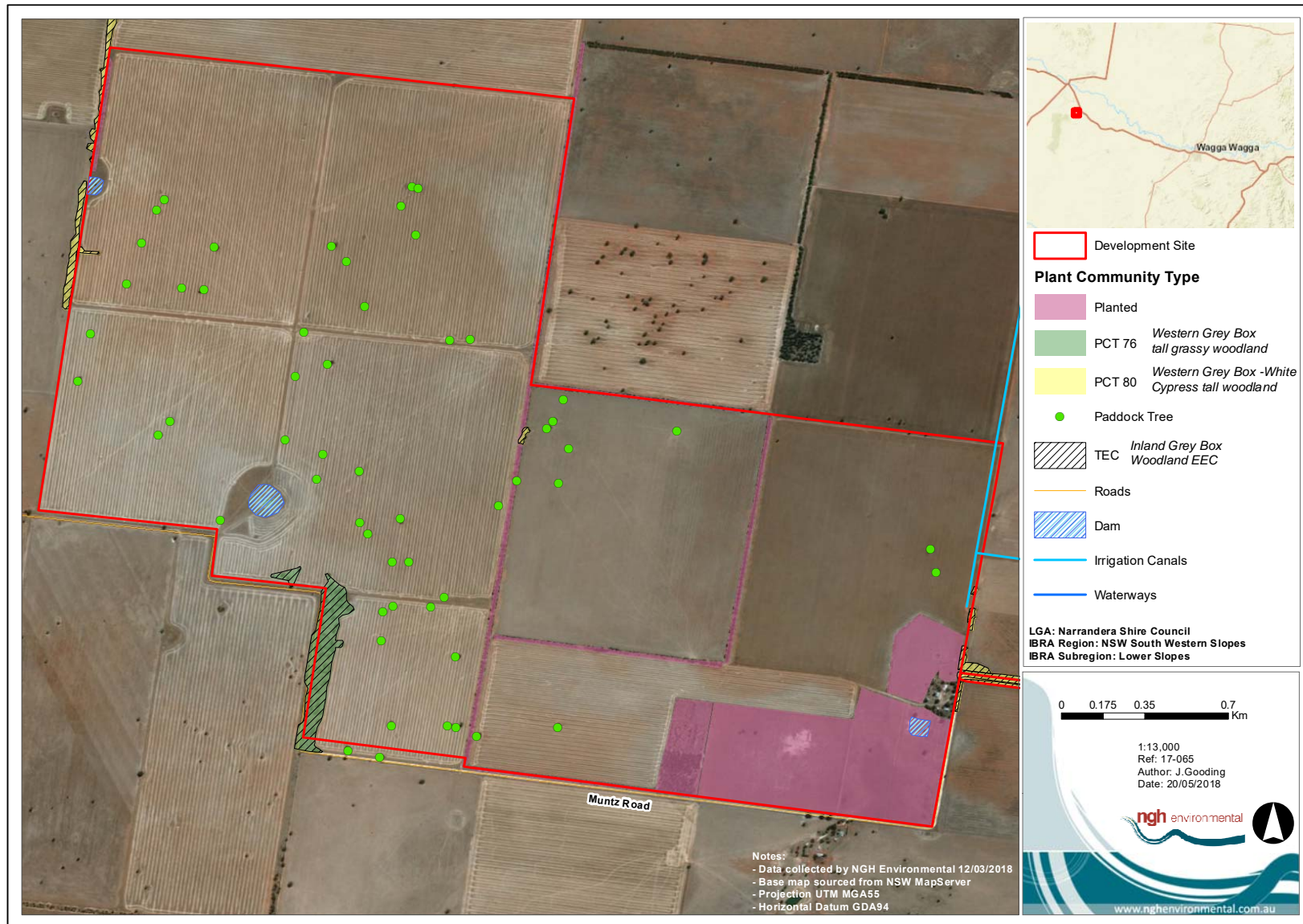


Figure 6-1 PCT and TEC at the development site

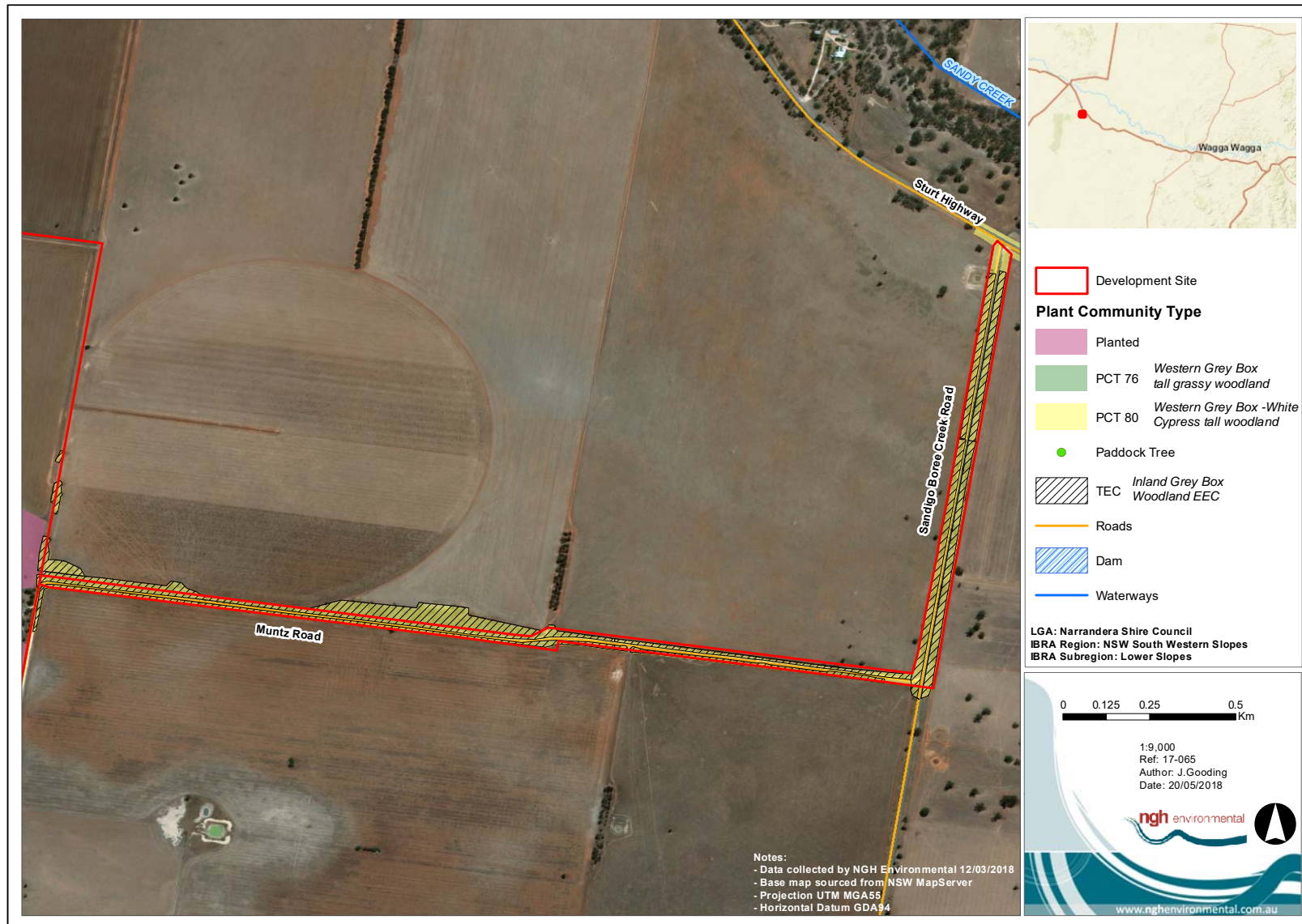


Figure 6-2 PCTs and TECs along Muntz and Sandigo Road

### 6.2.6 Potential impacts

The BDAR identified the potential direct, indirect and prescribed impacts to biodiversity values of the site that would result during the construction phase (Table 6-8 and Table 6-6).

Table 6-8 Potential direct biodiversity impacts as a result of the proposal.

Nature of impact	Extent	Frequency	Duration and timing	Consequence
<b>Direct impacts</b>				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	1.9ha.	Regular	Construction	<ul style="list-style-type: none"> <li>• Direct loss of native flora and fauna habitat</li> <li>• Potential over-clearing.</li> <li>• Injury and mortality of fauna during clearing of fauna habitat and habitat trees</li> <li>• Disturbance to stags, fallen timber, and bush rock</li> </ul>
Displacement of resident fauna	Unknown	Regular	Construction, operation	<ul style="list-style-type: none"> <li>• Direct loss of native fauna</li> <li>• Decline in local fauna populations</li> </ul>
Injury or death of fauna	Unknown	Regular	Construction	<ul style="list-style-type: none"> <li>• Direct loss of native fauna</li> <li>• Decline in local fauna populations</li> </ul>
Removal of habitat features e.g. HBTs	25 HBTs	Regular	Construction	<ul style="list-style-type: none"> <li>• Direct loss of native fauna habitat</li> <li>• Injury and mortality of fauna during clearing of habitat features</li> </ul>
Shading by solar infrastructure	176 ha (33%)	Regular	Operational Phase: Long-term	<ul style="list-style-type: none"> <li>• Modification of native fauna habitat</li> <li>• Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.</li> </ul>
Existence of permanent solar infrastructure	534 ha	Regular	Operational Phase: long-term	<ul style="list-style-type: none"> <li>• Modification of habitat beneath array (mostly non-native)</li> <li>• Reduced fauna movements across landscape due to fencing</li> <li>• Collision risks to birds and microbats (fencing).</li> </ul>



Table 6-9 Potential indirect biodiversity impacts as a result of the proposal.

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
<b>Indirect impacts (those listed below are included in the BAM)</b>					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short-term	<ul style="list-style-type: none"> <li>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penneplain, Nandewar and Brigalow Bely South Bioregion</li> <li>White fronted Chat (<i>Epthianura albifrons</i>)</li> <li>Grey Crowned Babbler (<i>Pomatostomus temporalis</i>)</li> <li>Superb Parrot (<i>Polytelis swainsonii</i>)</li> <li>Major Mitchell Cockatoo (<i>Lophochroa leadbeateri</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Direct loss of native flora and fauna habitat</li> <li>Injury and mortality of fauna during clearing of fauna habitat and habitat trees</li> <li>Disturbance to stags, fallen timber, and bush rock</li> <li>Increased edge effects</li> </ul>
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	<ul style="list-style-type: none"> <li>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penneplain, Nandewar and Brigalow Bely South Bioregion</li> <li>White fronted Chat (<i>Epthianura albifrons</i>)</li> <li>Grey Crowned Babbler (<i>Pomatostomus temporalis</i>)</li> <li>Superb Parrot (<i>Polytelis swainsonii</i>)</li> <li>Major Mitchell Cockatoo (<i>Lophochroa leadbeateri</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Degradation of Inland Grey Box Woodland EEC.</li> <li>Loss of native flora and fauna habitat</li> </ul>
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operational Phase: Short-term	<ul style="list-style-type: none"> <li>White fronted Chat (<i>Epthianura albifrons</i>)</li> <li>Grey Crowned Babbler (<i>Pomatostomus temporalis</i>)</li> <li>Superb Parrot (<i>Polytelis swainsonii</i>)</li> </ul>	<ul style="list-style-type: none"> <li>May alter fauna activities and/or movements</li> <li>Loss of foraging or breeding habitat</li> <li>Inhibit the function of plant species, soils and dams</li> </ul>

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
				<ul style="list-style-type: none"> <li>Major Mitchell Cockatoo (<i>Lophochroa leadbeateri</i>)</li> </ul>	
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction & Operational Phase: Long-term	<ul style="list-style-type: none"> <li>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Bely South Bioregion</li> </ul>	<ul style="list-style-type: none"> <li>Degradation of Inland Grey Box Woodland EEC</li> <li>Weed encroachment</li> </ul>
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction & Operational Phase: Long-term	<ul style="list-style-type: none"> <li>White fronted Chat (<i>Epthianura albifrons</i>)</li> <li>Grey Crowned Babbler (<i>Pomatostomus temporalis</i>)</li> <li>Superb Parrot (<i>Polytelis swainsonii</i>)</li> <li>Major Mitchell Cockatoo (<i>Lophochroa leadbeateri</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Loss of Foraging Habitat</li> </ul>
Trampling of threatened flora species	Unknown	Rare	Construction & Operational Phase: Long-term	Threatened species assumed present; <ul style="list-style-type: none"> <li><i>Brachyscome papillosa</i> Mossgiel Daisy</li> <li><i>Caladenia arenaria</i> Sand-hill Spider Orchid</li> <li><i>Diuris</i> sp. (Oaklands, D.L. Jones 5380) Oaklands Diuris</li> <li><i>Diuris tricolor</i> Pine Donkey Orchid</li> </ul>	<ul style="list-style-type: none"> <li>Loss of threatened species and genetic diversity</li> </ul>
Earthworks and mobilisation of sediments	Unknown	Regular	Construction	<ul style="list-style-type: none"> <li>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Bely South Bioregion</li> <li>Sloane's Froglet (<i>Crinia sloanei</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and sedimentation and/or pollution of soils, dams and downstream habitats.</li> </ul>
Rubbish dumping	Unknown	Regular	Construction & Operational	<ul style="list-style-type: none"> <li>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Bely South Bioregion</li> </ul>	<ul style="list-style-type: none"> <li>Degradation of Inland Grey Box Woodland EEC</li> </ul>

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.
- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.
- Impacts of development on the connectivity on movement of threatened species that maintains their life cycle.
- Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction and operational phase are avoided where possible, and minimised where they cannot be avoided. The mitigation measures that would be employed during the construction phase are provided in Section 6.2.7. Mitigation measures have considered methods of clearing, clearing operations, timing of construction and other measures that would minimise impacts of the proposal on biodiversity values.

### 6.2.7 Safeguards and mitigation measures

Table 6-10 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
BD1	<ul style="list-style-type: none"> <li>• Hollow-bearing trees would not be removed during breeding and hibernation season (Winter to summer) to mitigate impacts on Superb Parrots, Major Mitchell Cockatoo and Corben’s Long-eared Bat.</li> <li>• Old Man Saltbush Shrubland would not be removed during the breeding season (July to March) of the White-fronted Chat to mitigate impacts to this species.</li> <li>• If clearing outside of these period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.</li> </ul>	C		
BD2	Spring flora surveys by an ecologist/botanist along Muntz Rd and Sandigo Rd for: <ul style="list-style-type: none"> <li>• <i>Caladenia arenaria</i> (Sandhill Spider Orchid).</li> <li>• <i>Diuris sp. Oaklands, D. L. Jones 5380</i> (Oaklands Diuris).</li> <li>• <i>Austrostipa wakoolica</i> (A spear grass).</li> </ul>	Prior to construction		
BD3	Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing in the presence of a trained ecologist or licensed wildlife handler during clearing events, including: <ul style="list-style-type: none"> <li>• Pre-clearing checklist.</li> <li>• Tree clearing procedure.</li> </ul>	Prior to and during construction		
BD4	<ul style="list-style-type: none"> <li>• Implementation of Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement.</li> </ul>	C		

No.	Safeguards and mitigation measures	C	O	D
BD5	<ul style="list-style-type: none"> <li>Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing.</li> <li>No stockpiling or storage within dripline of any mature trees.</li> <li>In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.</li> </ul>	Prior to and during construction		
BD6	<ul style="list-style-type: none"> <li>The development and implementation of the Construction Environmental Management Plan (CEMP) will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.</li> </ul>	Prior to construction		
BD7	<p>Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill, including:</p> <ul style="list-style-type: none"> <li>Avoid Night Works.</li> <li>Direct lights away from vegetation.</li> </ul>	C	O	
BD8	<ul style="list-style-type: none"> <li>Daily monitoring of dust generated by construction and operation activities.</li> <li>Construction would cease if dust observed being blown from site until control measures were implemented.</li> <li>All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.</li> </ul>	C	O	
BD9	<ul style="list-style-type: none"> <li>Prior to commencement of each phase, a Weed Management procedure would be developed as part of the Biodiversity Management Plan for the proposal to prevent and minimise the spread of weeds. This would include: <ul style="list-style-type: none"> <li>Management protocol for declared priority weeds under the <i>Biosecurity Act 2015</i> during construction, operation and decommissioning stages.</li> <li>Weed hygiene protocol in relation to plant, machinery, and fill.</li> </ul> </li> <li>The weed management procedure would be incorporated into the Biodiversity Management Plan.</li> </ul>	Prior to and during construction	O	D
BD10	<p>Staff training and site briefing to communicate environmental features to be protected and measures to be implemented:</p> <ul style="list-style-type: none"> <li>Site induction.</li> <li>Toolbox talks.</li> </ul>	C		
BD11	<ul style="list-style-type: none"> <li>Preparation and implementation of Biodiversity Management plan that would include protocols for: <ul style="list-style-type: none"> <li>Protection of native vegetation to be retained.</li> <li>Best practice removal and disposal of vegetation.</li> <li>Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist.</li> <li>Weed management.</li> <li>Unexpected threatened species finds.</li> </ul> </li> <li>Rehabilitation of disturbed areas.</li> </ul>	Prior to and during construction	O	

No.	Safeguards and mitigation measures	C	O	D
<b>BD12</b>	<ul style="list-style-type: none"> <li>• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented</li> <li>• Spill management procedures would be implemented.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>
<b>BD13</b>	<ul style="list-style-type: none"> <li>• Awareness training during site inductions regarding enforcing site speed limits.</li> <li>• Site speed limits to be enforced to minimise fauna strike.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>

## 6.3 ABORIGINAL HERITAGE

### THE SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

*Include an assessment of the likely Aboriginal heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.*

### OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

*The EIS must also address the following specific issues:*

*The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document in an Aboriginal Cultural Heritage Assessment Report (ACHAR).*

*Consultation with Aboriginal people must be undertaken and documented. The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.*

*Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR and must demonstrate attempts to avoid impact upon cultural heritage values and identify conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts.*

*The assessment must include a surface survey, with results to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record, and results documented in the ACHAR.*

*The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal materials are uncovered during construction to formulate appropriate measures to manage impact.*

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the development site and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The full report is provided in Appendix E and is summarised below.

The ACHAR was prepared in line with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010a), and
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (OEH 2010b) produced by the NSW Office of Environment and Heritage (OEH)

Consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the *National Parks and Wildlife Regulation 2009*, following the consultation steps outlined in the (ACHCRP) guide provided by OEH.

#### 6.3.1 Archaeological Context

The assessment included a review of relevant information relating to the landscapes within the development site and surrounds. Included in this was a search of the OEH AHIMS database. No Aboriginal sites have previously been recorded within the development site. The closest sites to the development site are AHIMS#49-6-0038 and AHIMS #49-6-0039 located approximately 5km east of the development site. These two sites are recorded on the AHIMS system as modified trees which are located within the Sturt Highway

road reserve. Of the site types that have been recorded in the general area, modified trees are the most prevalent.

Assessment of Aboriginal site models for the region suggest that there is a pattern of site location that relates to the presence of potential resources for Aboriginal use. Archaeologically sensitive areas occur in association with major water sources, including anabranches and ephemeral and relict lake systems Grey Box fringed depressions. The extreme surface disturbance in the form of 100+ years of agricultural development of the proposal area is noted. Nonetheless, given that Aboriginal people have lived in the region for tens of thousands of years, there is some potential for archaeological evidence to occur across the proposal area. This would most likely be in the form of stone artefacts, ovens and scarred trees.

### **6.3.2 Site survey**

The survey strategy was to cover as much of the ground surface as possible within the proposal area given that the proposal was going to disturb approximately 570 hectares, within the development site. Survey transects were undertaken on foot across the proposal area to achieve maximum coverage. All mature trees within or adjacent to the development site were also inspected for evidence of Aboriginal scarring. Visibility within the development site was variable with visibility ranging from 90% in exposures to 20% along the fringes of the Muntz Rd access way. The average effective visibility for the site was 70% and overall was quite good. The paddocks with wheat crop stubble had exposures providing very high visibility with an average of around 75%.

Between the survey participants, over the course of the field survey, approximately, 60 km of transects were walked within the development site. Allowing for an effective view width of 5 m each person, this equates to a surface area examined of 97ha. However, allowing for the visibility restrictions, the effective survey coverage is reduced to 70 ha, or 70%.

### **6.3.3 Results**

Four artefact scatters, a scarred tree, a potential scarred tree and 64 isolated artefacts were recorded during the survey. The sites have been recorded as Avonlie Artefact Scatter 1, Avonlie Artefact Scatter 2, Avonlie Artefact Scatter 3, Avonlie Artefact Scatter 4, Avonlie Scarred Tree 1 (AHIMS 49-6-0148) and Avonlie Potential Scarred Tree 2.

Based on the land use history, an appraisal of the landscape, soil, level of disturbance and the results from the field survey it was concluded that there was negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the development site.

Given that the majority of the development site has been subject to extensive modification the disturbed and fragmented nature of the scatters and a lack of ovens/hearths as a site type was not unexpected. The modelling for the region notes that dominance of scarred trees in the area, especially where there are remnant stands of native trees. The survey results have confirmed the presence of a scarred tree however, a large number of artefacts were also recorded which is considered a more realistic representation of Aboriginal archaeological material across the region. A small stand of remnant Grey Box outside the proposal area yielded six further Culturally Significant trees as recorded by Aboriginal Representative. These trees are not within the proposal area and are not expected to be impacted by the development.

The cultural significance of the sites is only determined by the local Aboriginal community.

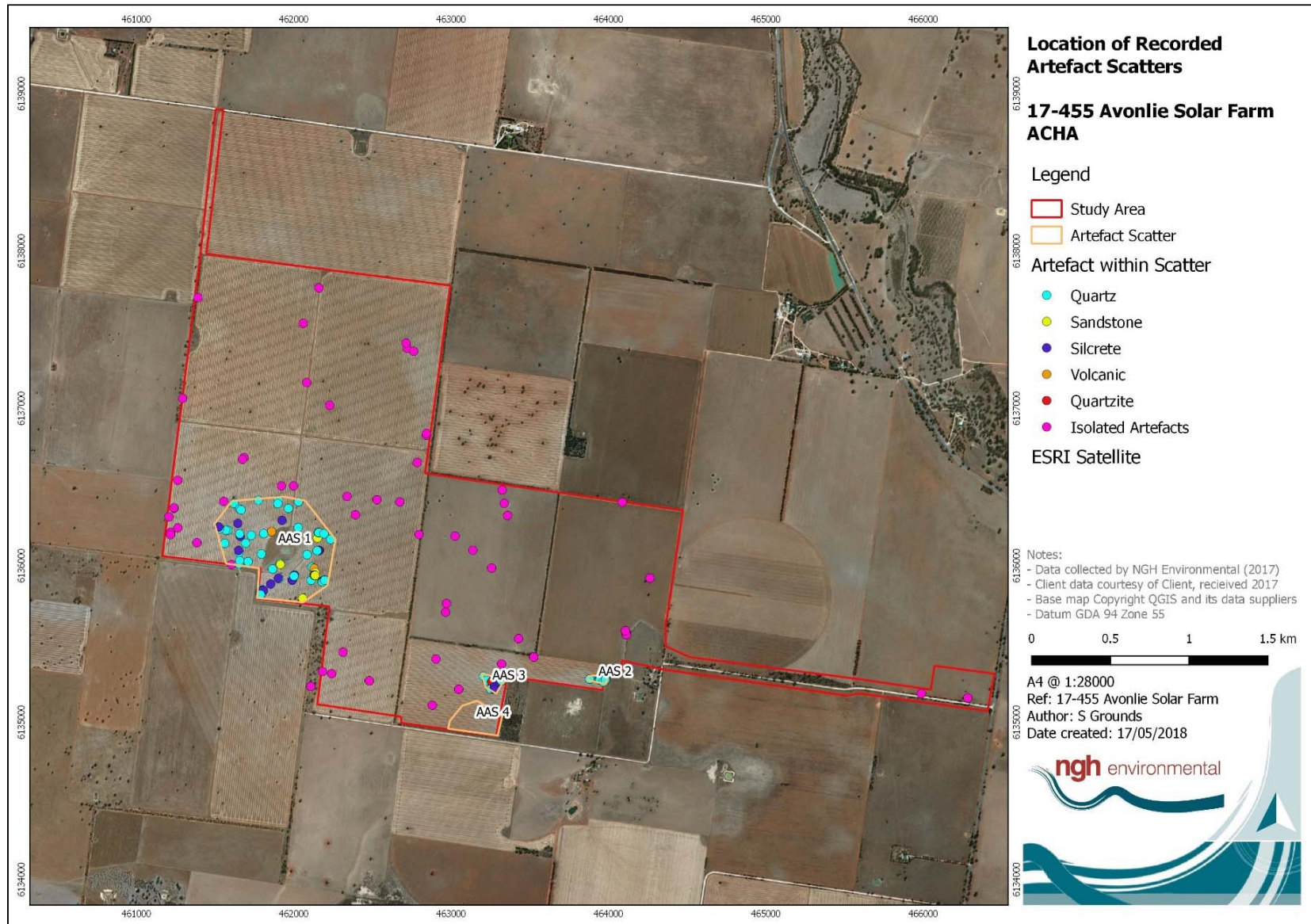


Figure 6-3. Location of recorded sites



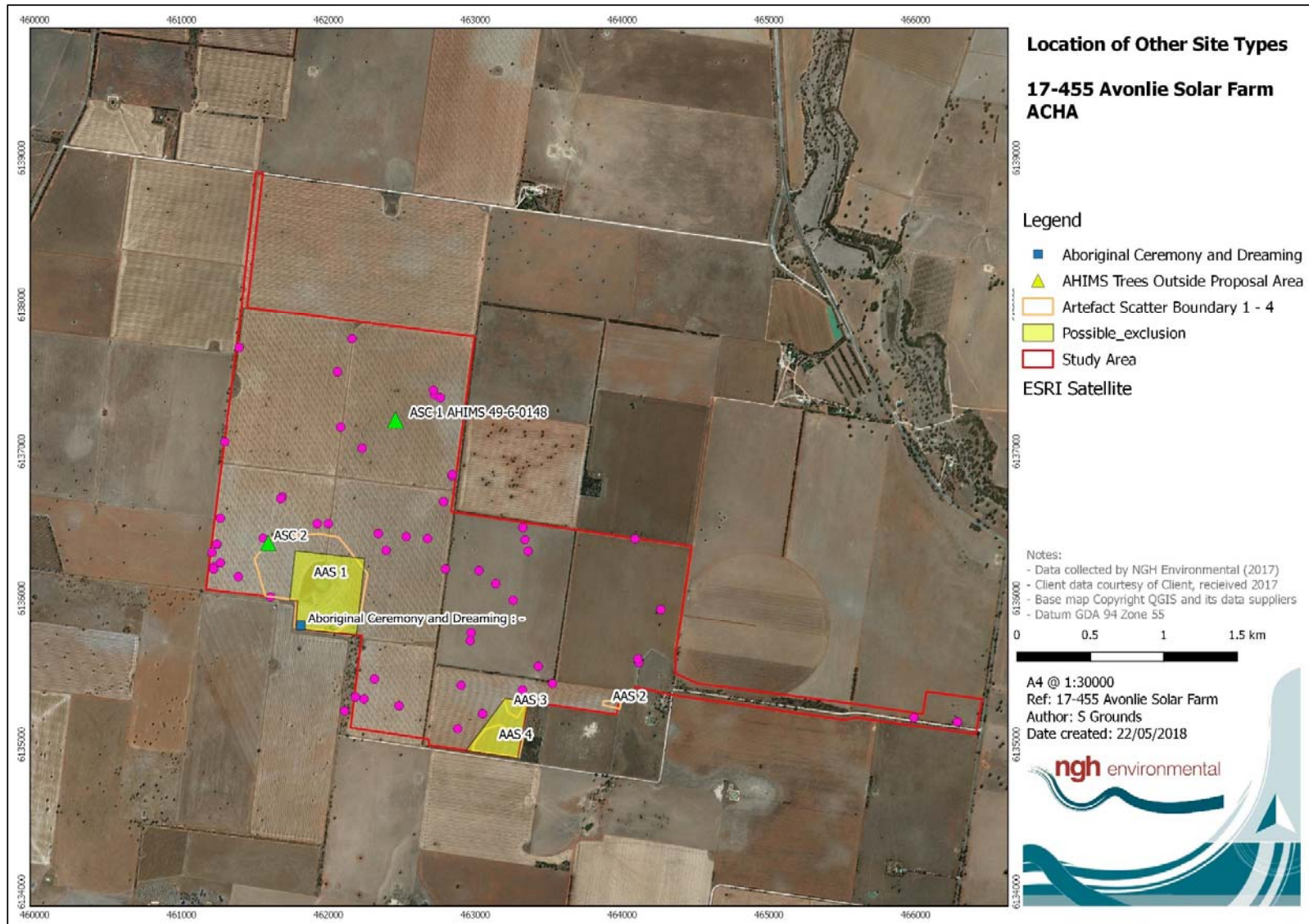


Figure 6-4 Location of proposed exclusion zones

### **6.3.4 Potential impacts**

#### **Construction**

Four archaeological sites were located within the development site. Avonlie Artefact Scatter 1, Avonlie Artefact Scatter 3 and Avonlie Artefact Scatter 4 have had either partial or total exclusion zones placed over them and the design of the Avonlie Solar Farm updated to reflect this exclusion (Figure 6-3).

The remainder of Avonlie Artefact Scatter 1, Avonlie Artefact Scatter 2, all isolated artefacts and Avonlie Scarred Tree 1 and 2 are within the development site and could be impacted by the proposed activity (Figure 6-3).

The impact to the scientific values of the sites Avonlie Artefact Scatter 2 and all isolated artefacts is considered to be low. While these sites are likely to be impacted by the development, they are considered to be sites of low potential to enhance our current understanding of the Aboriginal occupation of the area.

The impact to the scientific values if the site Avonlie Scarred Tree 1 was to be impacted by the current proposal is considered high. Consequently, there is potential that the intrinsic values of the tree and the scarring may be affected by the installation of solar array panels. Any damage to the trees would result in high impact to the representative values of the trees.

The Avonlie Solar Farm proposal is classified as State Significant Development under the EP&A Act which have a different assessment regime. As part of this process, Section 90 harm provisions under the NPW Act are not required, that is, an AHIP is not required to impact Aboriginal objects as the Department of Planning and Environment provides development approval.

#### **Operation**

During operation, it is unlikely the proposal would impact on Aboriginal archaeology. No mitigation is required.

### **6.3.5 Safeguards and mitigation measures**

The ACHAR identifies that the development proposal can proceed with no additional archaeological investigations. The report identifies a number of safeguards, these are identified below.

Table 6-11 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	The development must partially avoid Avonlie Artefact Scatter 1 and Avonlie Artefact Scatters 3 and 4 as per the agreed exclusion zones and development design plans detailed (Figure 6-4).	Design Stage		
AH2	Partial salvage through artefact collection of Avonlie Artefact Scatter 1 must be undertaken where the artefact scatter extends beyond the agreed exclusion zone and development design plans this report	Prior to Construction		
AH3	The development must avoid the site Avonlie Scarred Tree 1. A minimum 10m buffer around the tree should be in place to protect the tree root zone.	Design Stage		
AH4	As complete avoidance of Avonlie Artefact Scatters 2, 3 and 4 and the remaining isolated artefacts within the proposal area is not possible or warranted, the artefacts within the development footprint must be salvaged through collection prior to the proposed work commencing and moved to a safe area within the property that will not be subject to any ground disturbance.	Design Stage		
AH5	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties. A new site card/s will need to be completed once the artefacts are moved to record their new location on the AHIMS database.	Prior to construction		
AH6	RAPS and an archaeologist should be provided an opportunity to collect artefacts from any proposed fencing or firebreak alignments on the boundary of the proposal area, particularly within the designated exclusion areas.	Prior to construction		
AH7	An unexpected finds protocol (UFP) must be prepared and followed should there be an inadvertent discovery of Aboriginal objects occur.	C		
AH8	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	C		

*C: Construction; O: Operation; D: Decommissioning*

## 6.4 VISUAL IMPACT

### SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

#### Visual –

*Include an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.*

Moir Landscape Architecture completed a Visual Impact Assessment (VIA) of the proposed Avonlie Solar Farm. It provides a full assessment of the visual impacts associated with the proposal, including:

- Landscape values and character.
- Visual quality, sensitivity and effect.
- Visual impact rating.
- Overall viewpoint analysis and impact.

The VIA includes strategies to address identified impacts, including avoidance of unnecessary lighting and signage, building materials, limiting above ground infrastructure and minimising vegetation removal.

The report is provided in full in Appendix E and is summarised below.

#### 6.4.1 Approach

The VIA includes the following components:

- Objective assessment of the relative aesthetic value of the landscape defined as the visual quality expressed as high, medium or low.
- Determining the landscape sensitivity.
- Assessment of viewer sensitivity to change.
- Undertaking viewpoint analysis to identify areas likely to be affected by development.
- Assessment of visual impact and preparation of recommendations for impact mitigation.
- Preparation of photomontages.

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas, and is based on the number of people affected, land use, distance to the proposal etc. Sensitivity ratings are defined as high, moderate or low as outlined in Table 6-12 below.

Visual effect is defined as the interaction between a proposal and the existing visual environment, and is often expressed as the level of visual contrast of the proposal against its setting or background:

- Low level occurs when a proposal blends in with its existing viewed landscape due to high levels of integration or screening.
- Moderate level occurs where a proposal is visible and contrasts with its viewed landscape with a degree of integration.
- High level results when a proposal has a high visual contrast with little or no screening or integration.

The visual impact refers to the change in appearance of the landscape as a result of development. Visual impact is the combined effect of visual sensitivity and visual effect. Combinations of visual sensitivity and

visual effect will result in high, moderate and low overall visual impacts as suggested in Table 6-13. Table 6-12 Visual sensitivity rating table

VISUAL SENSITIVITY RATING					
	DISTANCE FROM SOLAR FARM				
LANDUSE	0-1 km	1-2 km	2 - 4.5 km	4.5-7 km	> 7 km
Townships	HIGH	HIGH	HIGH	LOW	NIL
Recreational Reserve	HIGH	HIGH	HIGH	LOW	NIL
Homestead	HIGH	HIGH	MOD	LOW	NIL
Rural Township	HIGH	HIGH	MOD	LOW	NIL
Main Highway	MOD	MOD	LOW	NIL - LOW	NIL
Local Roads	MOD	MOD	LOW	NIL - LOW	NIL
Farm Road	LOW	LOW	NIL - LOW	NIL - LOW	NIL
Agricultural Land	LOW	LOW	NIL - LOW	NIL - LOW	NIL

Table 6-13 Visual impact rating table

VISUAL IMPACT RATING				
		VISUAL EFFECT		
		HIGH	MODERATE	LOW
VISUAL SENSITIVITY	HIGH	HIGH IMPACT	HIGH IMPACT	MODERATE IMPACT
	MODERATE	HIGH IMPACT	MODERATE IMPACT	LOW IMPACT
	LOW	MODERATE IMPACT	LOW IMPACT	LOW IMPACT

Viewpoints were then selected to represent a range of views in the region, and these were informed by topographic maps, field work observations and other relevant influences such as access, residents, landscape character and the popularity of vantage points.

### 6.4.2 Results

A total of 12 viewpoints were taken during the field work process and assessed (Figure 6-5). The viewpoints are representative of where the development would be most prominent, either based on the degree of exposure or the number of people likely to be affected. Viewpoints were taken predominantly from accessible public places.

A summary of the viewpoint assessment can be seen in Table 6-14.

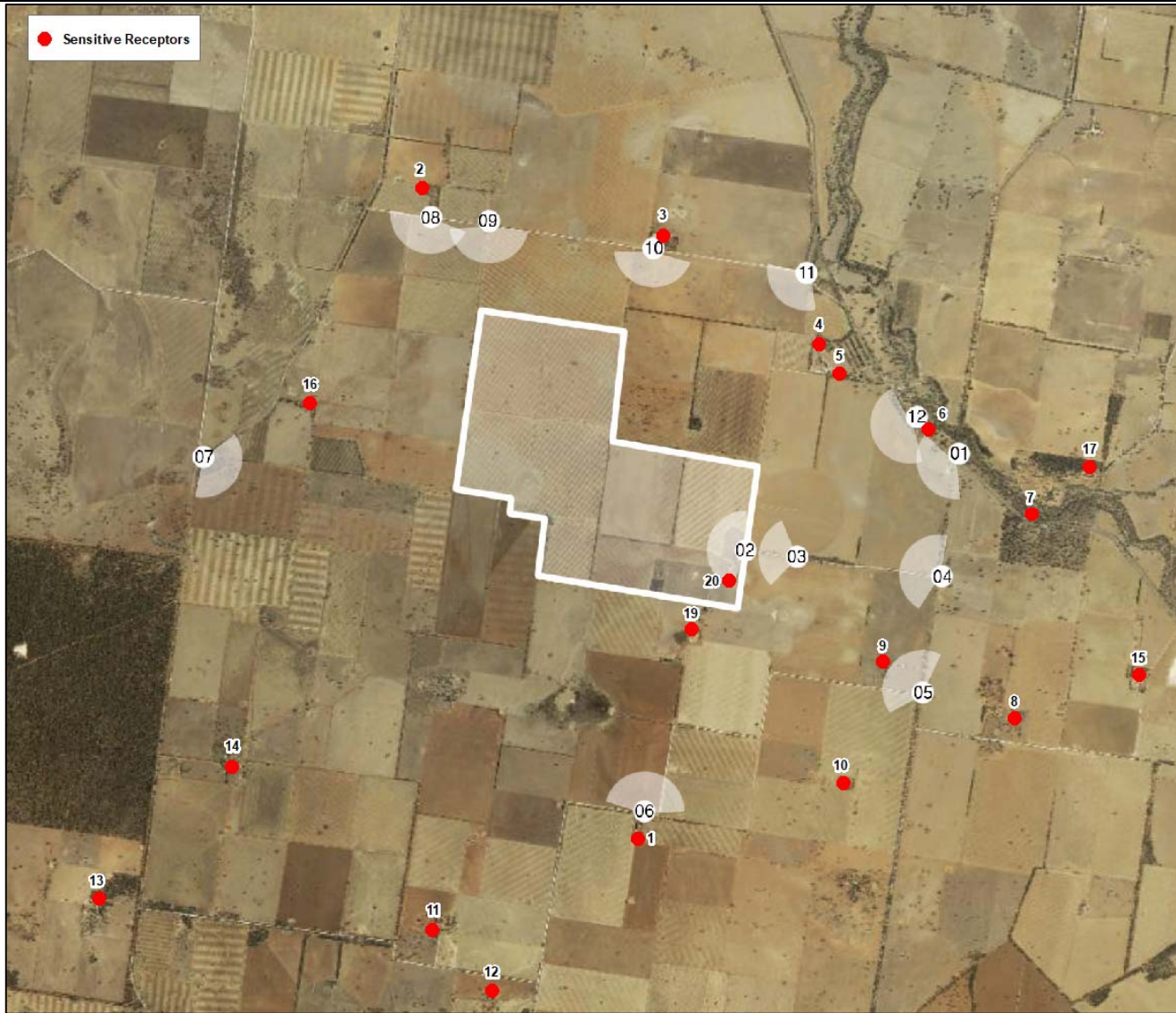


Figure 6-5 Viewpoint Assessment Locations

Table 6-14 Summary of Viewpoint Analysis

VIEWPOINT	PHOTO-MONTAGE	LOCATION	VISUAL SENSITIVITY RATING	VISUAL EFFECT RATING	VISUAL IMPACT RATING
VP01		Corner of Sturt Highway and Sandigo Road	LOW	LOW	LOW
VP02		Muntz Road	LOW	MODERATE	LOW
VP03		Muntz Road	LOW	LOW	LOW
VP04	PM01	Corner of Muntz Road and Sandigo Road	LOW	LOW	LOW
VP05		Corner of Birrego Road and Sandigo Road	LOW	NIL	NIL
VP06	PM02	Birrego Road	LOW	LOW	LOW
VP07		Strontian Road	LOW	NIL	NIL
VP08	PM03	Quilters Road	LOW	LOW	LOW
VP09		Quilters Road	LOW	LOW	LOW
VP10		Quilters Road	LOW	LOW	LOW
VP11	PM04	Quilters Road	LOW	LOW	LOW
VP12		Sturt Highway	LOW	LOW	LOW

The visual sensitivity and visual effect of each viewpoint was assessed, which resulted in an overall visual impact for the viewpoint. The proposal is likely to be visible from all of the viewpoints, with sensitivity rated as low for all viewpoints due to a combination of the viewing distances and land use.

The visual impact was rated as low for the majority of viewpoint locations due to distance and vegetation screening. The proposal will be screened from viewpoints VP05 and VP07 and therefore would be no variation to the existing landscape character. A moderate visual effect was recorded for VP02 due to the close proximity. However, due to the low visual sensitivity of the viewpoint, the visual impact will be low.

Photo montages of the proposal were prepared to assist in the impact assessment. A total for four viewpoints were selected, which are generally viewpoints determined to have the greatest potential for visual impact and best represent a range of distances and locations with differing views (Figures 6-5 to 6-8 below):



PHOTOMONTAGE 01A: Existing view from Muntz Road & Sandigo Road (Viewpoint 04)



PHOTOMONTAGE 01B: Indicative extent of Solar Farm



PHOTOMONTAGE 01C: Zoomed and cropped from PM01B

Figure 6-6 Photo montage from Muntz Road and Sandigo Road (Viewpoint 04)





PHOTOMONTAGE 02A: Existing view from Birrego Road (Viewpoint 06)



PHOTOMONTAGE 02B: Indicative extent of Solar Farm



PHOTOMONTAGE 02C: Zoomed and cropped from PM02B

Figure 6-7 Photo montage from Birrego Road (Viewpoint 06)



PHOTOMONTAGE 03A: Existing view from Quilters Road (Viewpoint 08)



PHOTOMONTAGE 03B: Indicative extent of proposed Solar Farm



PHOTOMONTAGE 03C: Zoomed and cropped from PM03B

Figure 6-8 Photo montage from Quilters Road (Viewpoint 08)



PHOTOMONTAGE 04A: Existing view from Quilters Road (Viewpoint 11)



PHOTOMONTAGE 04B: Indicative extent of proposed Solar Farm



PHOTOMONTAGE 04C: Zoomed and cropped from PM04B

Figure 6-9 Photo montage from Quilters Road (Viewpoint 11)

### 6.4.3 Potential impacts

Opportunities to view the proposal and its associated infrastructure are limited due to a combination of the following:

- Distance to site from publicly accessible viewing locations.
- Existing boundary planting surrounding the site.
- Roadside vegetation.
- Vegetation surrounding homesteads.

Views from the highway are also likely to be hard to discern due to a combination of speed and direction of travel. Any views would be fleeting and fragmented by existing roadside vegetation.

Impacts from each viewpoint is summarised in Table 6-15.

Table 6-15 Summary of impact from viewpoints

VIEWPOINT VP01
From this location, the proposal would be largely screened by existing vegetation. The southern extent may be visible from this location, however due to distance and speed of travel it is unlikely to be noticeable by motorists. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.
VIEWPOINT VP02
From this location it is likely that a number of solar panels, the BSF, transformer and temporary construction compound will be visible. Vegetation in the foreground is likely to fragment these views. The visual effect has been assessed as <b>moderate</b> resulting in a <b>low</b> visual impact rating.
VIEWPOINT VP03
From this location it is likely that the proposed solar farm and associated infrastructure will be visible to the north-west. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating if mitigation methods are employed.
VIEWPOINT VP04
It is likely vegetation on Muntz Road will screen views towards the southern portion of the site. Screening vegetation to the north will fragment views of infrastructure. Solar panels associated with the northern section may be visible through scattered vegetation to the north-west. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.
VIEWPOINT VP05
It is likely that views towards the proposal would be predominately screened by vegetation associated with 'Ellerslie'. Some fragmented views towards a small portion may be available through the middle ground, however is unlikely to be noticeable. There is likely to be no noticeable variation to the existing visual landscape from this viewpoint.
VIEWPOINT VP06
It is unlikely the proposal would be visible from the viewpoint given distance, and existing vegetation is likely to fragment views towards the proposal. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.
VIEWPOINT VP07
It is likely the proposal would be screened by vegetation in the foreground from the location. There is likely to be no noticeable variation to the existing visual landscape from this viewpoint.
VIEWPOINT VP08

<p>It is likely the proposal would be visible from this viewpoint in the distance to the south. Existing vegetation along the western boundary is likely to slightly fragment views towards the proposal. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.</p>
<b>VIEWPOINT VP09</b>
<p>It is likely the proposal would be visible from this viewpoint in the distance to the south. Existing vegetation along the western boundary is likely to fragment views towards the proposal. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.</p>
<b>VIEWPOINT VP10</b>
<p>It is likely the proposal would be visible from this viewpoint to the south-west. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.</p>
<b>VIEWPOINT VP11</b>
<p>It is likely a small section of the proposal will be visible through the break in vegetation to the south. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.</p>
<b>VIEWPOINT VP12</b>
<p>It is likely that the eastern section of the proposed solar farm would be visible through the break in vegetation to the south. Due to the speed of travel along the Highway, views would be fleeting and hard to discern. The visual effect has been assessed as <b>low</b> resulting in a <b>low</b> visual impact rating.</p>

#### 6.4.4 Safeguards and mitigation measures

Table 6-16 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
VA1	Avoidance of unnecessary lighting, signage, logos etc.	C		
VA2	Consideration given to controlling the type and colour of building material used especially with the use of light, highly reflective cladding, brick and tile materials which contrast dramatically with the landscape character. Any proposed buildings to be sympathetic to existing architectural elements in the landscape.	C		
VA3	Minimise cut and fill and loss of existing vegetation throughout the construction process. Where appropriate reinstate any loss in vegetation and allow natural vegetation to regrow over any areas of disturbance.	C	O	D

C: Construction; O: Operation; D: Decommissioning

## 6.5 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

The nature of a development determines whether a permanent land use change occurs or whether the development is reversible. Apart from direct uses of the land, such as agriculture, electricity generation or mining, associated impacts, such as the degree of visual impact and traffic regimes, can affect the compatibility of alternative land uses. These issues as they relate to the proposal are discussed below.

The proposal is consistent with the aims and planning principles of the Rural Lands SEPP. Part 4 of the SEPP relates to state significant agricultural land. Given the development site is not identified in Schedule 2, it is not identified as state significant agricultural land and Part 4 does not apply.

### SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

#### **Land –**

*An assessment of the impact of the development on agricultural land (including possible cumulative impacts on agricultural enterprises and landholders) and flood prone land, an assessment of any impacts to Crown lands, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries including but not limited to Wrights Pit, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and biosecurity risk) during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivision; and measures to remediate the land following decommissioning in accordance with State Environmental Planning Policy No 55 - Remediation of Land;*

### NSW DEPARTMENT OF PLANNING AND ENVIRONMENT – RESOURCES AND GEOSCIENCES

*The Division has reviewed the draft SEARs and provides the following advice:*

*The EIS requires an assessment of the impact of the development on existing land uses, including the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities) during operation and decommissioning.*

*Required to consult with the operators and/or title holders to establish if the proposal is likely to have a significant impact on current or future extraction of minerals, petroleum or extractive materials (including limiting access to, or impeding assessment of), and any way the proposed development may be incompatible with any existing approved uses, or current or future extraction or recovery.*

*Include a mineral, coal and petroleum titles search through the MinView Application, with results shown on a map.*

*EIS should identify Wrights Pit in text and on maps in relation to the project proposal and address land use compatibility considerations.*

*Should biodiversity offset be considered, LUTA requests consultation to ensure there are no potential sterilisation impacts to resources.*

### DEPARTMENT OF INDUSTRY

*The Department provides the following advice:*

*An assessment of the impact of the development of agricultural land and flood prone land, assessment of any impact to Crown Lands, a soil survey to consider the potential for erosion to occur, and assessment of compatibility of development with the existing land uses on the site and adjacent land during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivisions.*

*Measures to remediate the land following decommissioning in accordance with SEPP No. 55 – Remediation of Land.*

Assessment of rehabilitation and decommissioning/closure management that outlines rehabilitation objectives and strategies to guide the return of the land to agricultural production.

### 6.5.1 Existing environment

#### Agriculture and land capability

Sheep, beef cattle and grain farming involve 9.1% of the population of the Narrandera LGA (ABS, 2016). Crop production is dominated by grains, legumes and oilseeds (Narrandera Shire Council, 2017). Irrigated agriculture in the LGA includes grapes, fruit, nuts, vegetables, cotton and rice (Narrandera Shire Council 2017).

Mapping for the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (The Mining SEPP) does not extend as far as the proposal. As such, it is unknown if the land is classed as **Biophysical Strategic Agricultural Land** (BSAL), however it is unlikely given the environmental context of the land; BSAL has been described as land with high quality soil and water resources capable of sustaining high levels of productivity.

The land is classified as Class 3 under the Land and Soil Capability Assessment Scheme (OEH, 2012) and is described as sloping land capable of sustaining cultivation on a rotational basis (Figure 6-10). The land is readily used for a range of crops including cereals, oilseed and pulses. This class of land is considered **High Capability Land**: Land that has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.

It is important to note that solar farms do not preclude the use of land for agriculture. Some agricultural activity is still possible whilst a solar farm is operating (e.g. grazing). Additionally, the degree of permanent land disturbance in the construction and operation of solar farms is small, and upon decommissioning of the proposal, the development footprint will be rehabilitated to restore land capability to pre-existing agricultural use.

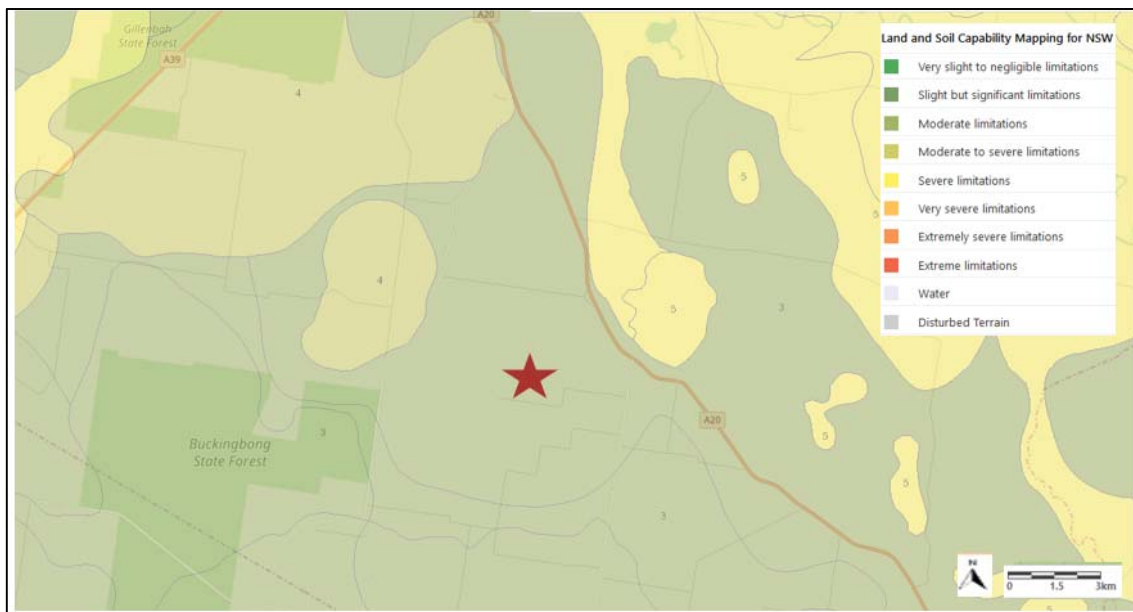


Figure 6-10 Land and soil capability mapping of the development site and surrounding area (SEED 2018a). The red star indicates the subject land, which is classed as Moderate Limitations.

## Surrounding land uses

Land use activities surrounding the development site are predominantly agriculture with associated rural dwellings. The development site is zoned RU1 (primary production) with surrounding zoning including RU3 (forestry) and RU4 (primary production small lots) (Figure 6-11). Surrounding agricultural land generally consists of cropping and grazing. Other land uses in the locality include:

- Buckingbong State Forest is located within 5 km of the development site. Buckingbong State Forest (Figure 6-10) is 11,922 ha of hardwood forest (NSW Forestry Corporation 2014).
- Travelling Stock Reserves to the north of the site, along the Sturt Highway.
- Residential dwellings and associated dwellings.
- Public road network.
- Electricity connection and transmission infrastructure.
- Wright's Quarry within 3 km of the site.
- Township of Narrandera within 20 km of the site comprising retail, health, accommodation and community services (refer to Section 7.5).
- The natural waterways of Sandy Creek (1.5 km) and the Murrumbidgee River (14 km) north of the site.

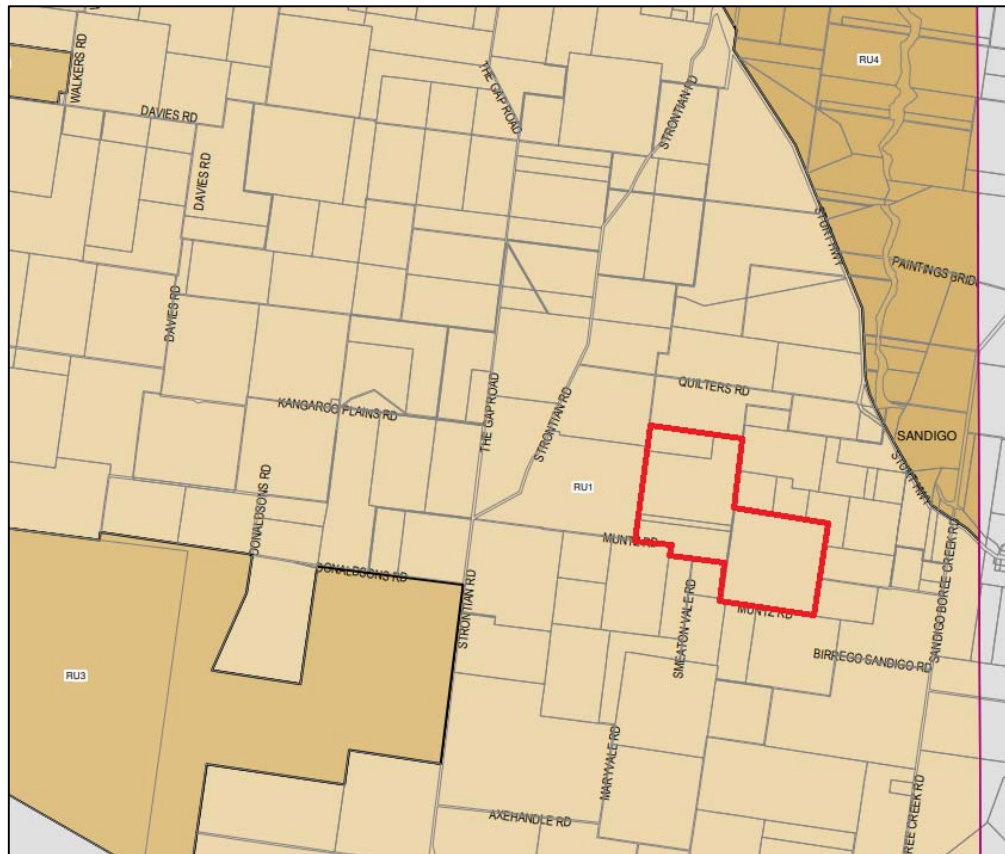


Figure 6-11 Land zoning surrounding development site (NSW Government 2013). *The subject land is identified by the red line.*

One exploration licence (EL0658) over the property was extinguished in 1974 (Figure 6-12). The development site no longer holds any mineral exploration licences or licence applications, and there are no exploration licences or licence applications within proximity of the development site. Wrights Quarry is also located approximately 2.75 km from the development site (Figure 6-12).



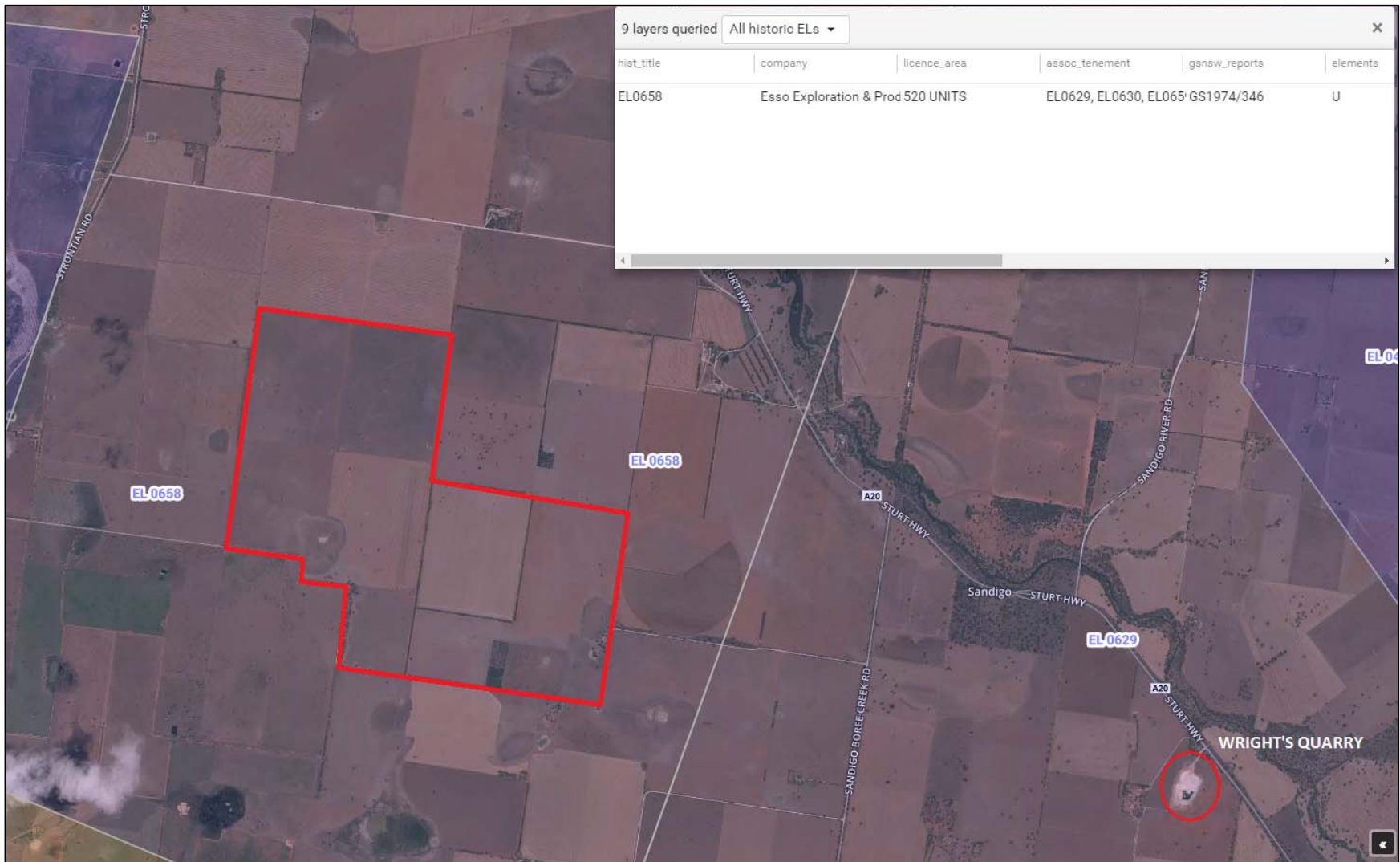


Figure 6-12 Extinguished Exploration Licences and quarries (MinView 2018)

## 6.5.2 Potential impacts

### Land use conflict risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). Given the proposed solar farm is different to the surrounding land use activities, primarily agriculture, this assessment aims to identify and rank potential land use conflicts so that they may be adequately managed. Where expected conflicts are adequately managed, the rights of the existing and proposed land uses can be protected.

The risk ranking in Table 6-18 has been determined using the risk ranking matrix shown in Table 6-17, and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). The matrix ranks the risk of impacts according to the probability of occurrence and the consequence of the impact. Probability 'A' is described as 'almost certain' to probability 'E', which is described as 'rare'. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk (DPI, 2011).

Table 6-17 Risk ranking matrix (Source: DPI, 2011)

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

Table 6-18 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
	Probability	Consequence		Probability	Consequence
Agricultural spraying (aerial)	D4	5	There is unlikely to be an impact to aerial spraying activities given low levels of glare and the limited height of infrastructure.	D4	5
Contaminated surface water runoff	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generated during the construction and decommissioning stages to be managed by the use of water carts when required. Dust is not expected to generate a land use conflict during operation.	C5	4

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Fire/ Bush fire	C1	22	Implementation of a Bush Fire Management Plan would significantly reduce the probability of solar farm operation starting a fire or a bush fire damaging the solar farm infrastructure	D3	9
Visual amenity	C2	18	Retain all existing boundary vegetation as screening. Reinstate any vegetation lost through the construction phase.	D5	2
Noise	C4	8	Noise generated during construction and decommissioning stages would be minimised through the implementation of mitigation measures.  Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict.	D4	5
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely, however the impact would be temporary and able to be managed (refer to Section 7.3).  There is a Travelling Stock Reserve with high conservation value within 2 km of the development site. Given the close proximity of the proposed access point to the Sturt Highway and that there is adequate room along Sandigo Road and Muntz Road for movement of stock, it is considered unlikely that traffic movements would generate a land use conflict with movement of local stock.  Traffic is not expected to generate a land use conflict during operation.	C4	8
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation phases	D4	5
Flood	C3	13	Implementation of erosion and sedimentation control measures.	C5	4

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			Implementation of a flood management strategy.		
Resource extraction/exploration	D3	9	It is unlikely there will be an impact on resource extraction or exploration.  In the long term (after decommissioning), the solar farm infrastructure would be removed, and the site made available for alternate land uses including for mining purposes, if desirable.	D5	2

### Construction and Operation

The expected impact on surrounding land uses during construction is considered to be minimal given the temporary nature of the work and the implementation of mitigation strategies would further reduce the level of impact.

Once construction of the solar farm commences, agricultural activities would cease in the areas involved in access and construction. Some agricultural activity could resume following completion of construction.

There may be some disruption to local traffic during the construction and due to construction traffic movements, which may impact the operation of surrounding land uses. This would be a temporary impact and could be managed in consultation with local landholders.

There are Travelling Stock Reserves (TSRs) within 7 km of the site, along the Sturt Highway. These are listed as having moderate to high conservation value (SEED, 2018b). There is adequate room along the Sturt Highway, Sandigo Road and Muntz Road for movement of stock. It is considered unlikely that traffic movements associated with the proposal activities would generate a land use conflict with movement of local stock. The likelihood of conflict can be further minimised by consulting with local landholders.

Connection of transmission lines to the TransGrid overhead power lines would be undertaken in consultation with TransGrid. The power lines are located within the development site and are unlikely to generate a land use conflict with surrounding landholders.

The potential operational land use impact has been assessed in accordance with guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013) and *The Land and Soil Capability Assessment Scheme* (OEH, 2012).

#### LAND AND SOIL CAPABILITY IMPACTS

The proposal is not expected to adversely affect the biophysical nature of the land which determines its capacity. During any broad area or trench line excavations at the site, topsoil would be removed, stockpiled separately and replaced to restore the original soil profile. Topsoil salvaged from the construction of the access tracks and other works would also be securely stored for use in site rehabilitation. Following construction, a perennial cover would be established to protect soils, enhance landscape function and prevent wind and water erosion. Some soil nutrients are expected to run down over time with the cessation

of the crop fertiliser regime. Soil restoration and treatments would be guided by the findings of a pre-works soil survey conducted at the site (refer section 7.1).

By maintaining perennial cover, the proposal would positively affect soils at the site by providing many of the benefits of long term fallow, including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving conditions for soil biota. Depending on the results of soil testing, treatment for acidity may be required prior to the establishment of groundcover (refer section 7.1). No loss of productive potential is expected to result from the proposal.

#### **AGRICULTURAL IMPACTS**

The NSW Murray Region, the broad region in which the subject land is located, contains approximately 910,000 ha of productive agricultural land supply, of which 770,000 ha is used for cropping. Approximately 550 ha of productive farming land will be lost to the solar farm development. This is 0.07% of all cropping land and 0.06% of all productive land in the NSW Murray Region (Appendix K). Therefore, the development of a solar farm would potentially result in the following agricultural impacts:

- Limited resource loss for the lifetime of the solar farm.
- A potential change to biosecurity risks.
- Potential increased bushfire risks.

Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing agricultural condition.

Some sheep grazing may continue to be undertaken at the proposal site for production purposes and to control grass and weed growth around the solar arrays. Grass fuel levels within the site would be managed to minimise bushfire risks. Adequate groundcover would be maintained to protect soil and water values, subject to climatic conditions.

#### **Resource loss and fragmentation**

The proposal would not impact on land identified by the NSW Government as BSAL. Construction works involve only minor excavation with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to section 7.1 and section 7.2 for soil and water quality impacts). At the end of the operational period, solar farm infrastructure would be removed, the land would be rehabilitated to its pre-existing condition and available for agricultural use. The proposal would not result in the permanent removal of agricultural land.

The proposal has been designed to minimise the development footprint.

#### **Disturbance to farming operations and livestock**

Adjacent farming operations are compatible with the proposal. Noise from nearby farming practices during the day would not impact on the proposal. The construction and decommissioning of the proposal would largely occur in daylight hours and would not conflict with adjacent farming activity.

Should any surrounding land be used for grazing, after a period of time livestock would become accustomed to the solar panels as they are to hundreds of installations currently on farms around the state.

During operation, the solar farm would be fenced for security. Strategic sheep grazing may be used within the development site to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.

### **Increase in biosecurity risks – pest, diseases and weed risks**

The proposal would result in the increased movement of vehicles and people to the development site. Higher numbers would access the development site during the construction and decommissioning phases. The primary risk to biosecurity is the spread of weeds that may result from the increased movement of vehicles in and out of the development site. Weed seeds can be transported through and from the development site on the tyres and undercarriages of vehicles and on the clothing of staff. The risk of weed dispersal would primarily be mitigated by confining vehicle and machinery movements to formed access tracks during all phases of the proposal and implementing a wash down procedure for vehicles entering the development site.

To assist in the management of all weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on the Narrandera Shire Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls.

An Operational Weed Management Plan would also be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the development site and the importation and spread of weeds through vehicle movements. The plan would also focus on weed control techniques including herbicides and grazing pressure.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can potentially increase the risk of pest animals at the development site (mostly cat and fox). Covered rubbish bins and regular waste removal during construction and operation would minimise this risk by removing the food source. Rabbit and fox numbers would be controlled through targeted pest management during the operational phase of the proposal. Grazing pressure and reduced plant matter would also reduce resources and cover for pest species.

### **Summary**

The duration of the proposal would be about 30 years. The loss of a very small amount of agricultural land in the region for this period is not considered a significant loss given:

- The development site is not BSAL.
- The proposal is highly reversible, with all above ground infrastructure being able to be removed to allow current agricultural land use activities to resume.
- Grazing practices can continue on site throughout operation of the solar farm.

During operation of the proposal it is considered that all potential land use conflicts could be adequately managed through the implementation of recommended mitigation measures.

### **MINING IMPACTS**

The development site is not located within an area that has been identified as a mining resource and there are no current mining exploration licences over the development site. Impacts on mining would be negligible. In the long term (after decommissioning), the solar farm infrastructure would be removed, and the site made available for alternative land uses, including for mining purposes, if desirable.

### **RENEWABLE ENERGY IMPACTS**

Given the proposal is for the construction of a solar farm, there would only be positive impacts in relation to renewable energy, such as increased renewable energy generation.

### **RESOURCE IMPACTS**

The proposal would require approximately 53,900 m<sup>3</sup> of gravel to surface the access road and internal service track network and CPU and substation hardstand. Sand may be required for the bedding of underground cables, depending on the electrical design and ground conditions. Approximately 10,000 m<sup>3</sup> of concrete would be required to construct the inverter, substation, CCTV and battery storage foundations. The availability of these resources is not declining or limited in the region.

Materials used in the fabrication and construction of the solar farm infrastructure would include precast masonry products and concrete, steel, aluminium, copper and other metals, glass, plastics and fuels and lubricants. These are common industrial and construction materials. Silicon and silver are the major raw materials for crystalline silicon PV; resource availability is not limiting for these materials. Most components would be reused or recycled when infrastructure is replaced or decommissioned.

In view of the nature of the resources, the limited quantities required and the opportunities for recycling, the proposal is unlikely to place significant pressure on the availability of local or regional resources. It is estimated that approximately 11.2 megalitres (ML) of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, on-site amenities and landscaping. The precise amount of water used during construction would be heavily affected by prevailing weather conditions and the need for watering to suppress dust generation.

A small amount of potable (drinking) water (approximately 0.34 ML) would be imported to the site during the construction period. The potable water supply would be augmented by rainwater collection in tanks installed beside site buildings as constructed. Any requirement for potable water would be limited, confined to the construction phase and would not place pressure on local drinking water supplies.

**Decommissioning**

As the proposal would have relatively low levels of impact on the soil surface, the proposal is considered to be highly reversible.

Following decommissioning the rehabilitated site would have similar opportunities for land use as the site currently possesses. At the end of the proposal, all above ground infrastructure would be removed and current agricultural activities could recommence.

**6.5.3 Safeguards and mitigation measures**

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-19.

Table 6-19 Safeguards and mitigation measures for land use impacts

No.	Safeguards and mitigation measures	C	O	D
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	C	O	D
LU2	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C		
LU3	A RDEMP is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning, and in accordance with State Environmental Planning Policy No 55 – Remediation of Land. The Rehabilitation and Decommissioning Management Plan is to include: <ul style="list-style-type: none"> <li>• Remove all above ground infrastructure.</li> <li>• Remove gravel from internal access tracks where required, in consultation with landowner.</li> <li>• Reverse any compaction by mechanical ripping.</li> </ul>			D

	<ul style="list-style-type: none"> <li>Reinstate irrigation infrastructure in consultation with landowner, including laser levelling and contour/bund reconstruction where required.</li> </ul>			
LU4	A pest and weed management plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Narrandera Shire Council and NSW DPI requirements. Where possible weed and pest management would be integrated with adjoining landowners.	C	O	
LU5	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	C	O	D
LU6	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning.	C		
LU7	If possible and practical, sheep grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		O	

*C: Construction; O: Operation; D: Decommissioning*



## 6.6 NOISE IMPACTS

### SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

#### **Noise –**

*Include an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and operational noise impacts in accordance with the NSW Noise Policy for Industry 2017 and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.*

Muller Acoustics Consulting Pty Ltd (MAC) was engaged to complete a Noise Assessment (NA) for the proposal (Appendix G). As per the SEARs, the purpose of the NA was to quantify potential environmental noise levels associated with the construction and operation of the proposal and identify mitigation measures.

The assessment includes the following:

- Review of construction and operation to identify noise generating plant, equipment, machinery or activities proposed to be undertaken.
- Identify the closest and/or potentially most affected receptors situated within the area.
- Establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs) and operational noise criteria.
- Undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the proposal at the closest and/or potentially most affected receptor.
- Provide a comparison of predicted noise levels against relevant construction NMLs and operational criteria.
- Assess the potential noise impacts associated with construction and operational aspects of the proposal.
- Provide feasible and reasonable noise management measures, and monitoring options where NMLs or operational criteria may be exceeded.

#### **6.6.1 Policy setting**

The NA was conducted in accordance with the following key policies, guidelines and standards (where relevant):

- NSW Department of Environment and Climate Change - NSW Interim Construction Noise Guideline (ICNG) 2009.
- Environment Protection Authority (EPA) - Noise Policy for Industry (NPI) 2017.
- NSW Department of Environment, Climate Change and Water (DECCW) - NSW Road Noise Policy (RNP) 2011.
- Standards Australia AS2436-2010 (R2016) (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.
- Standards Australia AS1055-1997 (AS1055) – Description and Measurement of Environmental Noise.
- Standards Australia AS IEC 61672.1-2004 (AS61672) – Electro Acoustics – Sound Level Meters Specifications Monitoring.

- Standards Australia AS1259.2-1990 (AS1259) – Acoustics Sound Level Meters – Integrating/Averaging as appropriate to the device.
- Standards Australia AS IEC 60942-2004 (AS60942) – Electroacoustics – Sound Calibrators

**Interim Construction Noise Guideline**

The assessment and management of noise from construction work is completed with reference to the ICNG, which is aimed at managing noise from construction work regulated by the EPA and used to assess in setting statutory conditions in licences or other regulatory instruments.

The ICNG sets out procedures to identify and address the impact of construction noise on residents and other sensitive land uses.

The ICNG provides 2 methodologies for the assessment on construction noise emissions. For the purpose of the NA, a quantitative assessment approach has been adopted. This includes identification of potentially affected receptors, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impacts at receptors, and provision of management and mitigation recommendations.

Table 6-20 summarises the ICNG recommended standard hours for construction and NMLs.

Table 6-20 Construction Noise Levels

Recommended Construction Hours	Noise Levels LAeq,15min <sup>1</sup>
Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	RBL + 10 dB
Justified work outside standard construction hours	RBL + 5 dB
Highly noise affected, likely strong community reaction	=75 dB(A)

The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the Assessment Base Levels.

Strong justification would typically be required to work outside of the recommended standard hours. As no work outside standard working hours is proposed, only the daytime noise management levels have been assessed.

**Noise Policy for Industry**

The NSW Noise Policy for Industry (NPI) (EPA, 2017) provides a process for establishing noise criteria for consents and licences enabling the EPA to regulate noise emissions from scheduled premises under the POEO Act. The policy sets out the procedure to:

- Determine the Project Noise Trigger Levels (PNTL) relevant to an industrial development. The PNTL is the lower value of the Project Intrusiveness Noise Level (PINL) and Project Amenity Noise Level (PANL).
- The PINAL (LAeq,15min<sup>1</sup>) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment.
- PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial

sources should remain below the recommended amenity noise levels (Table 6-21). The NPI defines 2 categories of amenity noise levels:

- Amenity Noise Levels (ANL) – determined considering all current and future industrial noise within a receiver area.
- Project Amenity Noise Levels (PANL) – recommended levels for a receiver area, specifically focusing on the project being assessed.

Table 6-21 NSW Recommended amenity noise levels for rural areas

Receiver Type	Noise Amenity Area	Time of Day	Recommended amenity noise level LAeq, dBA
Residential	Rural	Day	50
		Evening	45
		Night	40

### 6.6.2 Assessment Criteria

Background noise monitoring has not been conducted for the proposed Avonlie Solar Farm hence, the minimum applicable RBL of 35dBA for the daytime and 30dBA for the evening and night time periods was adopted for the NA.

NMLs for construction activities at all residential receptors are 45dB LAeq, 15min (RBL + 10dB). Construction activities will be limited to standard working hours, however relevant NML for standard hours and out of hours periods are summarised in Table 6-22.

Table 6-22 Construction noise management levels

Location	Time of day	RBL, dBA	NML dB LAeq, 15min
All Residences	Day	35	45 (RBL + 10dBA)
	Evening	30	35 (RBL + 5dBA)
	Night	30	35 (RBL + 5dBA)

PINLs for the proposal are presented within Table 6-23 and are determined based on the RBLs + 5dBA

Table 6-23 Project Intrusive Noise Levels

Location	Time of day	Adopted RBL dB LA90	PINL dB LAeq, 15min
All Residences	Day	35	40
	Evening	30	35
	Night	30	35

The PNTL are the lower of either the PINLs or the PANLs. Table presents the derivation of the PNTL's in accordance with the methodologies outlined in the NPI. For the NA the night time PNTL of 35dB LAeq, 15min is the limiting criteria.

Table 6-24 Project Noise Trigger Levels

Catchment	Time of day	Intrusive Noise Level dB LAeq, 15 min	PANL dB LAeq, 15min	PNTL dB LAeq, 15min
Residential Receptors (Rural)	Day	40	53	40
	Evening	35	48	35
	Night	35	43	35

The maximum noise level screening criterion is based on night time RBLs and trigger values as per the NPI.

Table 6-25 Maximum Noise Assessment Trigger Levels

LAeq, 15min		LAmix	
40dB LAeq, 15min or RBL + 5dB		52dB LAmix or RBL + 15dB	
Trigger	40	Trigger	52
RBL + 5dB	35	RLB + 5dB	45
<b>Highest</b>	<b>40</b>	<b>Highest</b>	<b>52</b>

### 6.6.3 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receptors for typical construction activities and operations (including road noise). A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data, ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receptors. Plant and equipment were modelled at various locations and heights, representative of realistic construction and operational conditions for assessed scenarios.

Construction activities are proposed to be progressive and will occur at several locations simultaneously. Noise emissions were modelled for the following scenarios:

- Earthworks involving trenching for cabling.
- Piling of panel supports.
- Assembly of panels.

It was envisaged that all three scenarios would occur simultaneously at up to 10 locations across the site.

Noise predictions were modelled for a typical worst-case scenario over a 15-minute period.

Noise emission can also be significantly influenced by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source. Prevailing winds for the proposal were obtained from the Bureau of Meteorology weather station near Narrandera Airport. The data was then analysed.

### 6.6.4 Results

Location of all sensitive receptors from the MAC report are detailed in Figure 6-13.

#### Construction Noise Results

Noise levels were predicted to each assessed receptor assuming receiver heights of 1.5 m above ground level for typical construction activities. Table 6-26 summarises the maximum predicted noise level from each of the construction scenarios (trenching, piling and assembly) at identified residential receptors.

Table 6-26 Predicted construction noise levels

Receiver ID	Address	Highest Predicted Noise Level dB LAeq,15min	NML Standard Hours dB LAeq,15min	Compliance
R4	1895 Sandigo Road	<30	45	Yes
R5	1777 Sandigo Road	<30	45	Yes
R6	441 Birrego Road	30	45	Yes
R7	838 Birrego Road	<30	45	Yes
R8	2358 Strontian Road	<30	45	Yes
R9	2794 Strontian Road	36	45	Yes
R10	456 Quilters Road	35	45	Yes
R11	204 Quilters Road	37	45	Yes
R12	7781 Sturt Highway	34	45	Yes
R13	7715 Sturt Highway	34	45	Yes
R14	7662 Sturt Highway	31	45	Yes
R14	7481 Sturt Highway	<30	45	Yes
R15	Settlers Road	<30	45	Yes
R15	7259 Sturt Highway	<30	45	Yes
R16	838 Birrego Road	<30	45	Yes
R17	2195 Strontian Road	<30	45	Yes
R18	838 Birrego Road	<30	45	Yes

### Operational Noise

Noise levels were predicted at each assessed receptor assuming receiver heights of 1.5 m above ground level. Table 6-27 summarises the predicted operational noise levels which are demonstrated to comply with the PNTLs at all residential receptors.

Table 6-27 Predicted Operational Noise Levels

Receiver ID	Address	Predicted Noise Level	Limiting Night PNTL	Comply
		dB LAeq,15min	dB LAeq,15min	
R4	1895 Sandigo Road	<20	35	Yes
R5	1777 Sandigo Road	<20	35	Yes
R6	441 Birrego Road	<20	35	Yes
R7	838 Birrego Road	<20	35	Yes
R8	2358 Strontian Road	<20	35	Yes
R9	2794 Strontian Road	<20	35	Yes
R10	456 Quilters Road	<20	35	Yes
R11	204 Quilters Road	20	35	Yes
R12	7781 Sturt Highway	20	35	Yes
R13	7715 Sturt Highway	20	35	Yes
R14	7662 Sturt Highway	<20	35	Yes
R14	7481 Sturt Highway	<20	35	Yes
R15	Settlers Road	<20	35	Yes
R15	7259 Sturt Highway	<20	35	Yes
R16	838 Birrego Road	<20	35	Yes
R17	2195 Strontian Road	<20	35	Yes
R18	838 Birrego Road	<20	35	Yes

### Maximum Noise Level Assessment - Operations

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB LAeq,15min and/or 52dB LAmax.

### Overall Result

The results of the NA demonstrate that construction noise levels satisfy relevant construction NMLs and operational noise levels satisfy the NPI PNTLs for assessed receptors. The results of the assessment show compliance with the relevant construction, operational and road noise criteria.

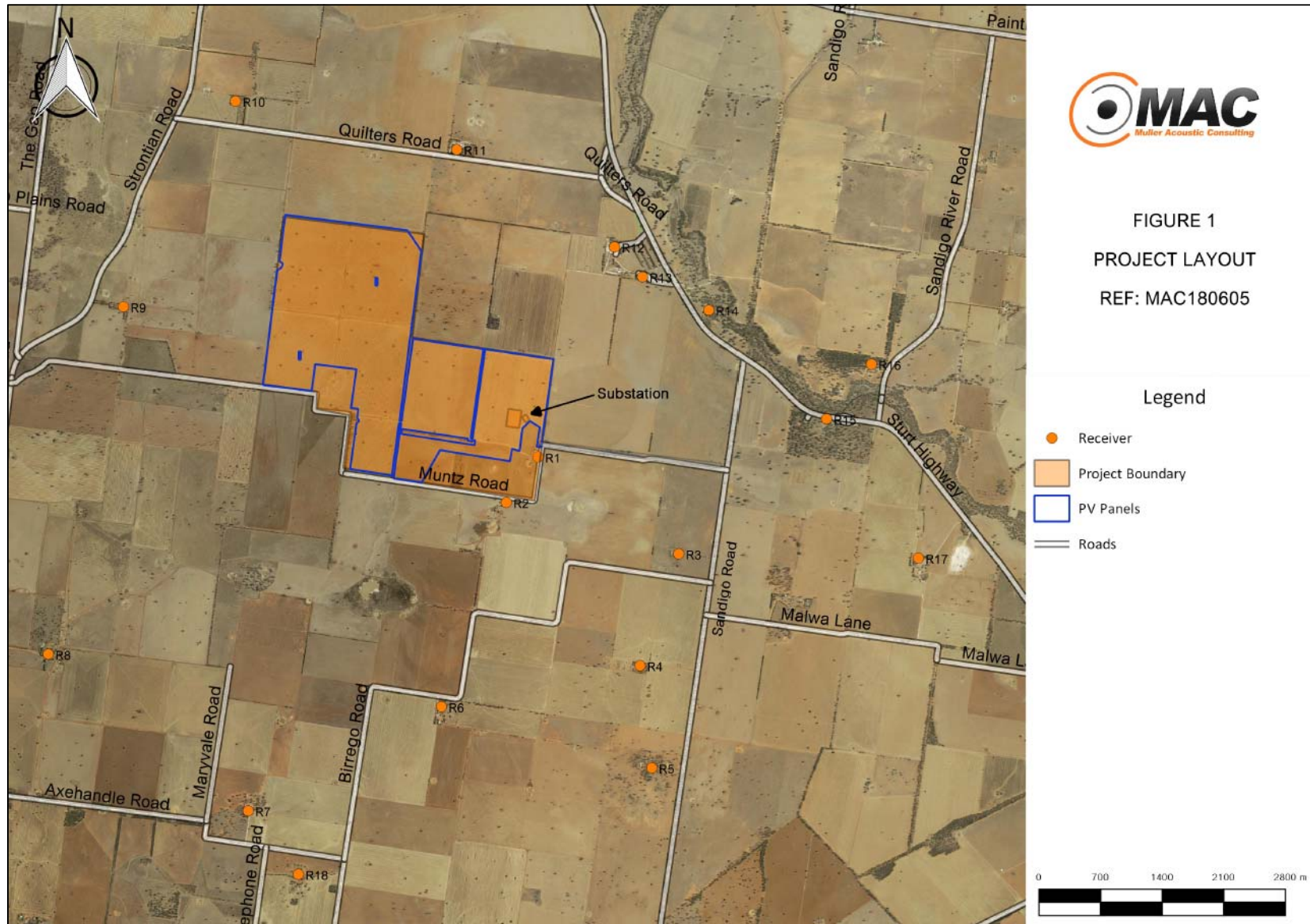


Figure 6-13 Sensitive Receptors

**6.6.5 Safeguards and mitigation measures**

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation)  Monday – Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	C		
NS2	Development of a Construction and Operational Noise Management Protocol to minimise noise emissions, manage out of hours works (minor) to be inaudible and response to community concern.	Prior to construction	O	
NS3	Operate plant in a conservative manner, which includes: <ul style="list-style-type: none"> <li>• Selection of the quietest suitable machinery.</li> <li>• Avoidance of noisy plant working simultaneously where practical.</li> <li>• Utilise broadband reverse alarm in lieu of high frequency type.</li> </ul>	C	O	D
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner. Provide toolbox meetings, training and education.	C	O	D
NS5	A letter box drop would be prepared and provided to residences in close proximity to the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	Prior to and during construction	O	D
NS6	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	C	O	D
NS7	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	C	O	

*C: Construction; O: Operation; D: Decommissioning*



## 7 ASSESSMENT OF ADDITIONAL ISSUES

### 7.1 SOIL

#### 7.1.1 Approach

The soil survey was undertaken by DM McMahon Pty Ltd. The report provides an analysis and evaluation of landforms and soil types as identified on subject land. Limitations and management actions are provided for the soil landscapes that have been identified. The report is available in full in Appendix H.

The methods that were used for sampling and classification of in situ soils was carried out as per the Australian Soil and Land Survey Field Handbook (NCST 2009) and The Australian Soil Classification (Isbell, 1996). Using the Guidelines for Surveying Soil and Land Resources (McKenzie *et al.* 2008), it was deemed that the density of investigation of the pits should be 'Moderately High (Detailed)' to satisfy the project planning objectives. For the full technical detail, refer to the report in Appendix H.

#### 7.1.2 Existing environment

A desk top survey was undertaken of the development site. A field survey was undertaken of 30 representative survey sites. The soil was analysed for topsoil and subsoil pH, electrical conductivity (EC), dispersion, nutrients and cations. The field survey sites are shown in Figure 7-1.

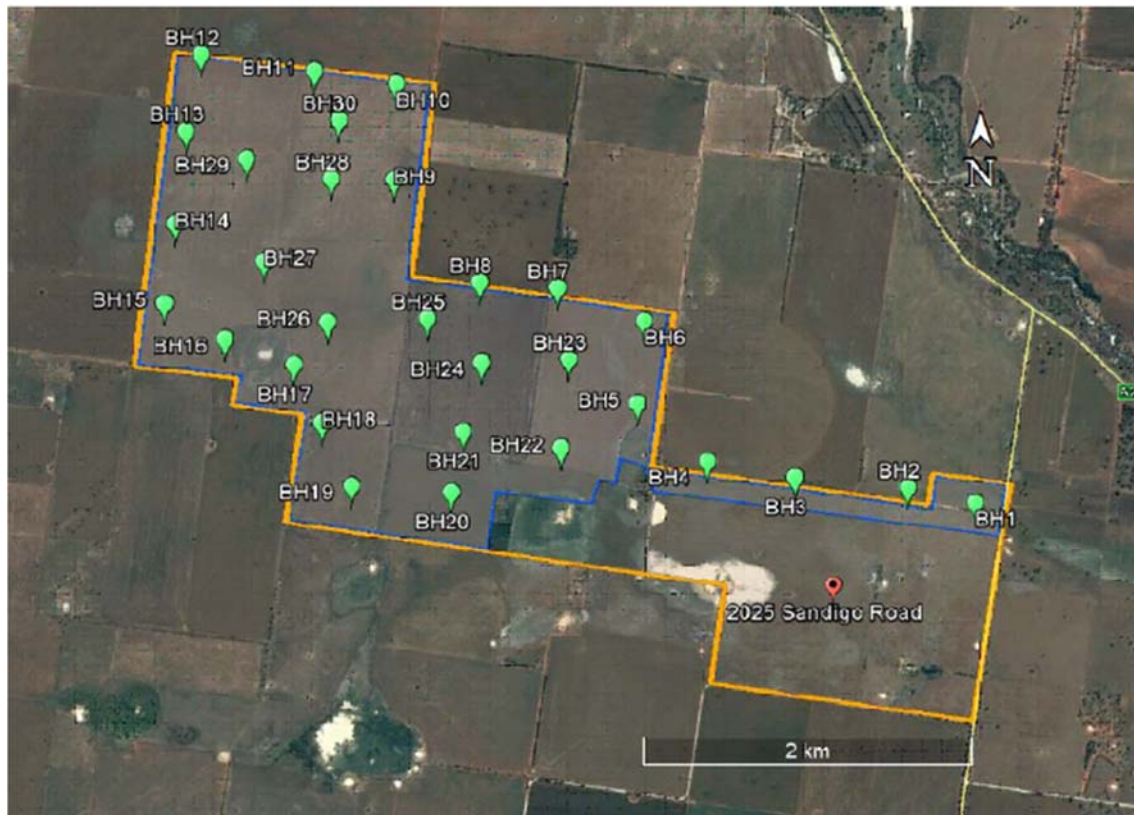


Figure 7-1 Soil survey core locations (McMahon, 2018). The boundary of the development site is indicated in yellow and the development footprint in blue

### Topography and geology

The site is located at an approximate elevation of 150 m above sea level. The site is classed as level and the landform is flat. The site geology is distributed over Cainozoic alluvium.

### Potential contamination

A search of the NSW EPA contaminated land public record (NSW Government, 2018a, 2018b) was undertaken for contaminated sites within the Narrandera Shire Council LGA on 28 March 2018. The search did not return any results for the LGA.

There is a risk that contamination associated with agricultural activities (such as use and storage of pesticides) could be present in the development site. However, no evidence of contamination was observed during the field work and this risk is considered very low.

### Soil

The site encompasses 2 units **Oc3** and **Oc7** from the Digital Atlas of Australian Soils (Figure 7-2), which are described in Table 7-1.

Table 7-1 Soil units in development site

Oc3	
Landscape	Plains with domes, lunettes and swampy depressions. Divided by continuous or discontinuous low river ridges associated with prior stream systems. Area traversed by present stream valleys.
Soils	Layered soil or sedimentary materials common at fairly shallow depths. The main soils are hard alkaline red soils, grey and brown cracking clays and other soils in a complex soil pattern.  General features include: <ol style="list-style-type: none"> <li>I. Well drained to moderately drained plains often with thin A horizons.</li> <li>II. Moderately to poorly drained gilgai plains subject to some seasonal flooding.</li> <li>III. Poorly drained gilgai plains subject to frequent seasonal flooding.</li> <li>IV. Swampy depressions.</li> <li>V. Domes.</li> </ol>
Oc7	
Landscape	Undulating country with broad slopes and low, narrow, often gravelly or stony ridges.
Soils	The main soils are hard alkaline red soils throughout the undulating terrain. Associated soils include: <ol style="list-style-type: none"> <li>I. Red earths, sometimes with clay D horizons in depositional sites.</li> <li>II. Gravelly or stony ridges of hard neutral red soils and shallow loams.</li> <li>III. Small gilgai areas with some cracking clays.</li> </ol>

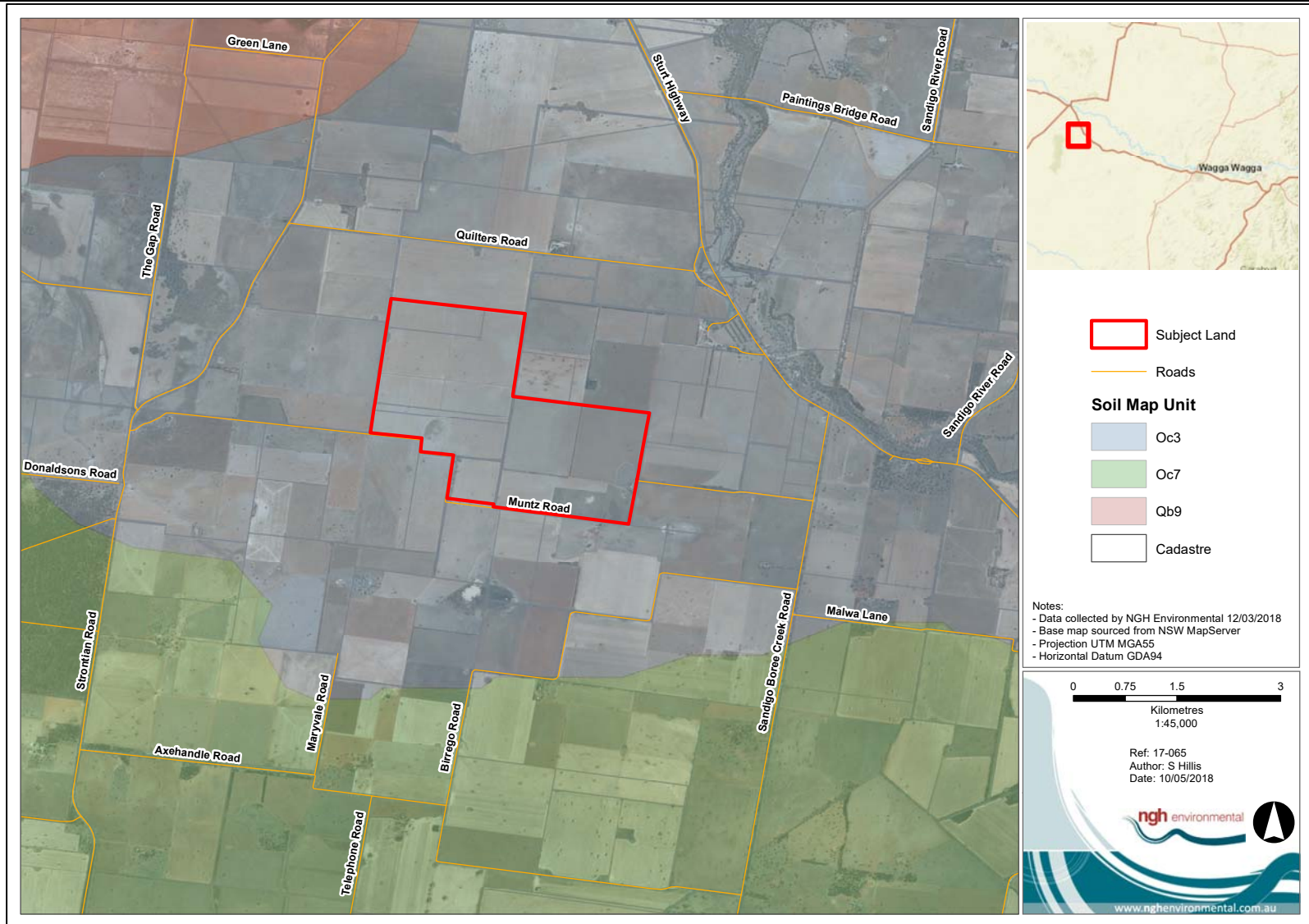


Figure 7-2 Digital Atlas of Soils mapping

Two soil characteristics exist at the site, Chromosols and Sodosols, classified using the Australian Soil Classification System (Isbell 1996).

**CHROMOSOLS**

These soils are mostly commonly encountered with agricultural use in Australia. The upper portion of the B horizon is not strongly acid and not strongly sodic. These soils have low-moderate fertility and water-holding capacity (Gray & Murphy 2002).

**SODOSOLS**

Sodosols are sodic and not strongly acid. Sodic soils are dispersive, as confirmed by the Emerson test performed on all samples. Sodosols found within the site are in the drainage lines on the development site and are considered sodic to strongly sodic.

Dispersible soils are easily eroded by water. There is an extremely high risk of erosion in sodic soils and this is often reflected in the formation of gullies and tunnels (Alt *et al.*, 2009).

The analysis of the soils is described in Table 7-2.

Table 7-2 Soil analysis results (McMahon, 2018)

Description	pH	EC	Cation exchange capacity	Dispersion	Plant available phosphorus	Phosphorus buffering index	Calcium: magnesium ratio
<b>Topsoil</b>	Ideal pH for plant growth (5.7 to 8.0)	Very low	Low - moderate	Moderate (localised)	5 to 33 mg/kg	43 to 99 (very low to low)	0.7 to 5.1 (low potential for swelling upon wetting)
<b>Subsoil</b>	Ideal pH for plant growth (5.5 to 7.3)	Very low	-	Moderate (localised)	-	-	-

**Limitations**

The identification of the landscape limitations of the site enable best practice management actions to be implemented for the construction, operation and decommissioning of the project. The potential landscape limitations are summarised below in Table 7-3.

Table 7-3 Landscape limitations (McMahon, 2018)

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulfate soils	Infrastructure
<b>Chromosol</b>	Predominant across the site	Low	Low	No	Moderate (localised)	No	Moderate

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulfate soils	Infrastructure
Sodosol	Along drainage channels	Moderate	Moderate	No	Moderate (localised)	No	Moderate

### 7.1.3 Potential impacts

#### Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, cause soil erosion and subsequent sedimentation. Earthworks are required during construction phase including for the construction of access roads, compound, laydown and parking areas, pile erection, trenching and boring and fencing.

These activities would remove the existing ground cover and disturb soils, potentially decreasing their stability and increasing their susceptibility to erosion. Most of these activities require only detailed earthworks or earthworks limited to a small defined area.

Soil compaction would occur as hardstands and internal access roads are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. During excavations mixing of different soil horizons can retard plant growth due to inadequate top soil layer. Overall, these impacts would occur in small, discrete parts of the development site and are not considered substantial.

Pile driving/screwing of steel posts supporting the arrays as well as installation of fencing uses light equipment within a small and discrete footprint and is unlikely to result in substantial disturbance of soils. The areas of disturbance would be sparsely distributed, and groundcover would be retained as far as possible prior to, during and post-construction.

Overall, the risk of erosion is considered low. With limited topographic relief, runoff is considered to be readily manageable and unlikely to cause substantial erosion or lead to substantial sediment loads entering any natural waterways.

The use of fuels and other chemicals onsite poses a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. When mobilised, such as in a rain event or flooding, the substances may spread via local drainage lines, affecting much larger areas including aquatic habitat. Overall, these risks are low and considered readily manageable.

The Narrandera LGA is not classed as an area identified by NSW Government (2015) as containing naturally occurring asbestos (NOA). Therefore, it is unlikely that the minor earthworks required during construction will impact on any NOA.

#### 7.1.4 Operation

The primary risk of erosion during operation is from concentrated runoff from the panels. Such runoff could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts. The soils have a moderate to severe erosion risk and retaining vegetation underneath the panels will assist in reducing erosion from rainfall run-off. During high rainfall events,

panels would be placed in a vertical position to decrease the concentrated surface runoff and increase the exposure of ground surface roughness.

Operational maintenance activities and vehicles would be largely confined to the formalised access tracks, minimising impacts to soils. Occasional vehicle access in between panel arrays will require traversing over undisturbed soils. This is expected to be infrequent and not likely to increase the erosion risk.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site.

The potential for wind erosion during operation would be low given the ability to stabilise soils exposed during and after construction.

**7.1.5 Safeguards and mitigation measures**

Table 7-4 Safeguards and mitigation measures for soil impacts

No.	Safeguards and mitigation measures	C	O	D
SO1	<p>A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared,, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as:</p> <ul style="list-style-type: none"> <li>• At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures.</li> <li>• Regularly inspect erosion and sediment controls, particularly following rainfall.</li> <li>• Maintain a register of inspection and maintenance of erosion control and sediment capture measures.</li> <li>• Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows.</li> <li>• Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks.</li> <li>• Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads.</li> <li>• In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation.</li> <li>• During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation.</li> <li>• Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity.</li> <li>• Manage works in consideration of heavy rainfall events.</li> <li>• Areas of disturbed soil would be rehabilitated promptly and progressively during construction.</li> </ul>	<b>Prior to and during construction</b>		<b>D</b>
SO2	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents. It would detail appropriate risk control measures	<b>C</b>	<b>O</b>	<b>D</b>

No.	Safeguards and mitigation measures	C	O	D
	that would need to be implemented to safely mitigate potential risk to health and safety of firefighters and first responders in the case of a hazardous spill.			
SO3	<p>A Spill and Contamination Response Plan (SCRP) would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to:</p> <ul style="list-style-type: none"> <li>• Manage the storage of any potential contaminants onsite.</li> <li>• Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation).</li> <li>• A protocol would be developed in relation to discovering buried contaminants within the development site (e.g. pesticide containers, if any). It would include stop work, remediation and disposal requirements.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>
SO4	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored to original condition or re-vegetated with native plants.	<b>C</b>	<b>O</b>	<b>D</b>
SO5	Soil should be treated with gypsum where required.	<b>C</b>		
SO6	<p>Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation control:</p> <ul style="list-style-type: none"> <li>• Integrate project design with any site constraints.</li> <li>• Preserve and stabilise drainageways.</li> <li>• Minimise the extent and duration of disturbance.</li> <li>• Control stormwater flows onto, through and from the site in stable drainage structures.</li> <li>• Install perimeter controls.</li> <li>• Stabilise disturbed areas promptly.</li> <li>• Protect steep slopes.</li> <li>• Employ the use of sediment control measures to prevent off- and on-site damage.</li> <li>• Protect inlets, storm drain outlets and culverts.</li> <li>• Provide access and general construction controls.</li> <li>• Inspect and maintain sediment and erosion control measures regularly.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>

*C: Construction; O: Operation; D: Decommissioning*

## 7.2 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER) AND HYDROLOGY

### SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

**Water –**

*Including:*

- *an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Sandy Creek, drainage channels, wetlands, riparian land, groundwater dependent ecosystems*

*and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;*

- *details of water requirements and supply arrangements for construction and operation; and*
- *a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004);*

## **OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS**

### **Flooding –**

*The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005:*

- *Flood prone land.*
- *Flood planning areas, the area below the flood planning level.*
- *Hydraulic categorisation (floodways and flood storage areas).*
- *Flood hazard.*

*The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.*

*The EIS must model the effect of the proposed development on the flood behaviour under current flood behaviours for a range of design events.*

*Modelling in the EIS must consider and document:*

- *Existing council flood studies in the area and examine consistency to the flood behaviours documented in these studies.*
- *The impact on existing flood behaviours for a full range of flood events including up to the probable maximum flood.*
- *Impacts on the development on flood behaviour resulting in detrimental changes in potential flood affectation of other developments of land.*
- *Relevant provisions of the NSW Floodplain Development Manual 2005.*

*The EIS must address the impacts on the proposed development on flood behaviour, including:*

- *Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.*
- *Consistency with Council Floodplain Risk Management Plans, and any Rural Floodplain Management Plans.*
- *Compatibility with the flood hazard of the land.*
- *Compatibility with the hydraulic function of flow conveyance in floodways and storage in flood storage areas of the land.*
- *Whether there will be adverse effect to beneficial inundation of the floodplain environment on, adjacent to or downstream of the site.*
- *Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.*
- *Any impact on existing community emergency management arrangements for flooding, discussed with SES and Council.*
- *Whether the proposal incorporates significant measures to manage risk to life from flood, discussed with SES and Council.*



- *Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk, to be discussed with, and have the support of, Council and SES.*
- *Any impacts the development may have on the social and economic costs to the community as a consequence of flooding.*

## **DEPARTMENT OF INDUSTRY REQUIREMENTS**

*The Department advises that the Environmental Impact Statement should also consider the following:*

### **Water –**

*An assessment of the likely impacts of the development on surface water and groundwater resources, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate impacts.*

*Details of water requirements and supply arrangement for construction and operation, including details of licensing and approval requirements and proposed new/modified water management infrastructure.*

*A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soil and Construction (Landcom 2004).*

## **FIRE AND RESCUE NSW REQUIREMENTS**

*The EIS must also address the following specific issues:*

- *A comprehensive Emergency Response Plan (ERP) is developed for the site.*
- *The ERP specifically addresses foreseeable on-site and off-site emergency incidents.*
- *The ERP details appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. Such measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and safe methods for shutting down and isolating the PV system.*

### **7.2.1 Existing environment**

#### **Surface water**

The development site is in the Riverina Local Land Services area within the Murrumbidgee River Catchment. The Murrumbidgee River is located about 14 km to the north. The development site is located on flat, low-lying land. The nearest natural water course is Sandy Creek, which runs south-north to its confluence with the Murrumbidgee River.

There is 1 drainage line and 2 farm dams located within the development footprint (Figure 7-3; Appendix B).



Figure 7-3 Farm dam in western portion of development site, looking north-east

### **Groundwater**

The NSW DPI database of groundwater lists no bores within 500 m of the development site. There are no ground water bores located within the development site (Figure 7-4).

The development site is not located in an area mapped as having groundwater vulnerability under the Narrandera LEP.

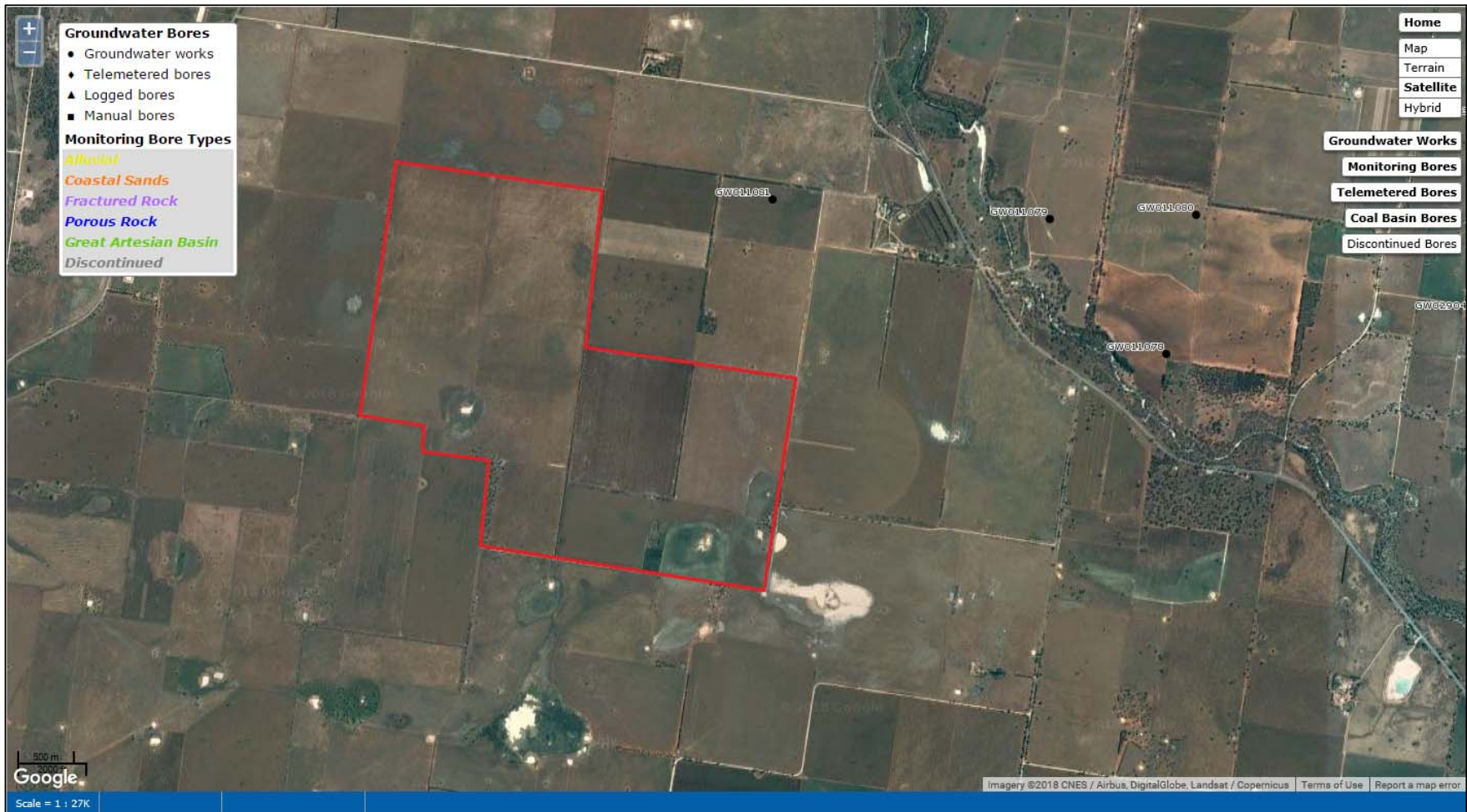


Figure 7-4 Groundwater works surrounding the development site (NSW DPI 2018).

### **Groundwater Dependent Ecosystems (GDEs)**

Potential GDEs within the vicinity of the development site are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2018a). There are no listed aquatic GDE sites within the development site (Figure 7-5). There are small areas within and around the development site that are listed as low potential terrestrial GDE (Figure 7-5).

Within 1 km of the site there are sites listed as GDEs as they interact with groundwater. There are high potential GDEs along Sandy Creek, within 1 km north of the development site (Figure 7-6). The Murrumbidgee River, located about 14 km to the north, is listed as a GDE as it interacts with groundwater (Figure 7-5).



Figure 7-5 Aquatic GDEs in proximity to the development site (BOM 2018a).

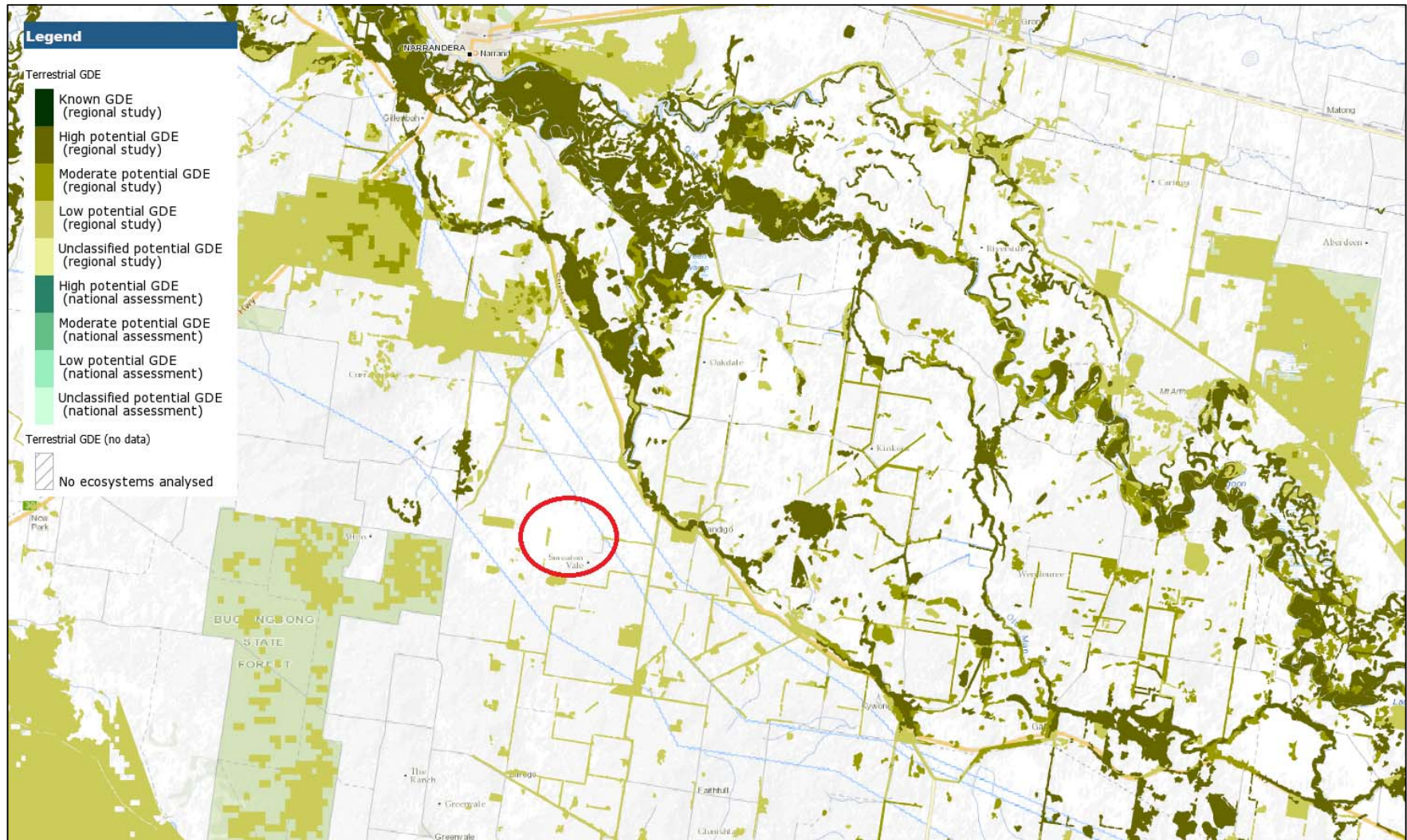


Figure 7-6 Terrestrial GDEs within and surrounding the development site (BOM 2018a).

### Surface hydrology and flooding

The development site is located within the Murrumbidgee River Catchment. The site is very flat, with an elevation of 150 m ASL.

The development site does not occur on Flood Prone Land under the Narrandera LEP (NSW Government, 2013). Figure 7-7 shows the extent of flood prone land in proximity to the site.

The extent of modelled riverine flooding for land adjacent to the Murrumbidgee River, Old Man Creek and Sandy Creek has been mapped (Lyll & Associates 2015) for recent flood events. Flood heights for the March 2012 flood are shown in Figure 7-8. This flood was more extensive than the floods mapped for December 2010 and September 1974 (Lyll & Associates, 2015).

Lyll and Associates (2015) have modelled flood events for a 10%, 5%, 1%, 0.5% and 0.2% annual exceedance probability (AEP) (Appendix I). The extent of flood modelling does not incorporate the development site. However, floodwaters associated with a 1% (100-year ARI) AEP extend to the south of the Sturt Highway and a low-lying area, less than 1 km in length, is affected by floodwaters (Figure 7-9). A 0.5% (200 year ARI) and 0.2% (500 year ARI) AEP sees the floodwater extend across the Sandy Creek floodplain to the south of the Sturt Highway (Figure 7-10 and Figure 7-11). In a 0.2% AEP event, the likely heights of the floodwaters on the Sandy Creek floodplain in proximity to the development site are 0.10 m to 0.90 m.

In an extreme flood event, the likely height of floodwaters across the Sandy Creek floodplain in proximity to the site is greater than 1 m (Appendix I).



Figure 7-7 Flood planning map for Narrandera Shire Council (NSW Government, 2013).



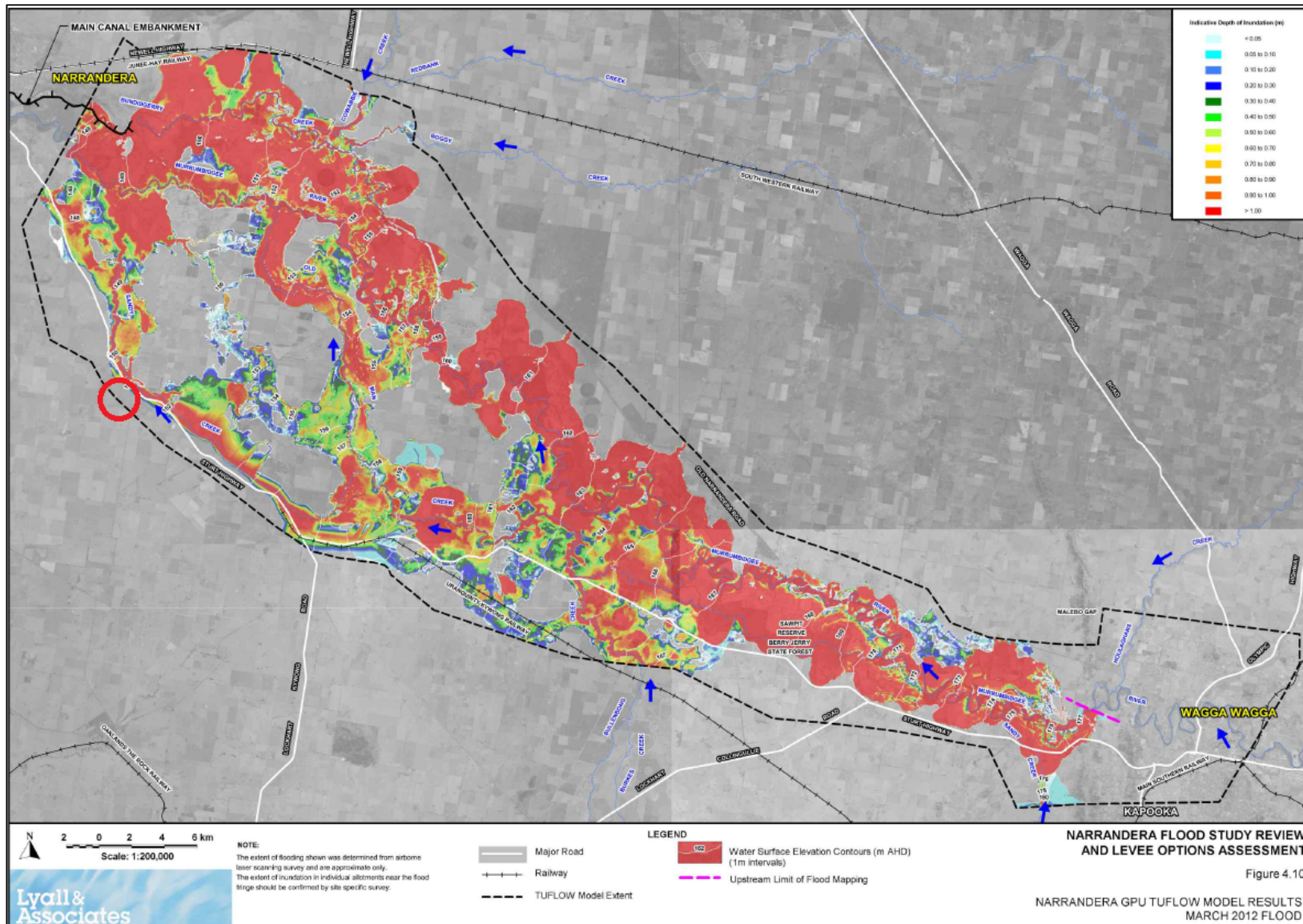


Figure 7-8 Modelled flood extent for the March 2012 flood (Lyall & Associates, 2015). The red circle indicates the development site

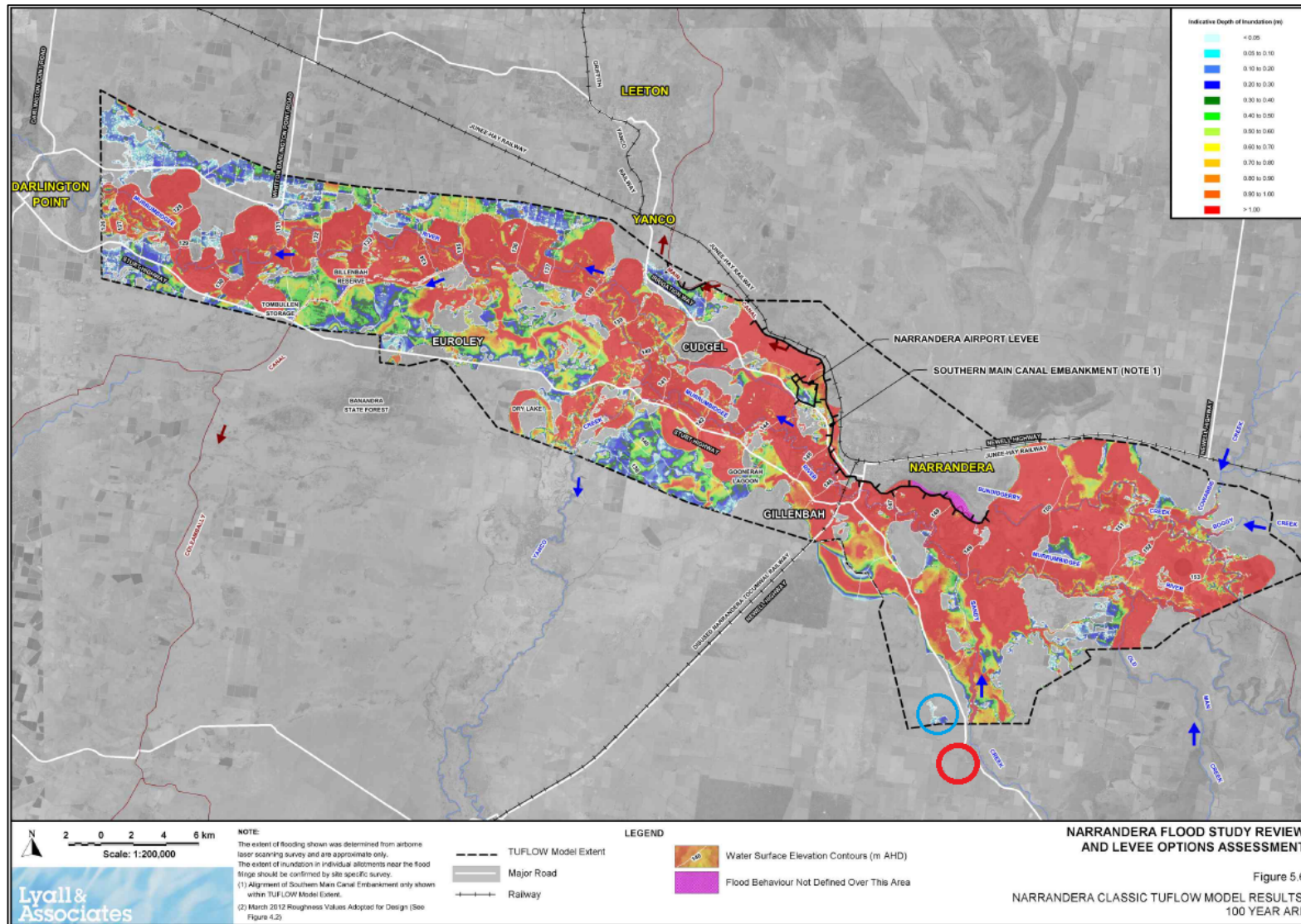


Figure 7-9 Modelled flood extent for a 1% AEP flood (Lyall & Associates, 2015). The red circle indicates the development site. Blue circle indicates low-lying area affected by floodwaters

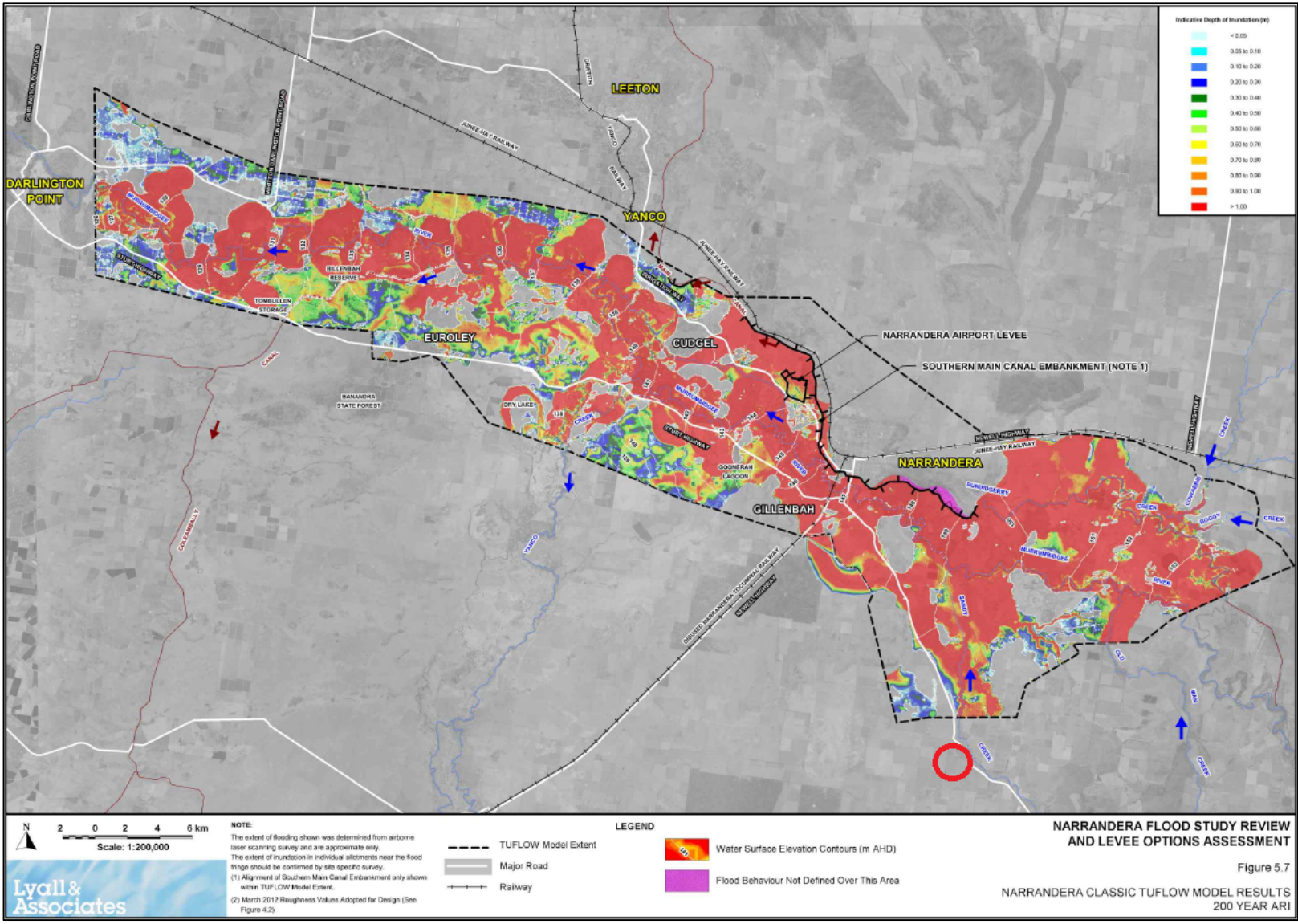


Figure 7-10 Modelled flood extent for a 0.5% AEP flood (Lyall & Associates, 2015). The red circle indicates the development site

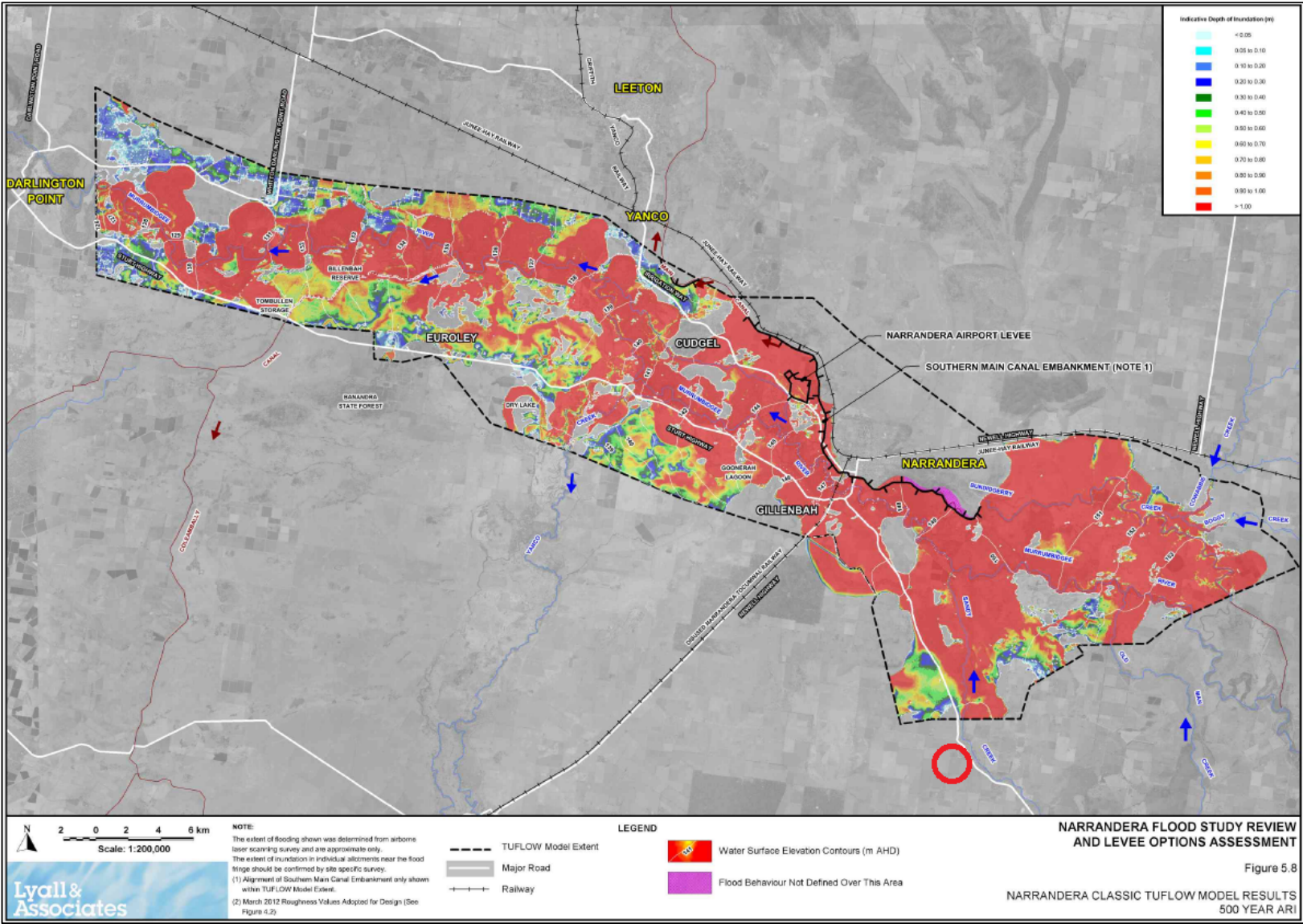


Figure 7-11 Modelled flood extent for a 0.2% AEP flood (Lyall & Associates, 2015). The red circle indicates the development site

In the unlikely event of storm water flooding, where water may pool from heavy rainfall events, the solar farm infrastructure would likely remain stable. Flood height would need to exceed 1 m before anything other than the piles are affected by floodwater. The development of the solar farm is unlikely to increase any impacts associated with flooding of the area.

The development will be compatible with any flood hazards identified in the mapping. The requirements of the EIS assessment for flooding are outlined in Table 7-5 below.

Table 7-5 Identification of flood hazards and mitigation measures for the development

Impact	Assessed by this EIS
Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other development or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.	<ul style="list-style-type: none"> <li>The framing used to hold the solar arrays has a very small footprint. It is unlikely they will have an impact on flood behaviour. Panels will be adjusted parallel to the ground and are 2 m above ground level. Therefore, will not be impacted by the 0.10 to 0.90 m maximum flood heights.</li> <li>Compacted areas (e.g. gravel roadways and set-down areas) are minimal and are unlikely to impact flood behaviour.</li> <li>The footprints of a staff amenities building, the connection station and the power stations between the arrays are small and unlikely to impact flood behaviour.</li> <li>As per the NSW Floodplain Development Manual 2005.</li> </ul>
Relevant provisions of the NSW Floodplain Development Manual 2005.	<ul style="list-style-type: none"> <li>Appendix C of the Manual applies to its application of rural and local overland flooding. Surface runoff is categorised as major drainage (depths in excess of 0.3m).</li> </ul>
Whether there will be detrimental increases in the potential flood affection of other properties, assets and infrastructure.	<ul style="list-style-type: none"> <li>The development is unlikely to adversely impact flood behaviour and will not increase potential flood affection of other property, assets and infrastructure.</li> <li>In the unlikely event of flooding, the solar farm infrastructure would likely remain stable. Flood height would need to exceed 1 m before anything other than the pile is affected by floodwater.</li> </ul>
Consistency with Council Floodplain Risk Management Plans	<ul style="list-style-type: none"> <li>Although the land boundary for the model used to map flood risk ends prior to the boundary of the proposed solar farm, it is likely there is floodplain flooding risk of the development site (Lyll &amp; Associates 2015).</li> <li>Development of the site will be compatible with the flood hazard mapping provided above.</li> </ul>
Consistency with any Rural Floodplain Management Plans	<ul style="list-style-type: none"> <li>A Rural Flood Management Plan does not exist for the development site.</li> </ul>

Impact	Assessed by this EIS
Compatibility with the flood hazard of the land.	<ul style="list-style-type: none"> <li>• Overland flow will not be disturbed by the proposal.</li> <li>• The proposal will be compatible with the flood hazard of the land.</li> </ul>
Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	<ul style="list-style-type: none"> <li>• The drainage line on site would act as a floodway. It is located along the eastern boundary of the development site. Infrastructure will be limited in these areas; refer to the constraints map of the site in Appendix B.</li> <li>• Dams within the development footprint will remain intact and will act as flood storage. No development will occur in the vicinity of the flood storage area; refer to constraints map of the site in Appendix B.</li> </ul>
Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site	<ul style="list-style-type: none"> <li>• The nature of the infrastructure of the proposal will unlikely impact inundation of any floodplain environment.</li> </ul>
Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.	<ul style="list-style-type: none"> <li>• It is unlikely that the proposal will increase erosion or sedimentation across the landscape or indirectly affect the riparian vegetation or bank stability of Sandy Creek during flooding.</li> <li>• Mitigation measures to reduce soil erosion and sedimentation are addressed in section 7.2.3.</li> </ul>
Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.	<ul style="list-style-type: none"> <li>• The development site is not located within a high-risk flood prone area, it is unlikely there will be any impacts upon existing community emergency management arrangements for flooding. Therefore, consultation is not required with Council or the SES.</li> <li>• Refer to Appendix C for further correspondence on this matter.</li> </ul>
Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.	<ul style="list-style-type: none"> <li>• Staff amenities building will be located away from floodways and flood storage zones.</li> <li>• A flood evacuation procedure will be in place for staff on site for a flooding event and embedded within emergency management procedures.</li> </ul>
Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.	<ul style="list-style-type: none"> <li>• Emergency management procedures will be prepared in consultation with Council and SES.</li> </ul>

Impact	Assessed by this EIS
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Any impacts the development may have on the social and economic costs to the community as a consequence of flooding.	<ul style="list-style-type: none"><li>Impacts on or caused by the proposed development are unlikely, therefore the impacts on community are low.</li></ul>
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### Aquatic Biodiversity

Species that could potentially be impacted under the *Fisheries Management Act 1994* are assessed in Table 7-6. It was determined that there would be minimal impact to aquatic biodiversity as a result of the proposal, due to the farm dams being retained on-site and the closest prescribed stream (Sandy Creek) being 1.5 km north of the development site.

Table 7-6 Habitat Table for species listed under the *Fisheries Management Act 1994*

Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
<b>Fish</b>				
Flathead Galaxias <i>Galaxias rostratus</i> CE EPBC CE FM	Below 150 m in altitude. Billabongs, lakes, swamps, and rivers, with preference for still or slow-flowing waters.	<b>No</b> No suitable permanent water above 150 m in altitude.	<b>Unlikely</b> Within distribution.	<b>No</b> species No suitable habitat in study area.
Murray Hardyhead <i>Craterocephalus fluviatilis</i> CE FM	Mostly recorded in saline lakes that are moderately acidic to highly alkaline and have relatively low turbidity. Margins of lakes, wetlands, backwaters, and billabongs. Open water, shallow, slow-flowing or still habitats, with sand or silt substrates. Also, deeper habitats with dense aquatic vegetation.	<b>No</b> No lakes, backwaters, billabongs with deep water.	<b>Unlikely</b> Within historic distribution.	<b>No</b> species No suitable habitat in study area.
Stocky Galaxias <i>Galaxias tantangara</i> CE FM	Small, cold, clear and fast-flowing alpine creek, flowing through open forest of eucalypts, low shrubs and tussock grass.	<b>No</b> No alpine creeks.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Australian Grayling <i>Prototroctes marena</i> E FM	Migrates between rivers, estuaries and coastal seas. Mostly in freshwater rivers and streams, usually in cool, clear waters with gravel substrate and alternating pool and riffle zones.	<b>No</b> No coastal habitat.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Eastern Freshwater Cod <i>Maccullochella ikei</i> E FM	Clear flowing rivers with rocky substrate and large amounts of in-stream cover.	<b>No</b> No flowing rivers.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.

<sup>1</sup> Information sourced from species profiles on NSW DPI species list or the Australian Government's *Species Profiles and Threats* database (SPRAT) unless otherwise stated.

OEH threatened species database: <https://www.dpi.nsw.gov.au/fishing/species-protection/conservation/what-current>

SPRAT: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>



Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Oxleyan Pygmy Perch <i>Nannoperca oxleyana</i> E FM	Coastal lowlands, mostly coastal floodplains in swamps, creeks and lakes of coastal Banksia heath.	<b>No</b> No coastal habitat.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Southern Pygmy Perch <i>Nannoperca australis</i> E FM	Slow-flowing waters and still, vegetated habitats in small streams, lakes, billabongs and wetlands.	<b>No</b> No flowing or suitable permanent water.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Southern Purple Spotted Gudgeon <i>Mogurnda adspersa</i> E FM	Rivers, creeks, and billabongs with slow-flowing or still waters or in streams with low turbidity. Cover in the form of aquatic or overhanging vegetation, leaf litter, rocks or snags.	<b>No</b> No suitable slow-flowing or still permanent water.	<b>Unlikely</b> Outside current known species distribution.	<b>No</b> No suitable habitat in study area.
Trout Cod <i>Maccullochella macquariensis</i> E FM	Areas with large in-stream woody debris.	<b>No</b> No suitable permanent water with large woody debris.	<b>Unlikely</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Murray Cod <i>Maccullochella peelii</i> V EPBC	Slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs.	<b>No</b> No deep, slow-flowing streams or rivers.	<b>Unlikely</b> Within distribution.	<b>No</b> species No suitable habitat in study area.
Macquarie Perch <i>Macquaria australasica</i> E EPBC E FM	Rivers, in clear, deep, rocky holes with plenty of cover including aquatic vegetation, large boulders, large woody debris, and overhanging banks.	<b>No</b> No deep water with plenty of cover.	<b>Unlikely</b> Within distribution.	<b>No</b> species No suitable habitat in study area.
Silver Perch <i>Bidyanus bidyanus</i> V FM	Faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin.	<b>No</b> No fast-flowing water.	<b>Unlikely</b> Within distribution.	<b>No</b> species No suitable habitat in study area.

Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Darling River Hardyhead population in the Hunter River catchment <i>Craterocephalus amniculus</i> EP FM	North-east part of the Murray-Darling Basin, especially MacIntyre, Namoi and other border rivers. The Hunter River population is the only known occurrence in an eastward flowing river.	<b>No</b> Outside Hunter River catchment.	<b>No</b> Outside population distribution.	<b>No</b> Population not in study area.
Murray-Darling Basin population of Eel-tailed Catfish <i>Tandanus tandanus</i> EP FM	Diverse range of freshwater environments including rivers, creeks, lakes, billabongs and lagoons. Clear, sluggish or still waters, but also found in flowing streams with turbid waters. Substrates range from mud to gravel and rock.	<b>Possible</b> Small freshwater dams with sand/mud substrate.	<b>Unlikely</b> Not recorded in locality.	<b>No</b> Species not recorded in locality.
Snowy River population of River Blackfish <i>Gadopsis marmoratus</i> EP FM	Clear flowing streams with good instream cover such as woody debris, aquatic vegetation and undercut banks.	<b>No</b> Outside Snowy River catchment.	<b>No</b> Outside population distribution.	<b>No</b> Population not in study area.
Western population of Olive Perchlet <i>Ambassis agassizii</i> EP FM	Western (Murray-Darling) population is limited to a few localities in Darling drainage upstream from Bourke.	<b>No</b> Outside Darling drainage system upstream from Bourke.	<b>No</b> Outside population distribution.	<b>No</b> Population not in study area.
Grey Nurse Shark <i>Carcharias taurus</i> CE FM	Inshore coastal waters along coast of NSW and southern Queensland.	<b>No</b> No coastal habitat.	<b>No</b> Outside species distribution.	<b>No</b> No suitable habitat in study area.
Scalloped Hammerhead Shark <i>Sphyrna lewini</i> E FM	Tropical and warm temperate seas between 45°N and 34°S, inshore and over continental shelf and in adjacent deep water from surface to at least 275 m depth.	<b>No</b> No marine habitat.	<b>No</b> Outside species distribution.	<b>No</b> No suitable habitat in study area.

Species and Status		Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Great Hammerhead Shark <i>Sphyrna mokarran</i> V FM		Occurs along coastlines, continental shelves and adjacent drop-offs to about 80 m depth.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	species No suitable habitat in study area.
White Shark <i>Carcharodon carcharias</i> V FM		Inshore habitats to outer continental shelf and slope areas.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	species No suitable habitat in study area.
Southern Bluefin Tuna <i>Thunnus maccoyii</i> E FM		Oceanic waters on seaward side of continental shelf.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	species No suitable habitat in study area.
Black Rockcod <i>Epinephelus daemeli</i> V FM		Caves, gutters and beneath bommies on rocky reefs, from near shore environments to depths of at least 50 m.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	species No suitable habitat in study area.
<b>Invertebrates</b>					
Darling River Snail <i>Notopala sublineata</i> CE FM		Darling River and its tributaries. Artificially introduced hard surfaces including irrigation pipelines.	<b>No</b> No artificial surfaces in waterways.	<b>Unlikely</b> Outside distribution.	species No suitable habitat in study area.
Hanley's River Snail <i>Notopala hanleyi</i> CE FM		Artificially introduced hard surfaces including irrigation pipelines.	<b>No</b> No artificial surfaces in waterways.	<b>Unlikely</b> Outside distribution.	species No suitable habitat in study area.
Fitzroy Falls Crayfish <i>Euastachus dharawalus</i> CE FM	Spiny	Creates burrows in soft stream bed below waterline.	<b>No</b> No suitable permanent streams.	<b>Unlikely</b> Outside distribution.	species No suitable habitat in study area.

Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Murray Crayfish <i>Euastachus armatus</i> V FM	Lotic waters of southern Murray-Darling Basin. Habitats ranging from pasture to sclerophyll forest, large and small streams. Deep flowing water proximal to clay banks, wood or rock cover.	<b>No</b> No permanent lotic habitat.	<b>Possible</b> Within distribution.	<b>No</b> species No suitable habitat in study area.
Marine Slug <i>Smeagol hilaris</i> CE FM	Small isolated location at Merry Beach, south of Ulladulla, NSW.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Adams Emerald Dragonfly <i>Archaeophya adamsi</i> E FM	Narrow, shaded riffle zones with moss and abundant riparian vegetation in small to moderate sized creeks with gravel or sandy bottoms.	<b>No</b> No suitable narrow, shaded riffle zones.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Sydney Hawk Dragonfly <i>Austrocordulia leonardi</i> E FM	Deep river pools with cooler water and permanent flow.	<b>No</b> No deep water or permanent flow.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Alpine Redspot Dragonfly <i>Austropetalia tonyana</i> V FM	Amongst rocks, logs and moss within the splash zone of waterfalls or in the nearby stream edge.	<b>No</b> No waterfalls or rocky streams.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Bousfield Marsh Hopper <i>Microrchestia bousfieldi</i> V FM	Mangrove swamps and salt marshes in eastern Australia.	<b>No</b> No coastal habitat.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
Buchanans Fairy Shrimp <i>Branchinella buchananensis</i> V FM	Lake Buchanan in southwest Queensland, and Gidgee and Burkanoko Lakes in northwest NSW.	<b>No</b> No lake habitat.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
<b>Plants</b>				

Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Marine Brown Alga <i>Nereia lophocladia</i> CE FM	Port Phillip Heads in Victoria and Muttonbird Island, Coffs Harbour in NSW.	<b>No</b> No coastal habitat.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
<i>Posidonia australis</i> seagrass, Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations EP FM	Coarse sandy to fine silty sediments between the low tide and approximately 10 m in depth.	<b>No</b> No marine habitat.	<b>No</b> Outside distribution.	<b>No</b> species No suitable habitat in study area.
<b>Endangered Ecological Community</b>				
Lowland aquatic community Darling River ecological EEC FM	Natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within NSW, including Menindee Lakes and Barwon River.	<b>No</b> Not in Darling River catchment.	<b>No</b> Outside distribution.	<b>No</b> community No suitable habitat in study area.
Lowland aquatic community Lachlan River ecological EEC FM	Natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, floodrunners, effluent streams (those that flow away from the river) and the floodplains of the Lachlan River within NSW, including Lake Brewster, Lake Cargelligo and Lake Cowal.	<b>No</b> Not in Lachlan River catchment.	<b>No</b> Outside distribution.	<b>No</b> community No suitable habitat in study area.
Lowland aquatic community Murray River ecological EEC FM	Natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray River (also known as the River Murray) downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries, anabranches and effluents including Billabong Creek, Yanco Creek, Colombo Creek, and their tributaries, the Edward River and the Wakool River and their tributaries, anabranches and effluents, Frenchmans Creek, the Rufus River and Lake Victoria.	<b>Yes</b> Ephemeral stream is tributary of Murrumbidgee River.	<b>Unlikely</b> Within distribution.	<b>No</b> community No riparian vegetation impacted.

Species and Status	Description of habitat <sup>1</sup>	Presence of habitat	Likelihood of occurrence	Potential for impact?
Snowy River aquatic ecological community EEC FM	Rivers, creeks and streams of the Snowy River catchment. This includes Snowy, Eucumbene, Thredbo (or Crackenback), Gungarlin Mowamba, Bombala, McLaughlin, Delegate, Pinch and Jacobs Rivers and their tributaries.	<b>No</b> Not in Snowy River catchment.	<b>No</b> Outside community distribution.	<b>No</b> No suitable habitat in study area.

CE FM = listed as Critically Endangered under Schedule 4A of the NSW *Fisheries Management Act 1994*.

E FM = listed as Endangered under Schedule 4 of the NSW *Fisheries Management Act 1994*.

V FM = listed as Vulnerable under Schedule 5 of the NSW *Fisheries Management Act 1994*.

EP = listed as an Endangered Population under Schedule 4 of the NSW *Fisheries Management Act 1994*.

EEC = listed as an Endangered Ecological Community under Schedule 4 of the NSW *Fisheries Management Act 1994*.

**7.2.2 Potential impacts**

**Construction and decommissioning**

**WATER USE**

Water use during construction will be minimal and largely used for dust suppression on unsealed roads and for the construction of new roads. The water requirement will vary, dependent on weather conditions, and is estimated to be up to 11.2ML in total. About 0.34ML of potable water would be required for employees and contractors (refer to Table 7-7).

Table 7-7 Water requirements during construction

Water quality	Annual construction water requirement (ML)	Sources	Availability
<b>Potable (drinking)</b>	0.34 ML (for ~9 months)	Bottled water	Available as required – commercial supply
<b>Non-potable</b>	11.2 ML (for ~18 months)	Truck delivery Narrandera Shire Depot stand pipe	Available as required

All non-potable water will be sourced from the Narrandera Shire Depot stand pipe.

**SURFACE WATER QUALITY**

The proposal would not directly affect surface water quality.

Indirectly, the proposed works would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff affecting local water ways including the irrigation channels during rainfall events. These potential impacts are discussed in Section 7.1 and are unlikely to significantly impact on water quality.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides, none of which are considered difficult to manage.

Detention ponds, if required to manage surface water during construction and operation, will be detailed in the design phase, specific to the array layout. Erosion and sediment control measures would be implemented to mitigate any impacts in accordance with Landcom (2004); refer to section 7.1.5.

**GROUNDWATER**

It is unlikely that ground water would be extracted during construction. There is no groundwater vulnerability under the Narrandera LEP. It is considered that the proposal would have negligible impact on groundwater quality given the low pollution potential of the solar farm. Impacts to groundwater as a result of the proposed works are unlikely.

**AQUATIC BIODIVERSITY**

No impact to aquatic biodiversity is expected as a result of works.

**Operation**

**WATER USE**

Requirements would be extremely minor except for cleaning which is fully dependant on weather. Some solar plants are never cleaned, others require more than 2 cleanings per year. Should water be required, it would be sourced from existing dams on the development site or trucked in from the Narrandera Shire Depot stand pipe. A licence under the WM Act is not required to draw water from onsite dams, and a water use approval under section 89 of the WM Act is not required for SSD.

The toilet facilities would be connected to a septic tank installed in line with Narrandera Shire Council requirements.

Approval under Section 68 of the *Local Government Act* the proponent is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Narrandera Shire Council has already been granted for use of a standpipe.

**WATER QUALITY**

During operation, there is minimal potential for any impact to surface water quality. Appropriate drainage features would be constructed along internal access roads to minimise the risk of dirty water leaving the site or entering waterways. With the exception of internal roads, parking areas and areas around site offices, the site would be largely vegetated with grass cover. Risks to water quality impacts during operation would therefore be low.

There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

**GROUNDWATER**

No operational activities would affect groundwater. There would be no impacts to GDEs during operation.

**AQUATIC BIODIVERSITY**

No impact to aquatic biodiversity is expected as a result of operation of the solar farm.

**7.2.3 Safeguards and mitigation measures**

Table 7-8 Safeguards and mitigation measures for water quality impacts

No.	Safeguards and mitigation measures	C	O	D
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	C	O	D
WA3	Adequate incident management procedures will be incorporated into the Construction, Operation and Decommissioning Environmental Management Plans, including requirement to notify the relevant agencies of pollution incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	C	O	D
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained	C		D



No.	Safeguards and mitigation measures	C	O	D
	through toolbox talks for the minimisation and management of accidental spills.			
WA6	Emergency management procedures will be prepared in consultation with Council.	<b>C</b>	<b>O</b>	
WA7	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	<b>C</b>	<b>O</b>	<b>D</b>
WA8	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents in consultation with Narrandera Shire Council in accordance with the NSW Government's Flood Prone Land Policy and the Floodplain Development Manual. It would detail appropriate risk control measures that would need to be implemented to safely mitigate potential risk to health and safety of firefighters and first responders in the case of a hazardous spill or flood risk.	<b>C</b>	<b>O</b>	<b>D</b>

*C: Construction; O: Operation; D: Decommissioning*

## 7.3 TRAFFIC, TRANSPORT AND ROAD SAFETY

### SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

#### Transport –

Include an assessment of the site access routes (including Sturt Highway, Sandigo Boree Creek Road, Muntz Road, Strontian Road and Quilters Road), site access points, any potential rail safety issues and likely transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction (including cumulative impacts from nearby developments), and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);

### ROADS AND MARITIME REQUIREMENTS

Given the scale and operational characteristics of the proposed development the traffic related issues relevant to the development should be considered and addressed in 2 distinct stages as follows:

- Construction & decommission phase – the transport of materials and equipment/components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility,
- Operational phase – the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project.

Roads and Maritime Services emphasises the need to minimise the impacts of any development on the existing road network and maintain the level of safety, efficiency and maintenance along the road network. Given the scale of the proposal a Traffic Impact Assessment (TIA) should be submitted with the Development Application. Any Traffic Impact Assessment needs to address the impacts of traffic generated by this development upon the nearby road network.

The supporting scoping report acknowledges the need for the Environmental Impact Statement to include an assessment of traffic impacts during the construction period. The supporting report acknowledges the need for development of a Traffic Management Plan to manage the traffic generation during the construction period. Traffic should also be considered and addressed during operation of the facility. The Traffic Management Plan shall detail the potential impacts associated with the phases of the development, the measures to be implemented to maintain the standard and safety of the road network, and procedures to monitor and ensure compliance. This is consistent with the draft SEARs document that was forwarded.

For guidance in the preparation of the TIA the application is referred to section 2 of the "Guide to Traffic Generating Developments" prepared by the RTA and the Austroads publications, particularly the Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development and Part 13: Traffic Studies and Analysis. The TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site.

Given the type and scale of the proposed development and its proximity to the public road network it is considered appropriate that issues relating to potential for distraction of, and for glint/glare impacts on, passing motorists to be addressed in the development submission. Consideration could be given to the establishment and maintenance of a visual barrier, such as a vegetated buffer, within the subject site along its frontage to any public road.

### NARRANDERA SHIRE COUNCIL REQUIREMENTS

Narrandera Shire Council advises that the Environmental Impact Statement should also consider the following:

#### Transport –

Traffic movement of heavy vehicles and their impact upon road safety, local traffic movement and the condition of local roads.

### 7.3.1 Existing environment

#### Regional road network

Sandigo is located about 17 km south east of the Narrandera township and about 70 km north west of Wagga Wagga. Access to the Avonlie Solar Farm would be via Sturt Highway (A20), Sandigo Road and the unsealed road of Muntz Road.

The Sturt Highway is a regional state highway and runs east-west through southern NSW. It extends from the Hume Highway north of Tarcutta through to Adelaide in South Australia, a total distance of approximately 947 km. It has one traffic lane in each direction and a sealed carriageway of approximately 16 m (TDG, 2018).

The Sturt Highway in the vicinity of the development site is listed on the RMS Restricted Access Vehicles Map as being an approved route for up to 25/26 m B-doubles (RMS, 2018). The speed limit varies along the route, with a maximum posted speed limit of 80 or 100km/h occurring outside urban areas.

The Sturt Highway is of vital importance to communities living in towns within southern NSW. The Sturt Highway would experience traffic from freight and livestock transporters, agricultural machinery, caravaners and holiday makers, emergency services and local traffic. In 2011 the average daily traffic count for the Sturt Highway was 2,472 vehicles per day (vpd) (RMS, 2018). TDG (2018) assumed a 0.05% annual growth from 2011, therefore an average traffic volume of 2,560 vpd is expected (Table 7-9).

There are no rail links in proximity to the development site.

#### Local road network

Sandigo Road runs north-south and extends from the Sturt Highway in the north to where it continues as Orara Street, about 22 km south. It is sealed with an approximate width of 5 m in the vicinity of the site. It has wide, unsealed shoulders that enable simultaneous two-way movement of vehicles.

Muntz Road is unsealed and runs east-west from Sandigo Road to its termination about 2.8 km to the west. It has a road width of 7 m in the east and about 4-5 m further west.

Site access to the Avonlie Solar Farm during construction and operation is proposed from Muntz Road, as shown in Appendix B, Appendix J and Figure 3-9. The proposed site access will be able to accommodate the simultaneous entry/exit of the largest design vehicle expected to access the site.

Speed limits on these roads vary between 80 km/hr to 100 km/hr.

The most recent traffic volumes for Sandigo Road were obtained from Narrandera Shire Council for 2013. TDG (2018) assumed a growth of 0.05% per year to estimate current volumes of traffic. This data is shown in Table 7-9. No data is available for Muntz Road. It is expected to carry an even lower volume of daily traffic.

Table 7-9 Traffic volumes around the development site (Appendix J)

Location	Two-way average vpd	Current two-way average vpd (assuming 2% growth)
Sturt Highway	2472	2560
Sandigo Road	33	42
Muntz Road	<33	<42

### 7.3.2 Potential impacts

#### Proposal requirements

Access requirements can be separated into the following categories:

- Cars - would be required by project management staff and site workers to access the site. Cars would make up the largest proportion of vehicles accessing the site.
- Mini buses – would be used to transport workers to and from the site to minimise traffic volumes and transit risks during construction.
- Utility vehicles – would be required to transport equipment and materials around the site and for the local collection of materials.
- Trucks – Semi-trailers and dog trailers ( $\leq 26$  m) would be used to transport equipment and materials around the site and for the local collection of materials. Larger sized deliveries would be undertaken by trucks as opposed to utility vehicles.
- Standard articulate trucks – would be used to transport 12 m containers from point of origin.
- Oversize and/or over-mass vehicles – may be required to deliver larger infrastructure components

Vehicle access to the site would generally be confined to the standard hours of construction. Exceptions would occur as staff arrive and leave the site before and after shifts. Additionally, the delivery of large components may take place outside normal working hours.

Vehicles would travel around the site via constructed access tracks, which will be required to access the following locations:

- Around the perimeter of the solar farm.
- Site office/compound.
- Construction equipment laydown area.
- Transmission line route.
- Solar substation.

Internal access tracks would remain unsealed but would be re-sheeted with gravel or crushed and compacted soil, to maintain their condition during the construction phase.

#### Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby receptors.
- Reduction of the level of service on the road network caused by 'platooning' of construction traffic.
- Road closures along Muntz Road during construction of site access.
- Restrictions to one-way access on Sandigo Road and Muntz Road during the delivery of transformers for short time periods.

## HAULAGE

While a detailed haulage program has not yet been developed, it is expected that the project’s components are most likely to be delivered by road from Sydney and in some instances Melbourne. From Sydney, the route would likely include the South Western Freeway, the Hume Highway (M31), the Sturt Highway (A20), Sandigo Road and Muntz Road. From Melbourne, the route would likely include the Hume Highway (M31), the Olympic Highway (A41), the Sturt Highway (A20), Sandigo Road and Muntz Road. These roads are of sufficient capacity to accommodate the haulage of components required for the construction of the solar farm and transmission line.

## INCREASED VEHICLE NUMBERS

The duration of construction is expected to be 15-18 months. There will be an increase in traffic numbers during this period. There will be up to 200 direct and 320 indirect staff on-site at any one time during the peak construction time.

Infrastructure will be arriving on a variety of vehicles. The type of vehicle and the expected number of movements per day during peak construction is summarised in Table 7-10. There is a 50:50 split of inbound and outbound vehicles. A 50T mobile crane may be required for the offloading of the PV boxes or PV skids and the transformer.

Table 7-10 Summary of the estimated traffic volumes during the peak construction period (Appendix J)

Vehicle type	Vehicle movements per day (peak: 3-4 months)
Light vehicles (car / utility / mini bus)	268
Heavy vehicles	32
<b>Total:</b>	<b>300</b>

## DAMAGE TO ROAD INFRASTRUCTURE

The increase in traffic and heavy vehicle movements could impact the condition of roads on the haulage network. Along major highways, the impact is expected to be negligible due to the existing capacity of the road network. The use of the local road network by larger vehicles accessing the proposed development site is not dissimilar to the existing use of the road by trucks associated with surrounding land uses, particularly for agriculture.

However, the strength of the pavement of Sandigo Road between the Sturt Highway and Muntz Road should undergo a pavement assessment to determine if it can support the proposed volume of construction traffic (TDG, 2018).

## ROAD AND INTERSECTION UPGRADES

Road upgrades are required to Sandigo Road and Muntz Road to accommodate the increased number of heavy vehicle movements during construction and decommissioning. TDG (2018) have proposed three passing bays are required along the eastern boundary of Sandigo Road for oncoming vehicles (Appendix J).

Muntz Road would remain unsealed. However, the S-bend in Muntz Road, approximately 820 m west of the intersection with Sandigo Road, is of insufficient width to allow for two-way vehicle flow. TDG (2018) recommends that this section be widened to allow for 2 AVs to simultaneously pass each other (Appendix J). TDG (2018) proposes that four passing bays along the southern side of Muntz Road be provided, west of the S-bend, to allow for incoming vehicles to pull over and outgoing vehicles pass (Appendix J).

An estimated 42 vehicles per hour will be moving through the intersection of the Sturt Highway and Sandigo Road during peak construction. TDG (2018) propose a Basic Right Turn (BAR) turning treatment is required eastbound and a Basic Left Turn (BAL) turning treatment is required westbound on the Sturt Highway (Appendix J).

The same estimated 42 vehicles per hour will be moving through the intersection of Sandigo Road and Muntz Road. TDG (2018) propose to widen Muntz Road on the southern side from the intersection with Sandigo Road to enable AVs to turn onto Muntz Road from Sandigo Road while an AV waits on Muntz Road (Appendix J).

Road upgrade works would meet the requirements of Narrandera Shire Council. The proponent would manage construction impacts on local roads with a Traffic Management Plan. This may require periodic road improvements and lane closures to preserve traffic flow.

#### ASSOCIATED NOISE AND DUST

The increase in traffic during construction and decommissioning may increase noise and dust in the local area, particularly on the unsealed portion of Muntz Road. Due to the access of the site being located about 1 km from the intersection with Sandigo Road, it is unlikely that traffic will be travelling at high speeds along this unsealed road. Impacts from dust generated from the proposed activity, including that associated with increased traffic, is considered in Section 7.4.

The increase in traffic and heavy vehicle movement during construction and decommissioning will result in a minor increase in noise as a result of the proposed works. Sandigo Road is located directly to the east of the development site and forms part of the intersection where the concentration of traffic is expected.

Sandigo Road is a minimally used local road. The closest sensitive receptor to the intersection of Sandigo Road and Muntz Road is about 1 km. The same sensitive receptor is the closest to the access point on Muntz Road, located about 2 km from the access point on the south-eastern side of Muntz Road. The traffic noise during construction and decommissioning could be noticeable at the nearest sensitive receptors. The noise associated with the additional traffic during construction and decommissioning is considered in Section 6.6.

#### DISRUPTION TO EXISTING SERVICES

Local traffic and traffic commuting between Narrandera and Wagga Wagga would be minimally affected. There would be an increase in vehicles from construction staff seeking accommodation and services, and conducting commercial activities relating to the solar farm. This would extend outside construction hours but would unlikely impact existing traffic movements in and around Narrandera.

#### RESTRICTED VEHICLE FLOW

The largest construction vehicle expected to access the site is an articulated vehicle (AV). Restricted access vehicles (RAVs) are expected to access the site outside of construction and local traffic peak hours. This will allow the RAVs to enter/exit the site comfortably, as Sandigo Road and Muntz Road will be restricted to one-way vehicle flow.

Temporary road closures may be required along Sandigo Road and Muntz Road during the construction of the passing bays and the S-bend widening.

#### SUMMARY OF CONSTRUCTION AND DECOMMISSIONING IMPACTS

Overall, the additional traffic associated with the construction and decommissioning of the solar farm would be a small component of the existing traffic loads on local and state roads. The proposed access route to the proposed Avonlie Solar Farm is suitable to accommodate the expected construction vehicle types and traffic volumes (Appendix J). No substantive increased collision risk, damage to road infrastructure, noise or dust impacts, disruption to existing services or reduced level of service is expected to accompany construction or decommissioning.

**Operation**

During operation there could be several vehicles accessing the site daily. Vehicles would use the designated road network to access the site and travel within the site during the operational phase. Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure. Operational staff would be confined to designated parking areas and access roads/tracks within the development site.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access or be above the background noise levels.

Additional risks to road safety from operational traffic would be minimal.

**7.3.3 Safeguards and mitigation measures**

Table 7-11 Safeguards and mitigation measures for traffic, transport and safety impacts

No.	Safeguards and mitigation measures	C	O	D
TT1	<p>A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to:</p> <ul style="list-style-type: none"> <li>• Assessment of road routes to minimise impacts on transport infrastructure.</li> <li>• Scheduling of deliveries of major components to minimise safety risks (on other local traffic).</li> <li>• Traffic controls (signage and speed restrictions etc.).</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>
TT2	<p>A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan would include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network, to be undertaken in consultation with Council.</li> <li>• Assessment of road condition prior to construction on all local roads that would be utilised.</li> <li>• A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic.</li> <li>• The designated routes of construction traffic to the site.</li> <li>• Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction.</li> <li>• Scheduling of deliveries.</li> <li>• Community consultation regarding traffic impacts for nearby residents.</li> <li>• Consideration of cumulative impacts.</li> <li>• Traffic controls (speed limits, signage, etc.).</li> <li>• Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts.</li> </ul>	<b>C</b>		<b>D</b>

No.	Safeguards and mitigation measures	C	O	D
	<ul style="list-style-type: none"> <li>• Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.</li> <li>• Water to be used on unsealed roads to minimise dust generation through increased traffic use.</li> <li>• Following construction, a post condition survey of the relevant sections of the existing road network to be undertaken to ensure it is of similar condition to that prior to construction.</li> </ul>			
TT3	<p>The proponent would consult with Narrandera Shire Council regarding the proposed addition of three passing bays along Sandigo Road on the eastern boundary between Sturt Highway and Muntz Road.</p> <p>The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.</p> <p>See Appendix J for proposed passing bay design.</p>	C		
TT4	<p>The proponent would consult with Narrandera Shire Council regarding the proposed widening of the S-bend on Muntz Road and the addition of four passing bays to the west of the S-bend, prior to site access.</p> <p>The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.</p> <p>See Appendix J for proposed passing bay design.</p>	C		
TT5	<p>The proponent would consult with RMS and Narrandera Shire Council regarding the proposed BAR and BAL turning treatments for the Sturt Highway at the intersection with Sandigo Road.</p> <p>The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.</p> <p>See Appendix J for proposed intersection design.</p>	C		
TT6	<p>The proponent would consult with Narrandera Shire Council regarding the proposed widening of the southern boundary of Muntz Road from the intersection with Sandigo Road.</p> <p>The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.</p> <p>See Appendix J for proposed intersection design.</p>	C		
TT7	<p>The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.</p>	C		D
TT8	<p>A flood response plan to be prepared that will include an access contingency plan in times of flooding when the Sturt Highway could be closed.</p>	C	O	D

C: Construction; O: Operation; D: Decommissioning



## 7.4 CLIMATE AND AIR QUALITY

### 7.4.1 Existing environment

#### Climate

The development site is located in the NSW South West Slopes Bioregion. The Bioregion is dominated by a sub-humid climate characterised by hot summers and no dry season. Mean annual temperatures increase across the Bioregion from low temperatures in the south and east, to higher temperatures in the north and west (OEH, 2016).

The closest Bureau of Meteorology Weather Station is Narrandera Airport NSW, located about 17 km north of the development site. Mean annual maximum temperature is 23.8°C and minimum annual temperature is 9.9°C. Mean annual rainfall is 437.3mm (BOM 2018b). A summary of monthly climatic statistics from 1967 to 2018 is detailed in Figure 7-12.

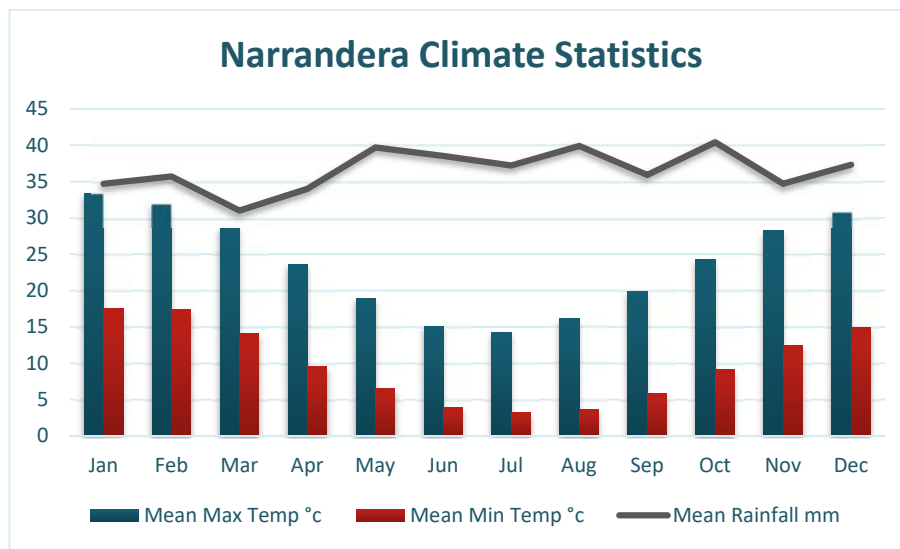


Figure 7-12 Climate statistics for Narrandera Airport (BOM 2018b)

#### Local air quality

The air quality in the development site is generally expected to be good and typical of that found in a rural setting in NSW. Existing sources of air pollution for the development site include:

- Vehicle emissions.
- Dust from nearby unsealed roads.
- Agricultural activities including sowing, lime application, burning of paddocks or earth moving.

A search of the National Pollutant Inventory (Australian Government, 2016) identified three substance emissions facilities located within 25 km of the development site, which include:

- Pig Improvement Company Grong Grong Facility, Berrembed Street, Grong Grong
- Petroleum and coal product manufacturing, Driscoll Road, Narrandera
- Aero Refuellers Narrandera Airport, Narrandera.

There are no residences within the development site, and adjoining land uses include grazing and cropping for agriculture. Six properties have been identified as being involved with the project, with an additional

12 uninvolved neighbours within 5 km of the site. There are no sensitive receptors within 500 m of the site. Topography of the development site is relatively flat and there is vegetation screening the development site.

#### CRITERIA

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m<sup>2</sup>/month are also specified by the EPA.

#### Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases (GHGs) in the atmosphere. GHG's include carbon dioxide, methane and water vapour. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall declines in southern Australia and more extreme weather events including intense rainfall, more severe drought and harsher fires (CSIRO, 2015).

#### 7.4.2 Potential impacts

##### Construction and decommissioning

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along the unsealed access road during construction and decommissioning of the proposed solar farm. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving or lead to adverse health impacts when severe or prolonged. Emission of GHGs are likely to contribute to climate change.

The construction phase is expected to last approximately eighteen months with a peak period lasting approximately four months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (bus) transport, (up to 200 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in Section 7.3).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. The construction of the solar arrays uses a piling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be less than 1% of the development site.

The closest residential dwelling is approximately 1 km from the proposed solar farm. Existing mature vegetation occurs between this receptors and the development site. Due to the distance between the receptors and the development site, and the existing vegetation, it is unlikely that this sensitive receptors would be affected by dust generated from the construction or decommissioning of the solar farm.

There are also 5 involved receptors and 1 uninvolved receptor within 2 km of the development site. Due to the distance of these residential dwellings, dust and emissions would be expected to dissipate readily over this distance. Substantive air quality impacts are not anticipated for these dwellings. With the minor earthworks involved and implementation of mitigation measures, air quality issues are considered manageable.

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

required for the construction phase. The construction and decommissioning of the proposal is not anticipated to have a significant impact on air quality. Identified impacts are highly manageable.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. Haulage traffic and plant and equipment would generate emissions, however, the short duration of the work, the scale of the proposal and mitigation strategies in place suggest this contribution would be negligible in a local or regional context.

**Operation**

The generation of solar energy during the operation of the proposal would generate negligible air quality impacts and emissions. The operation of the solar farm would produce minimal CO<sub>2</sub> emissions when compared to conventional coal and gas fired powered stations (Table 7-12). As discussed in Section 2.2, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 473,040MWh per annum, the proposal would offset the brown coal equivalent of more than 157,800 tonnes per annum of CO<sub>2</sub> emissions and power the equivalent of about 79,900 NSW homes.

Table 7-12 Comparison of CO<sub>2</sub> equivalent emissions produced per kilowatt hour for the lifecycle of the asset

Generation method	Emissions produced (grams CO <sub>2</sub> equivalent per kWh)	Source
PV solar farm	19-59	Wright and Hearps (2010)
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema <i>et al.</i> (2006)

Maintenance activities during operation would result in some minor, localised vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads. The impacts on local and regional air quality are expected to be negligible during operation. During regular operation, no vehicles would be present at the site on a permanent basis, with only occasional visits by light vehicles. During major maintenance activities, this number could increase to 20-30 vehicles at any one time for a limited period.

Limited amounts of fuel would be required for maintenance vehicles during operation of the solar farm and for temporary power generation in the event of an unplanned outage. During operation, the proposal would have a significantly positive impact on the global climate by assisting to reduce Australia’s reliance on fossil fuels for electricity generation (discussed in Section 2.2).

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 7.9.

**7.4.3 Safeguards and mitigation measures**

Air quality impacts would be addressed via the mitigation strategies in Table 7-13.

Table 7-13 Safeguards and mitigation measures for climate and air quality impacts

No.	Safeguards and mitigation measures	C	O	D
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	C	O	D

No.	Safeguards and mitigation measures	C	O	D
AQ2	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	<b>C</b>	<b>O</b>	<b>D</b>
AQ3	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the development site. This includes dust from stockpiled materials.	<b>C</b>	<b>O</b>	<b>D</b>

*C: Construction; O: Operation; D: Decommissioning*

## 7.5 SOCIOECONOMIC AND COMMUNITY

Large and new types of developments can produce social and economic impacts on local communities. These can be positive, such as the provision of employment and increased retail trade. They can also produce unintended or adverse impacts, such as creating strains on existing infrastructure (such as public transport or accommodation facilities during construction, or social infrastructure such as volunteer services, social ties and networks). This section investigates the socio-economic profile of the region to understand the impact of the proposal on socioeconomics and the community.

### SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

#### **Socio-Economic –**

*Include an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.*

### NARRANDERA SHIRE COUNCIL REQUIREMENTS

*Accommodation for workers during the expected six- to nine-month construction phase.*

#### 7.5.1 Background

##### Socio-economic profile

RES commissioned Essential Economics Pty Ltd to prepare an Economic Impact Assessment for the proposal (Appendix K). Essential Economics (2018) determined a suitable study area around the proposed site that includes the LGAs of Narrandera Shire, Leeton Shire, Wagga Wagga City and Griffith City. The study area has a resident population of approximately 108,000 people, which is expected to reach approximately 120,000 by 2036 with a moderate growth of 0.6% per year.

The Narrandera LGA has a population of 5,853 people (ABS, 2016). In the 2011 Census, the population was 5,902 people, which represents almost a 1% decline in population over a period of five years. Therefore, major projects which stimulate new investment and jobs are vital for supporting the regional economy (Appendix K).

The percentage of people of Indigenous origin in 2016 was 9.7%, which is high in comparison to the Australian average of 2.8%. The overseas immigrant population is small with 83.1% of the population born in Australia compared to the Australian average of 66.7% (ABS, 2016).

The local economy is based primarily on dryland, broadacre agriculture and livestock production (Narrandera Shire Council, 2017). The main crops are grains, legumes and oilseeds. Only 2.5% of the agricultural land is irrigated with the main irrigated activities being grapes, fruit, nuts, vegetables, cotton and rice production (Narrandera Shire Council, 2017). Other activities include 2 large piggeries, 2 commercial aquaculture facilities and a Department of Primary Industries (DPI) Research Station and hatchery (Narrandera Shire Council, 2017). Sheep, beef cattle and grain farming involves 9.1% of the population (ABS, 2016). Other sectors that support the economy include local government administration, aged care residential services and hospitals (ABS, 2016).

The unemployment rate for Narrandera LGA is 6.1%, which is less than the national rate of 6.9% (ABS, 2016). During construction, the proposed project could provide new short-term employment for the local workforce, which would continue on in a smaller capacity once operational (Appendix K).

Narrandera is the closest service centre to the development site and includes:

- Located mid-way between Wagga Wagga and Griffith and situated on the Murrumbidgee River.
- DPI Fisheries Research Station and hatchery.
- Public Library.
- Accommodation facilities.
- Educational facilities that include three primary schools, one high school and TAFE.
- Health services, which include the Narrandera District Hospital, Child and Family Health Nurses, Physiotherapist (Narrandera Shire Council, 2018).
- Aged care and disability services.
- Shopping precinct with banks, post office, supermarket, newsagency, pharmacy and cafes.
- Narrandera Art and Community Centre.
- Recreational and sporting facilities including Lake Talbot and Lake Talbot aquatic park, Narrandera Sport Stadium, Narrandera Sports Ground, Narrandera Golf Course, and gyms, tennis and lawn bowl facilities (Narrandera Shire Council, 2018).

In the townships of Narrandera and Leeton there are trade supplies and transport services, and machinery hire and repairs. Wagga Wagga Regional Airport will supply access for interstate workers and professional services such as engineering, major civil construction, machinery/equipment requirements, and higher-order medical and emergency services (Appendix K).

### **Community make-up and priorities**

Narrandera Shire Council has five key strategic themes in its Community Strategic Plan 2017-2030 (Narrandera Shire Council, 2018). The 13-year plan identifies the community's main priorities and aspirations for the future. The five key themes are:

- Community.
- Environment.
- Economy.
- Infrastructure.
- Civic Leadership.

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with particular reference to welcoming and supporting economic development other than agriculture and to explore, embrace and promote alternate sustainable energy sources.

### **General attitudes to renewable energy projects**

Research indicates there is widespread support for solar energy as a source of energy for electricity generation in Australia (ARENA n.d.); 78% of respondents to the ARENA survey were in favour of large-scale solar energy facilities and 87% are in favour of domestic installations. The large-scale solar energy sector is still at a relatively early stage of development in Australia. However, while most members of the community are aware of large-scale solar energy, many do not know a great deal about their impacts (ARENA n.d.).

Three approaches to improving community understanding of the visual impacts of large-scale installations include:

- Provision of images (from many angles) of large scale solar facilities, particularly in the early stages of a proposal.

- Understanding the similarities between highly supported domestic scale installations and large-scale facilities.
- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for (Source: extracted from ARENA n.d.).

Section 6.4 and Appendix E of this EIS provides a visual assessment of how the impact the proposed solar farm would have on the rural landscape and visual amenity of the area.

### **Community feedback on the proposal**

The proponent has undertaken extensive preliminary consultation with surrounding neighbours and the general community including one-on-one meetings, community open days and creating a website dedicated to the proposal providing information about the proposal and allowing communication and feedback to be received.

#### **ONE-ON-ONE MEETINGS**

One-on-one meetings were offered to four neighbours who requested it. The general consensus was positive, with no real issues or concerns raised. Most neighbours did not believe they would be impacted by the proposal.

One neighbour questioned fire risk and insurance implications if the landowner is found to be 'negligent'.

#### **COMMUNITY OPEN DAYS**

Community information sessions were hosted by the proponent. The first session was held in Sandigo at the Sandigo Community Hall on Tuesday 20<sup>th</sup> March 2018. The second session was held in Narrandera at the Narrandera Shire Library on Wednesday 21<sup>st</sup> March 2018. The general consensus was positive, with no real issues or concerns raised.

#### **WEBSITE**

RES has established a dedicated project website (<http://www.avonlie-solarfarm.com/>), which provides information on the proposed Avonlie Solar Farm. The website includes an online community feedback form that can be filled in by any members of the community. An email address [info@avonlie-solarfarm.com](mailto:info@avonlie-solarfarm.com) and phone number also allows the anyone interested to reach the proponent about general enquiries and project related enquiries.

No responses have been submitted through the website.

### **Accommodation availability**

There is ample accommodation available in the townships Narrandera and Leeton. Between the 2 locations there are 245 hotels available and four caravan parks (Appendix K), although it is expected that the majority of staff will be local and not require commercial accommodation. The accommodation requirement of workers during the peak construction period would provide a boost to local accommodation operators (Appendix K).

The development site is mid-way between 2 large regional centres. The City of Griffith is 98 km to the north-west and the City of Wagga Wagga is 99 km to the east. Griffith has a population of about 19,000 and Wagga Wagga has a population of about 48 000 respectively in the urban centres. Wagga Wagga and Griffith provide substantial accommodation opportunities, and community and health services.

## **7.5.2 Potential impacts**

### **Construction**

During construction, it is considered the proposal would generate some adverse socio-economic impacts, however significant positive impacts are also likely. Likely positive impacts include:

- Significant boost to the local and regional economies through generation of employment. It will involve around 200 direct and 320 indirect positions during the peak construction period, and many of these could be drawn from the local area.
- Significant boost to the local and regional economies through increased demand for accommodation, goods and services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to section 7.3).
- Change in the rural landscape character and visual amenity of the area (refer to section 6.5).
- Influx of workers may put pressure on local accommodation and health services.
- Demand for accommodation and increase in traffic movements may have an impact on tourism if the construction phase coincides with local festivals or events.

Narrandera and surrounding areas provide a large number of visitor accommodations. It is possible that, in conjunction with other major projects, shortages of accommodation may occur at times during the construction stage. The project would engage with local accommodation providers and Narrandera Shire Council if necessary to provide additional short term and temporary accommodation at these businesses. The proponent would also consult with Narrandera Shire Council and ESCO Pacific (Sandigo Solar Farm) to co-ordinate construction schedules to minimise conflict with any local festivals or activities. Scheduling staff Rostered Days Off could help alleviate accommodation pressures by allowing itinerant workers to return home.

It is considered that the demand for health care and other services would also be dispersed throughout the surrounding towns to coincide with where workers are staying.

The community is in support of the development, demonstrated through the strategic principles of the Narrandera Community Strategic Plan 2030 and the feedback gained from the community during consultation activities. Overall, it is considered that the proposal would have a positive socio-economic impact given the significant economic boost the proposal would generate. It is considered that the expected adverse impacts would be minimal given the temporary nature of the construction phase and that impacts would be managed through the implementation of safeguards.

### **Operation and decommissioning**

The development of rural land uses compatible with agricultural activities, such as solar power generation, has potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. They also provide a substitute for carbon emission producing electricity production that is stable, renewable and consistent with State and National greenhouse emission reduction objectives.

The installation of solar array modules that involves little soil disturbance and provides an alternative income stream for large agricultural properties can be seen as an important local economic benefit.



Minimal adverse impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be consistent but at low levels. The additional accommodation, traffic and healthcare impacts of operational staff are not likely to be noticeable.

Although the number of employees required during decommissioning would be less than that for construction, it is considered likely to offer a similar economic benefit in terms of opportunities for local staff and industries. Decommissioning may also include local recycling of infrastructure components.

It is generally considered that land prices around the development site are strongly linked to the agricultural productivity of the land. Agricultural productivity on surrounding land would not be affected by the proposal. No residentially-zoned or lifestyle properties are located within proximity to the development site. It is therefore considered unlikely that land prices would be adversely affected by the proposal.

### 7.5.3 Safeguards and mitigation measures

Table 7-14 Safeguards and mitigation measures for socioeconomic and community impacts

No.	Safeguards and mitigation measures	C	O	D
SE1	A Community Consultation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: <ul style="list-style-type: none"> <li>• Protocols to keep the community updated about the progress of the project and project benefits.</li> <li>• Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.).</li> <li>• Protocols to respond to any complaints received.</li> </ul>	<b>C</b>	<b>O</b>	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	<b>C</b>	<b>O</b>	
SE3	Liaison with local representatives regarding accommodation options for staff to minimise adverse impacts on local services.	<b>C</b>		<b>D</b>
SE4	Liaison with local tourism industry representatives to manage potential timing conflicts or cooperation opportunities with local events.	<b>C</b>		<b>D</b>

*C: Construction; O: Operation; D: Decommissioning*

## 7.6 RESOURCE USE AND WASTE GENERATION

### NARRANDERA SHIRE COUNCIL REQUIREMENTS

The EIS must also address the following specific issues:

*Management of large quantities of unsorted waste generated, and the processing capability of local landfill facilities, during the construction phase.*

#### 7.6.1 Existing environment

##### Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar farm include those listed in Section 3.6.3.

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Water requirements during operation are estimated to be 1.7 ML/year.

##### Waste generation

##### POLICY POSITION

Legal requirements for the management of waste are established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The proposal's resource management options would be considered against a hierarchy of the following order:

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

##### CONSTRUCTION

Solid waste is one of the major pollutants caused by construction. Several construction activities would produce solid wastes, such as:

- Packaging materials.
- Excess building materials.
- Scrap metal and cabling materials.
- Plastic and masonry products, including concrete wash.
- Excavation of topsoils and vegetation clearing (expected to be minimal).
- Bio wastes from onsite septic systems.

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction phase would be classified as building and demolition waste within the class general solid waste (non-putrescible). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescible) in accordance with the POEO Act.

On-site waste materials (including dangerous goods and hazardous waste) will be disposed of at one of the licenced local waste management centres including the Narrandera Waste Depot (17 km), the Gregadoo Waste Management Centre in Wagga Wagga (99 km) and the Tharbogang Waste Management Centre in Griffith (98 km).

#### OPERATION

During operation the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels, lubricants and metals may require replacement over the operational life of the project.

#### DECOMMISSIONING

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

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriately licenced facilities. All above ground infrastructure would be removed from the site during decommissioning.

### **7.6.2 Potential impacts**

#### **Construction and decommissioning**

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the proposal are not currently limited or restricted. In the volumes required, the proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

Water would be required during construction for activities including watering of roads and in the site office and amenities. Water use is considered in Section 7.2.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. The proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. The majority of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

#### **Operation**

#### LIFE CYCLE ANALYSIS

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total life cycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A life cycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 25 to 30-year lifetime of the panels, it is expected that 28g of GHG would be produced per kWh of energy generated (Fthenakis et al., 2011). The ‘energy payback time’ for multicrystalline PV panels is dependent on the geographical location, however on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer ISE, 2015), which is considered comparable to the development site.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis et al., 2011). The waste produced during production of the panels which can be recycled includes graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis et al., 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer ISE, 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the system’s life cycle (GA and ABARE, 2010).

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO<sub>2</sub> emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

**RESOURCES AND WASTE STREAMS**

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the solar farm.

Operational waste streams would be very low given the low maintenance requirements of the solar farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation. However, these activities would occur very infrequently and there would be a high potential for recycling or reuse of the waste.

**7.6.3 Safeguards and mitigation measures**

Table 7-15 Safeguards and mitigation measures for resource use and waste generation

No.	Safeguards and mitigation measures	C	O	D
WM1	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: <ul style="list-style-type: none"> <li>• Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>

No.	Safeguards and mitigation measures	C	O	D
	<ul style="list-style-type: none"> <li>• Quantification and classification of all waste streams.</li> <li>• Provision for recycling management onsite.</li> <li>• Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant).</li> <li>• Tracking of all waste leaving the site under the POEO Act.</li> <li>• Disposal of waste at facilities permitted to accept the waste.</li> <li>• Requirements for hauling waste (such as covered loads).</li> </ul>			

*C: Construction; O: Operation; D: Decommissioning*

## 7.7 HAZARDS

An environmental hazard is a thing or situation which can threaten the environment or human health. Hazards may be natural or artificial or result from the interaction between human activity and the natural environment. Hazards relevant to the proposal and proposal site include risks associated with hazardous goods, electromagnetic fields, fire and flooding.

### 7.7.1 Hazardous materials and development

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 Guidelines lists industries that may fall within SEPP 33, which precludes solar farms and energy storage facilities. Appendix 2 of the guidelines provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. The Applying SEPP 33 is however a guide only, and final determination is made based on considerations is the development will fall under the definition of potentially hazardous in the actual SEPP 33.

#### RISK SCREENING

SEPP 33 screening procedure is based on the quantity of dangerous goods stored or transported, the frequency of transportation movements, and in some cases the distance of the materials from the site boundary. The guidelines require goods to be classified according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

A development which exceeds screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. For quantities below the given threshold, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage are detailed in Table 7-16, with the location of the proposed storage sites shown on Figure 3-9. Transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, therefore would not be considered potentially hazardous and would not require a PHA.

Table 7-16 SEPP 33 Transport Thresholds

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
<b>Class 2.1 Flammable Gases</b>					
LPG	10 Tonnes or 16m <sup>3</sup> (above ground)	>500 cumulative >30/week	2-5 tonnes	Up to 45kg cylinders beside control building, 20 m from boundary	No
<b>Class 2.2 Non-flammable, Non-toxic Gases</b>					
Inert fire suppression gas	NA	NA	NA	Compressed in steel bottles in BSF	No
<b>Class 3 - Flammable Liquids (PG II)</b>					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	3-5 tonnes	Stored in a bunded area, 20 m from boundary	No
<b>Class 6.1 Toxic Substances (PG II, III)</b>					

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
Pesticides (herbicides)	2.5 tonnes	All	1-2.5 tonnes	Secure operations storage building	No
<b>Class 9 Miscellaneous Dangerous Substances and Articles</b>					
Li-ion batteries	284.4m <sup>3</sup>	>1000 cumulative >60/week		BSF buildings in a secure compound.	No

Class 2.2 Non-flammable, non-toxic gases

Inert gas will be stored in compressed form in the proposed BSF for fire suppression. Gases within class 2.2 are excluded from the SEPP 33 risk screening process and are not considered to be potentially hazardous with respect to off-site risk. These materials have a Workcover notification threshold of 10,000 litres.

The use of inert gases for fire suppression in enclosed spaces carries asphyxiation risk. Gases commonly used are blends of argon, nitrogen and carbon dioxide, and are used to reduce oxygen content to extinguish fires. The risk of accidental asphyxiation can be minimised by proper installation and operation, regular maintenance, provision of warning signs and information, emergency response training, fixed or personal oxygen monitoring equipment, auditable and visible alarm systems, incorporation of odour to gas, effective ventilation and air exchange, and effective purging system.

Class 9 Miscellaneous dangerous substances and articles

Class 9 represents all miscellaneous dangerous goods, which pose little threat to people or property that may pose an environmental hazard. Lithium-ion batteries (LIB) are under Class 9 Hazardous Goods, which are also excluded from the SEPP 33 screening process. However, Appendix 4 of the Guidelines clarifies that the consent authority should consider whether a potential for harm exists. The major hazard offered by LIB is fire as a result of the flammability of the substances used in the battery. Class 9 materials have a Workcover notification threshold of 10,000 litres or kilograms.

LIB are classified as hazardous waste under the Commonwealth *Hazardous Waste Act (Regulation of Exports and Imports) 1989*, and are classified as Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The ADG Code requires dangerous goods to be carried in a secure, safe and environmentally controlled manner. The code specifies ‘special provisions’ and ‘packing instructions’ applying to the transportation of LIB. The code listing also applies to waste LIB. The National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998 (the NEPM), which sets the regulatory framework for transporting ‘controlled wastes’ between Australian states and territories, does not currently cover LIB. Waste LIB are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randell, 2016).

**OTHER RISK FACTORS**

The proposal would not involve the storage or transport of incompatible materials, generation of hazardous wastes, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, or storage or processing operations involving high (or extremely low) temperatures. There are no known past incidents (or near misses) involving hazardous materials and processes at solar farms.

**POTENTIALLY OFFENSIVE INDUSTRY**

The proposal would result in vehicle and machinery exhaust emissions during the construction phase. The emissions occur outside, in a rural locality, and would be readily dispersed. The emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would also largely be confined to standard working hours during the construction phase and would not be hazardous to employees or neighbouring residents. Water pollution risks are assessed as low, subject to identified mitigation measures, with longer term benefits following cessation of cultivation and establishment of groundcover across the site

### **7.7.2 Fire**

Bush fire presents a threat to human life and assets and can adversely impact ecological values. Bush fire risk can be considered in terms of environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines and other electrical components).

### **FIRE AND RESCUE NSW REQUIREMENTS**

*The EIS must also address the following specific issues:*

*A comprehensive Emergency Response Plan (ERP) is developed for the site:*

- *The ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents.*
- *The ERP details appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. Such measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and safe methods for shutting down and isolating the PV system.*
- *Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.*
- *Two copies of the ERP to be stored in a prominent 'Emergency Information Cabinet' which is in a position directly adjacent the site's main entry points.*

*Once constructed and prior to operation, the operator of the facility must contact the relevant Local Emergency Management Committee (LEMC).*

### **NSW RURAL FIRE SERVICES REQUIREMENTS**

*Incorporate a Bush Fire Hazard Assessment Report prepared by a suitably qualified person which includes site-specific recommendations for the proper design of:*

- *Asset protection zones.*
- *Measures to prevent fire occurring within the site from developing into a bush/grass fire risk to the surrounding area.*
- *Water supply for firefighting purposes.*
- *Land and vegetation management.*
- *Emergency management procedures, including the development of a Fire Management Plan in consultation with the Local NSW RFS District Fire Control Centre.*
- *Vehicular access and defensible space around the solar array.*

### **Existing environment**

The development site is flat. Local native vegetation remains in and around the site as remnant and planted corridors, native planted areas and scattered paddock trees. Remnant roadside native vegetation is minimal to the south of the site along Muntz Road. Native tree plantings occur within the site along internal fence boundaries in the eastern portion of the site and along a portion of the western boundary (Appendix



B). There are large patches of native forestry and Old Man Saltbush planted in the south-eastern corner of the development site. Patches of remnant vegetation are located along the boundary of the south-western portion of the development site (18.72%). The majority of the development site has been cleared and cultivated in the past. 2.1 ha of native vegetation (2.02%) requires to be cleared from the development footprint. The site is not identified as bush fire prone land (NSW RFS, 2018).

The existing bushfire hazards within the development site are:

- Narrow strips of planted eucalypt woodland along the internal boundaries and the northern, western and southern boundaries.
- Remnant patches of vegetation are located along the western boundary.

Ground cover has largely been removed or reduced due to cultivation practices.

The local bush fire danger period occurs between October and March. The harvest period of November to mid-December is considered a prime risk period due to machinery in crops and generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas.

In terms of resources to fight fire, there are two retained farm dam in the development site. There are scattered farm dams on properties surrounding the site. Sandy Creek is within 1.5 km to the north and the Murrumbidgee River is about 13 km to the north. There are 2 Rural Fire Service stations within 12 km of the development site, one on Stonybank Road to the west and one on Kywong Road to the west. A water storage tank will be maintained on-site as a fire-fighting resource.

Internal access tracks would be 4 m wide to ensure safe operational access and egress for emergency service personnel.

In terms of receptors and assets at risk from bush fire, one dwelling is located within 1 km of the development site. Seven dwellings are located within 2 km. Additionally, farm sheds, watering points, silos and equipment are common in the local area. As stated above, November to mid-December represents a period of high activity when many people may be active in harvest and other farm activities onsite and in the local area.

#### PLANNING FOR BUSHFIRE PROTECTION GUIDELINES

According to the *Planning for Bushfire Protection (PBP) guidelines* (RFS 2006), an acceptable level of protection from bushfires is achieved for developments through a combination of strategies which:

- *control the types of development permissible in bush fire prone areas.*
- *minimise the impact of radiant heat and direct flame contact by separating the development from the bush fire hazard.*
- *reduce the rate of heat output (intensity) of a bush fire close to a development through control of fuel levels.*
- *minimise the vulnerability of buildings to ignition from radiation and ember attack.*
- *enable relatively safe access for the public and facilitate fire-fighting operations.*
- *provide adequate water supplies for bush fire suppression operations.*
- *implement community education programs, focusing on property preparedness, including emergency planning and property maintenance requirements.*
- *facilitate the maintenance of APZs, fire trails, access for firefighting and on-site equipment for fire suppression.*

The PBP guidelines provide six key Bush Fire Protection Measures for developments:

- a) *the provision of clear separation of buildings and bush fire hazards in the form of fuel reduced APZ (comprising inner and outer protection areas and defendable space).*
- b) *construction standards and design.*
- c) *appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation.*
- d) *adequate water supply and pressure.*
- e) *emergency management arrangements for fire protection and/or evacuation.*
- f) *suitable landscaping to limit fire spreading to a building.*

#### Draft Planning for Bush Fire Protection 2017

The draft *Planning for Bush Fire Protection (RFS 2017)* provides the following bushfire management objectives for National Construction Code Class 5 to 8 buildings (including commercial and industrial facilities) and Class 10 non-habitable buildings and structures (such as garages and fences):

- *to provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress with evacuation.*
- *to provide adequate supplies of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*
- *to provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development and consideration of storage of hazardous materials away from the hazard wherever possible.*

The draft guidelines do not specifically address solar farms but, in relation to wind farms, provide for a 10 m Asset Protection Zone (APZ) from structures, and adequate firefighting access. The draft guidelines require a bush fire emergency management and operation plan covering the suspension of work involving risk of ignition during total fire bans, the availability of fire-suppression equipment, storage and maintenance of flammable materials, notification of the local NSW RFS Fire Control Centre for any works during the fire danger period that have the potential to ignite surrounding vegetation, and bush fire emergency management planning.

### **7.7.3 Potential impacts**

#### **Construction and decommissioning**

Activities associated with construction that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol-powered tools.
- Hot works, including welding and soldering activities.
- Battery storage.
- Operating a petrol, LPG or diesel-powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the low vegetation cover over the development site and other factors discussed above, it is considered unlikely that construction of the solar farm would pose a significant bush fire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

There is potential for a fire event in the battery system which could initiate a bushfire in the surrounding grazed grasslands. Prevention measures to reduce the likelihood of a fire starting and effective mitigation measures to contain the fire reduces any risk.

The bush fire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bush fire mitigation measures outlined in Section 7.7.5.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction and operation activities (below), any bush fire risk associated with decommissioning of the project would be highly manageable.

## **Operation**

Repairs and maintenance activities during operation could increase bush fire risk. All electrical components would be designed to minimise potential for ignition. Ground cover beneath panels would be maintained and not permitted to accumulate to high fuel loads (access and solar input requirements are in line with this activity). Strategic grazing is one potential method for keeping fuel loads to a minimum around the solar farm infrastructure.

An APZ would be maintained around individual buildings and the entire development site including inverters, delivery station and substation. Maintenance of the substation APZ will transfer to TransGrid on completion of the proposal.

Internal access tracks are 4 m wide allowing adequate access for emergency vehicles including fire trucks.

Bush fire risks during operation of the solar farm and connection infrastructure would be manageable.

### **LITHIUM-ION BATTERIES**

All energy storage systems carry risks associated with the uncontrolled release of energy. While lithium-ion batteries offer significant advantages over competing commercialised storage technologies in terms of energy density, efficiency and charging times, these advantages also elevate the risk of fire. The Li-ion based BSF will be designed with proper disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate the fire risk to the required level of safety.

Operating strategies spanning proper planning, risk assessment, storage methods, maintenance protocols, and response protocols are the other important factors in mitigating Li-ion fire risks (Butler, 2013).

### Fire risks

Li-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Li-ion systems can span -10 to 50 degrees Celsius but the cells inside the containers are kept within a smaller range, 10 to 30 degrees Celsius, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come in contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350-400°C (Recharge, 2013). Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical

conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated.

#### Fire causes

Battery overheating may be caused by a range of factors including electrical shorting, rapid discharge, overcharging, manufacturers defect, poor design and mechanical damage (Butler, 2013). LIB do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault (Department of Commerce, 2017). The main failure modes for these battery systems are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum and Long, 2016).

A large majority of incidents involving Li-ion batteries have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge, 2013).

#### Risk and incident management

Factors listed in Department of Commerce (2017) to avoid and mitigate battery fire impacts include:

- Building codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations.
- Manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature.
- Adequate ventilation.
- Containment of electrolyte spills.
- Adequately fire-rated walls are used to avoid or delay the spread of fire.
- Adequate access/egress for installation and maintenance.
- Adequate mechanical protection.

Battery location and spatial design are also important safety factors. Large-scale Li-ion energy storage systems can further mitigate widespread impact by isolating different parts of a system.

Fire containment and suppression systems need to be employed to deal with a potential battery fire event, applying the Suppression through Cooling, Isolation, and Containment (SCIC) approach (Butler, 2013). However, while most current systems have automated and manually triggered fire suppression systems, the technology is new and there is limited knowledge about the usefulness of the suppression systems in the event of fire (Blum and Long, 2016).

Li-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler, 2013). The Avonlie Solar Farm would manage the fire risks associated with the BSF by:

- Locating the BSF as far as practicable from any sensitive receptors (residences) or large stands of vegetation.
- Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems.
- Installing reliable integrated fire detection and fire suppression systems (inert gas).
- Ensuring the battery containers are not vulnerable to external heat effects in the event of a bushfire.
- Designing appropriate separation and isolation between individual battery containers and between batteries and other infrastructure, including gravel surfacing around the facility.

- Compliance with all relevant guidelines and standards.
- Preparation of a specific Battery Fire Response Plan, under the general Fire Response Plan, in consultation with fire authorities, fire suppression experts, RES' experienced storage team, and in reference to relevant standards and guidelines.
- Facilitation (including funding) of first responder training in the management of Li-ion battery fires at the site for local brigades.

Though the specific battery manufacturer and model has not yet been determined, each battery module within the implemented solution would have its temperature and voltage monitored. The RESolve control system would likely be employed, which has proven capabilities to suspend BSF operation if temperature or voltage exceeds pre-set levels.

The fire suppression system within the BSF would comprise the storage and release of inert gas within each battery container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

There would be spare aircon units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all aircon units fail, the auto shutdown of the batteries would prevent overheating.

#### Standards and guidelines

The installation of lithium-ion batteries has been identified as in need of relevant standards and Standards Australia is developing a new standard (AS/NZS 5139) for smaller scale battery installations (Standards Australia, 2017). The Clean Energy Council provides requirements for accredited installers, the Australian Energy Storage Council has produced a Guide for Energy Storage Systems, and the WA Department of Commerce has released a guide for electrical contractors in relation to battery storage systems (Department of Commerce, 2017).

#### COMPLIANCE WITH PBP GUIDELINES

##### Asset Protection Zones

Appendix 2 of the PBP guidelines provides minimum APZ requirements for habitable buildings in residential developments designated as bush fire prone. While the proposal is not residential, these APZ prescriptions would be applied to the solar farm infrastructure to provide defensible space and to manage heat intensities at the infrastructure interface.

The PBP guidelines indicates a minimum APZ width of 10 m for grassy woodlands (total fuel load 15 tonnes/hectare) and semi-arid woodlands (total fuel load 18 tonnes/hectare) on flat ground in the Southern Riverina with a Fire Danger Rating of 80. This setback is based on the need to conform to Level 3 construction (AS3959 – 1999) for a building of Class 1 or 2 under the BCA.

The 2017 *Planning for Bush Fire Protection* (RFS, 2017b) specifies the following minimum APZ widths for residential subdivisions on flat ground in FDI 80 areas:

Grassy woodlands	11 m
Semi-arid woodlands (grassy)	6 m.

An APZ of minimum width of 10 m would be provided around the solar farm buildings, substation and BSF, and around the outside perimeter of the solar array. The 10 m APZ setback requirement would also be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm. All of the APZ would be managed as an Inner Protection Area. The APZ surrounding the proposed BSF and substation

would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

#### Fuel hazard management

According to the PBP guidelines, the APZ should provide a tree canopy cover of less than 15% located greater than 2 m from any part of the roofline of a dwelling and should not overhang any building. Trees should have lower limbs removed up to a height of 2 m above the ground. The understorey should be managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season.

There would be no trees or shrubs within the APZ established for the solar farm, or within the solar array area. Grassland Fuel Hazard is a function of grass height and cover, with variation according to curing and species fuel characteristics. Grass fuel would be monitored and managed using stock grazing or mowing to maintain safe fuel levels. Grass height within the APZ would be maintained at or below 5 cm throughout the October-April fire season. Grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 cm throughout the fire season.

The overhead powerlines at the development site would be managed by maintaining appropriate vegetation clearances to minimise potential ignition risks, in accordance with the ISSC 3 Guideline for Managing Vegetation Near Power Lines.

#### Access

Safe and efficient access (suitable for firefighting appliances) would be established and maintained over the solar farm site. The APZ around the perimeter of the site would incorporate a 4 m wide gravel access track. The perimeter track would comply with the requirements for Fire Trails in section 4.1.3 of the PBP guidelines, including:

- A minimum carriageway width of 4 m with an additional 1 m wide strip on each side of the trail clear of bushes and long grass.
- Minimum vertical clearance of 4 m.
- Capacity for passing using reversing bays and/or passing bays every 200 m suitable for fire tankers.
- Connection to the property access road and/or to the through road system at frequent intervals of 200 m or less.

The turn radius and swept path clearance on access roads would be suitable for Category 1 Tankers (Medium Rigid Vehicle).

#### Fire-fighting resources and preparedness

A steel or concrete water storage tank would be installed adjoining the main internal access road for firefighting and other non-potable water uses, with a 65mm Storz outlet, a metal valve and a minimum of 20,000 litres reserved for fire-fighting purposes. Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity. Suitable fire extinguishers and PPE would be maintained at site buildings.

A Bush Fire Management Plan would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the solar farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through site orientation and information events and the facilitation of training in the management of lithium-ion battery fires. An Emergency Response Plan, including an Evacuation Plan, Emergency Fire Response Plan (with a specific battery fire response section) and SCRP would also be developed to enable rapid, safe and effective incident response.

#### 7.7.4 Electric and magnetic fields

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs).

##### **SECRETARY'S REQUIREMENTS**

*The EIS must also address the following specific issues:*

##### **Hazards and Electromagnetic Interference –**

*An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure (including the proposed transmission line and substation) against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.*

##### **About EMFs**

EMFs consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO, 2012).

Electric fields are produced by voltage. Magnetic fields are produced by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances while operational (WHO, 2007). Electric and magnetic field strengths reduce rapidly with distance from the source and, while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300Hz.

Research into photovoltaic solar arrays in California by Chang and Jennings (1994) indicated that magnetic fields (the EMF type of greatest public concern) were significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, nd). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF electric fields at the low levels generally encountered by the public (WHO, 2007), such as those that would be produced by electricity generation at the proposed solar farm and along the transmission line. Although recently studied, there has been no support for the notion that exposure to 50-60Hz magnetic fields is a cause of childhood leukaemia (ICNIRP, 2010).

Whether exposure to ELF magnetic fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2015) advises that 'the scientific evidence does not firmly establish that exposure to 50Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

Australia does not currently have a standard regulating exposure to ELF electric or magnetic fields. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz) in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects.

To prevent health-relevant interactions with ELF fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached. The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions will also be met (in the body). These are not the actual limits, they are simply guidance figures for when it is necessary to investigate the basic restriction (ICNIRP, 2010). Reference levels for occupational and general public exposure are shown in Table 7-17.

Table 7-17 ICNIRP reference levels for electric and magnetic fields. Values are for 50Hz

Exposure characteristics	Electric fields	Magnetic fields
<b>Occupational</b>		
	ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
	field actually required: 24.2 kV/m	field actually required: 3.03 mT
<b>General public</b>		
	ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 $\mu$ T
	field actually required: 9.9 kV/m	field actually required: 606 $\mu$ T

The proposal includes five main types of infrastructure that could create EMFs:

1. Solar Panels and invertors.
2. Underground cables.
3. Overhead 132kV transmission line.
4. Solar substation
5. Battery

Typical and maximum EMF levels for these types of infrastructure are discussed below. Strength attenuates with distance from the infrastructure, as seen below.

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal.

The substation is classified as an intermediate substation. The highest electromagnetic field is usually produced by the lines and cables supplying the substation and not by the equipment inside the substation itself. If the substation itself produces a field outside its perimeter, it usually falls away over the first few m (EMFs info, 2017). Works undertaken to facilitate the connection of the transmission line will require mitigation measures to ensure reduced exposure.



## Potential impacts

### Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the project. The maximum magnetic field of the proposed transmission line is well under the 200 $\mu$ T and 1000 $\mu$ T limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing 132kV overhead transmission line. Exposure to EMFs during the construction of the substation and its connection to the existing transmission line will be short term, therefore the effects are likely to be negligible.

The construction site would be fenced to protect the public from construction health and safety risks.

### Operation

During operation, EMF sources would include underground cabling, and the solar array incorporating inverters.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts minimised also.

The site is surrounded by agricultural land. Public access would be restricted by fencing around the site including substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

Using the Principle of Prudent Avoidance to design and site infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

### 7.7.5 Safeguards and mitigation measures

ICNIRP sets out a number of protective measures to reduce personal harm from EMFs if the basic restrictions are expected to be exceeded. These include engineering design, administrative controls and personal protective clothing. The works undertaken for the proposed solar farm are not expected to exceed the basic restriction levels. The following safeguard and mitigation measures will be implemented to reduce any further risks associated with EMF exposure (Table 7-18).

Table 7-18 Safeguards and mitigation measures for health and safety

No.	Safeguards and mitigation measures	C	O	D
HA1	An Emergency Response Plan, incorporating an Evacuation Plan, Flood Response Plan and SCRP would be developed prior to commissioning the solar farm. A copy of the plan would be kept on site in a prominent position adjacent to the site entry point at all times.	C	O	D
HA2	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: <i>The storage and handling of flammable and combustible liquids</i> , and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and banded.	C	O	D

No.	Safeguards and mitigation measures	C	O	D
HA3	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	<b>C</b>	<b>O</b>	<b>D</b>
HA4	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	<b>C</b>		
HA5	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	<b>C</b>		
HA6	Design of electrical infrastructure would minimise EMFs (underground).	<b>C</b>		
HA7	<p>A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to:</p> <ul style="list-style-type: none"> <li>• Management of activities with a risk of fire ignition.</li> <li>• Management of fuel loads onsite.</li> <li>• Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression.</li> <li>• The below requirements of Planning for Bush Fire Protection 2006: <ul style="list-style-type: none"> <li>○ Identifying asset protection zones.</li> <li>○ Providing adequate egress/access to the site.</li> <li>○ Emergency evacuation measures.</li> </ul> </li> </ul> <p>Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.</p>	<b>C</b>	<b>O</b>	<b>D</b>
HA8	<p>A comprehensive Emergency Fire Response Plan would be developed and implemented during construction, operation and decommissioning, and include but not limited to:</p> <ul style="list-style-type: none"> <li>• Address foreseeable on-site and off-site fire events.</li> <li>• Details appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders.</li> </ul> <p>Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.</p>	<b>C</b>	<b>O</b>	<b>D</b>

*C: Construction; O: Operation; D: Decommissioning*

## 7.8 HISTORIC HERITAGE

A search of listed items (under the NSW *Heritage Act 1977*, the Australian Heritage Database and those listed by local Councils and State Government agencies) was completed for the Narrandera LGA on 1 March 2018. None of the items listed are located within 10 km of the development site.

### THE SECRETARY'S REQUIREMENTS

*The EIS must also address the following specific issues:*

*Include an assessment of the likely historic heritage (cultural and archaeological) impacts of the development.*

### OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

*The EIS must provide a heritage assessment including an assessment of impacts to state and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage values, buildings, works, relics, gardens, landscapes, views and trees should be assessed. Where impacts are identified, the assessment shall:*

- *Outline the proposed mitigation and management measures.*
- *Be undertaken by a suitably qualified heritage consultant.*
- *Include a statement of heritage impact for all heritage items.*
- *Consider impacts including vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscapes and vistas, and archaeological noise treatment.*
- *Where potential archaeological impacts have been identified, develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations and include the results of these test excavations.*

#### 7.8.1 Approach

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the development site. Heritage databases searched as part of this assessment included:

- The NSW State Heritage Inventory (SHI) (includes items on the State Heritage Register and items listed by state agencies and local government) to identify any items currently listed within or adjacent to the development site. The area searched was the Narrandera LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the development site.
- The Environmental Heritage (Schedule 5) of the Narrandera LEP (2013) for locally listed heritage items that are within or adjacent to the development site.

#### 7.8.2 Results

The results of the heritage searches listed above indicate that no known historic items or places occur within the development site. A summary of the results of the heritage searches are illustrated in Table 7-19. Details of listed items are provided below.

Table 7-19 Summary of heritage listings in the Narrandera LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	11

NSW State Heritage Register	7
State Agency Heritage Register	42
Narrandera Local Environment Plan (LEP) 2013	95

### Commonwealth Heritage List

A search of the Australian Heritage database within the Narrandera LGA indicated seven listings:

- Butherwah Homestead, Urana.
- CBC Bank (former), Narrandera.
- CWA Rest House, Barellan.
- Dry Lagoon Area, Narrandera.
- Narrandera Courthouse and Police Station Group, Narrandera.
- Narrandera Nature Reserve, Narrandera.
- Narrandera Post Office, Narrandera.
- Narrandera Rail Bridge, Narrandera.
- Narrandera Showground, Narrandera.
- Railway Station and Station Masters Residence, Narrandera.
- St Johns Uniting Church and Hall, Narrandera.

None of the above items are located within or adjacent to the development site.

### State Heritage Register

A search of the NSW State Heritage Register within the Narrandera LGA indicated seven listings:

- Berembed Weir and Site, Narrandera.
- CWA Rest House, Barellan.
- Derrendi Cottage, Narrandera.
- Narrandera Rail Bridge over Murrumbidgee River, Narrandera.
- Narrandera Railway Station and Yard Group, Narrandera.
- Narrandera Showground Industrial Hall, Narrandera.
- Wooden Wicket – Berembed Weir Site, Grong Grong.

These items are listed under the *NSW Heritage Act 1977* and are not located in or adjacent to the development site.

### NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register within the Narrandera LGA indicated 42 listings. These included:

- Narrandera Courthouse, Narrandera.
- Narrandera Residence, Narrandera.
- First Cottage Hospital, Narrandera.
- Narrandera Railway Precinct, Narrandera.
- Narrandera Murrumbidgee River Underbridge, Narrandera.
- Narrandera Railway Stockyard, Narrandera.
- Poisoned Waterholes Creek Bridge, 8.4 km east of Narrandera.
- Barellan Police Station, Barellan.

- Grong Grong Police Station and Lockup Residence, Grong Grong.
- Narrandera Official Residence 1, Narrandera.
- Narrandera Official Residence 2, Narrandera.
- Narrandera Official Residence 3, Narrandera.
- Narrandera Police Station, Narrandera.
- Main Building Jellingbah St, Narrandera.
- Isolation Ward Jellingbah St, Narrandera.
- New Ward Jellingbah St, Narrandera.
- Nurses Quarters Jellingbah St, Narrandera.
- Berembed Canal Bridge No. 1 Murrumbidgee River, Grong Grong.
- Berembed Canal Bridge No. 2 Murrumbidgee River, Grong Grong.
- Berembed Canal Bridge No. 3 Murrumbidgee River, Grong Grong.
- Berembed Canal Bridge No. 4 Murrumbidgee River, Grong Grong.
- Berembed Canal Bridge No. 5 Murrumbidgee River, Grong Grong.
- Narrandera Fire Station, Narrandera.
- Narrandera Railway Precinct, Narrandera.
- Berembed Offtake Regulator, Grong Grong.
- Berembed Weir, Grong Grong.
- Berembed Weir Access Road, Grong Grong.
- Berembed Weir House, Grong Grong.
- Berembed Weir House Storage Shed, Grong Grong.
- Berembed Weir House Toilet, Grong Grong.
- Berembed Weir Picnic Area, Grong Grong.
- Berembed Weir Pump Shed, Grong Grong.
- Spillers Regulator, Yanco Creek.
- Narrandera Nature Reserve.
- Item Yapunyah Street, Barellan.
- Courthouse, Narrandera.
- Post Office, Narrandera.
- National Australia Bank, Narrandera.
- Narrandera Railway Station, platform and Stationmaster's Residence, Narrandera.
- Police Station Group, Narrandera.
- Steel and Brick Water Tower, Narrandera.

The above items are listed by State Agencies under s.170 of the *Heritage Act 1977*. None of the above items are located within the development site.

### **Local Heritage Schedule**

A search of the Narrandera LEP (2013) resulted in a total of 95 local heritage items being recorded within the LGA. The majority of these items are concentrated in the town of Narrandera and the townships of Grong Grong and Barellan. One item of heritage was located within 1 km of the development site (Sandigo Hall) (Figure 7-13). No other items were located within 10 km of the development site.

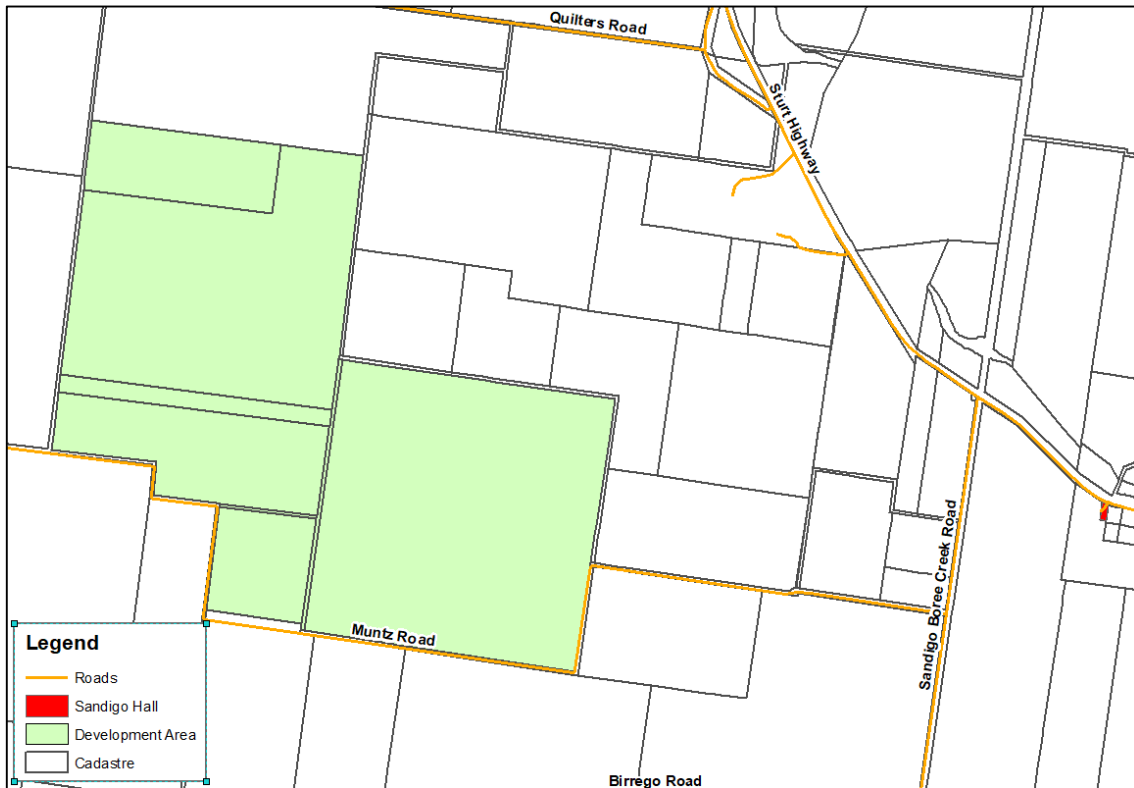


Figure 7-13 Sandigo Hall heritage item located within 1 km of the development site (NSW Government 2013)

### 7.8.3 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. Most of these items are found in Narrandera and other towns and villages. None of these items are found within 10 km of the development site.

The proposal is not considered likely to have a significant impact on heritage values in accordance with the NSW *Heritage Act 1977*, the EP&A Act, and the EPBC Act.

The Heritage Council will be notified if any relics are located on the development footprint.

### 7.8.4 Safeguards and mitigation measures

Table 7-20 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	Should a relic be located, the NSW Heritage Council will be notified prior to further work being carried out in the vicinity.	C	O	D

C: Construction; O: Operation; D: Decommissioning

## 7.9 CUMULATIVE IMPACTS

Adverse cumulative impacts occur when the infrastructure or activities at the development site exacerbate the negative impacts on other infrastructure or activities occurring nearby. There are 2 active major projects listed on the Major Projects Register within the Narrandera LGA:

- Sandigo Solar Farm, Sandigo – EIS submitted.
- Yarrabee Park Solar Farm, Morundah – SEARs issued.

The proposed Sandigo Solar Farm is within approximately 15 km of the site.

No undetermined development applications are within proximity of the development site (Narrandera Shire Council, 2018).

In the broader study area, there are a number of SSD projects that include:

- Deniliquin Ethanol Plant.
- Currawarra Solar Farm (near Deniliquin)
- Tarleigh Solar Farm (near Deniliquin).
- Coleambally Solar Farm.

The proposal is unlikely to impact on traffic, labour and resources required to support these developments as:

- The different construction timeframes and staging of all projects.
- The Currawarra and Tarleigh solar farms are also being developed by the proponent and therefore would fall into sequence with Avonlie to reduce any internal resourcing issues and therefore cumulative impacts.
- There is a large construction base in the region (i.e. 16,760 construction-related workers and 2,000 construction-related businesses) (Appendix K).

Development of the Avonlie Solar Farm could be concurrent with the development of the Sandigo Solar Farm. However, there are significant resources available in the broader region, including Wagga Wagga, for commercial accommodation facilities and employment. No cumulative impacts are anticipated (Appendix K). The majority of staff will also be local, and not require commercial accommodation or facilities.

Cumulative impacts will not affect the SSD proposals occurring within the LGA.

Generally, adverse cumulative impacts to the road network, noise, visuals etc. are anticipated to be negligible.

Approximately 550 ha of productive farming land will be lost to the solar farm development. This is 0.07% of all cropping land and 0.06% of all productive land in the NSW Murray Region (Appendix K). Therefore, the development of a solar farm would potentially result in the following agricultural impacts:

- Limited resource loss for the lifetime of the solar farm.
- A potential change to biosecurity risks.
- Potential increased bushfire risks.

Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing agricultural condition. As such, no cumulative impacts to agricultural enterprise is expected. Refer to Section 6.5 for further detail.

## 8 ENVIRONMENTAL MANAGEMENT

### 8.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposed Avonlie Solar Farm would be managed by implementing a project-specific suite of mitigation measures detailed in Sections 5 and 7 and summarised below.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan, consisting of a CEMP, an Operation Environmental Management Plan and a RDEMP. These plans would be prepared sequentially, prior to each stage of works.

These plans would detail the environmental management responsibilities of specific staff roles, reporting requirements, monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training, complaint response procedures and adaptive management mechanisms to encourage continuous improvement.

### 8.2 MITIGATION MEASURES

Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

*Construction (C), Operation (O), Decommissioning (D)*

No.	Safeguards and mitigation measures	C	O	D
BD1	<ul style="list-style-type: none"> <li>Hollow-bearing trees would not be removed during breeding and hibernation season (Winter to summer) to mitigate impacts on Superb Parrots, Major Mitchell Cockatoo and Corben's Long-eared Bat.</li> <li>Old Man Saltbush Shrubland would not be removed during the breeding season (July to March) of the White-fronted Chat to mitigate impacts to this species.</li> </ul> <p>If clearing outside of these periods cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.</p>	C		
BD2	<p>Spring flora surveys by an ecologist/botanist along Muntz Rd and Sandigo Rd for:</p> <ul style="list-style-type: none"> <li><i>Caladenia arenaria</i> (Sandhill Spider Orchid).</li> <li><i>Diuris sp. Oaklands, D. L. Jones 5380</i> (Oaklands Diuris).</li> <li><i>Austrostipa wakoolica</i> (A spear grass).</li> </ul>	Prior to construction		
BD3	<p>Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing in the presence of a trained ecologist or licensed wildlife handler during clearing events, including:</p> <ul style="list-style-type: none"> <li>Pre-clearing checklist.</li> </ul> <p>Tree clearing procedure.</p>	Prior to and during construction		
BD4	<p>Implementation of Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement.</p>	C		
BD5	<ul style="list-style-type: none"> <li>Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing.</li> <li>No stockpiling or storage within dripline of any mature trees.</li> </ul> <p>In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.</p>	Prior to and during construction		



No.	Safeguards and mitigation measures	C	O	D
<b>BD6</b>	The development and implementation of the Construction Environmental Management Plan (CEMP) will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	Prior to construction		
<b>BD7</b>	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill, including: <ul style="list-style-type: none"> <li>Avoid Night Works.</li> </ul> Direct lights away from vegetation.	C	O	
<b>BD8</b>	<ul style="list-style-type: none"> <li>Daily monitoring of dust generated by construction and operation activities.</li> <li>Construction would cease if dust observed being blown from site until control measures were implemented.</li> <li>All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.</li> </ul>	C	O	
<b>BD9</b>	<ul style="list-style-type: none"> <li>Prior to commencement of each phase, a Weed Management procedure would be developed as part of the Biodiversity Management Plan for the proposal to prevent and minimise the spread of weeds. This would include: <ul style="list-style-type: none"> <li>Management protocol for declared priority weeds under the <i>Biosecurity Act 2015</i> during construction, operation and decommissioning stages.</li> <li>Weed hygiene protocol in relation to plant, machinery, and fill.</li> </ul> </li> <li>The weed management procedure would be incorporated into the Biodiversity Management Plan.</li> </ul>	Prior to and during construction	O	D
<b>BD10</b>	Staff training and site briefing to communicate environmental features to be protected and measures to be implemented: <ul style="list-style-type: none"> <li>Site induction.</li> <li>Toolbox talks.</li> </ul>	C		
<b>BD11</b>	<ul style="list-style-type: none"> <li>Preparation and implementation of Biodiversity Management plan that would include protocols for: <ul style="list-style-type: none"> <li>Protection of native vegetation to be retained.</li> <li>Best practice removal and disposal of vegetation.</li> <li>Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist.</li> <li>Weed management.</li> <li>Unexpected threatened species finds.</li> <li>Rehabilitation of disturbed areas.</li> </ul> </li> </ul>	Prior to and during construction	O	
<b>BD12</b>	<ul style="list-style-type: none"> <li>An erosion and sediment control plan would be prepared in conjunction with the final design and implemented</li> <li>Spill management procedures would be implemented.</li> </ul>	C	O	D
<b>BD13</b>	<ul style="list-style-type: none"> <li>Awareness training during site inductions regarding enforcing site speed limits.</li> <li>Site speed limits to be enforced to minimise fauna strike.</li> </ul>	C	O	D
<b>AH1</b>	The development must partially avoid Avonlie Artefact Scatter 1 and Avonlie Artefact Scatters 3 and 4 as per the agreed exclusion zones and development design plans detailed (Figure 6-4).	Design Stage		
<b>AH2</b>	Partial salvage through artefact collection of Avonlie Artefact Scatter 1 must be undertaken where the artefact scatter extends beyond the agreed exclusion zone and development design plans this report	Prior to Construction		

No.	Safeguards and mitigation measures	C	O	D
<b>AH3</b>	The development must avoid the site Avonlie Scarred Tree 1. A minimum 10m buffer around the tree should be in place to protect the tree root zone.	Design Stage		
<b>AH4</b>	As complete avoidance of Avonlie Artefact Scatters 2, 3 and 4 and the remaining isolated artefacts within the proposal area is not possible or warranted, the artefacts within the development footprint must be salvaged through collection prior to the proposed work commencing and moved to a safe area within the property that will not be subject to any ground disturbance.	Design Stage		
<b>AH5</b>	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties. A new site card/s will need to be completed once the artefacts are moved to record their new location on the AHIMS database.	Prior to construction		
<b>AH6</b>	RAPS and an archaeologist should be provided an opportunity to collect artefacts from any proposed fencing or firebreak alignments on the boundary of the proposal area, particularly within the designated exclusion areas.	Prior to construction		
<b>AH7</b>	An unexpected finds protocol (UFP) must be prepared and followed should there be an inadvertent discovery of Aboriginal objects occur.	C		
<b>AH8</b>	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	C		
<b>VA1</b>	Avoidance of unnecessary lighting, signage, logos etc.	C		
<b>VA2</b>	Consideration given to controlling the type and colour of building material used especially with the use of light, highly reflective cladding, brick and tile materials which contrast dramatically with the landscape character. Any proposed buildings to be sympathetic to existing architectural elements in the landscape.	C		
<b>VA3</b>	Minimise cut and fill and loss of existing vegetation throughout the construction process. Where appropriate reinstate any loss in vegetation and allow natural vegetation to regrow over any areas of disturbance.	C	O	D
<b>LU1</b>	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	C	O	D
<b>LU2</b>	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C		
<b>LU3</b>	A RDEMP is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning, and in accordance with State Environmental Planning Policy No 55 – Remediation of Land. The Rehabilitation and Decommissioning Management Plan is to include: <ul style="list-style-type: none"> <li>• Remove all above ground infrastructure.</li> <li>• Remove gravel from internal access tracks where required, in consultation with landowner.</li> <li>• Reverse any compaction by mechanical ripping.</li> </ul> Reinstate irrigation infrastructure in consultation with landowner, including laser levelling and contour/bund reconstruction where required.			D
<b>LU4</b>	A pest and weed management plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Narrandera Shire Council and NSW DPI requirements. Where possible weed and pest management would be integrated with adjoining landowners.	C	O	

No.	Safeguards and mitigation measures	C	O	D
LU5	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	C	O	D
LU6	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning.	C		
LU7	If possible and practical, sheep grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		O	
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation)  Monday – Friday 7 am to 6 pm Saturday 8 am to 1 pm  No work on Sundays or public holidays	C		
NS2	Development of a Construction and Operational Noise Management Protocol to minimise noise emissions, manage out of hours works (minor) to be inaudible and response to community concern.	Prior to construction	O	
NS3	Operate plant in a conservative manner, which includes: <ul style="list-style-type: none"> <li>• Selection of the quietest suitable machinery.</li> <li>• Avoidance of noisy plant working simultaneously where practical.</li> <li>• Utilise broadband reverse alarm in lieu of high frequency type.</li> </ul>	C	O	D
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner. Provide toolbox meetings, training and education.	C	O	D
NS5	A letter box drop would be prepared and provided to residences in close proximity to the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	Prior to and during construction	O	D
NS6	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	C	O	D
NS7	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	C	O	
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared,, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: <ul style="list-style-type: none"> <li>• At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures.</li> <li>• Regularly inspect erosion and sediment controls, particularly following rainfall.</li> <li>• Maintain a register of inspection and maintenance of erosion control and sediment capture measures.</li> <li>• Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows.</li> <li>• Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks.</li> <li>• Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads.</li> <li>• In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation.</li> </ul>	Prior to and during construction		D

No.	Safeguards and mitigation measures	C	O	D
	<ul style="list-style-type: none"> <li>During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation.</li> <li>Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity.</li> <li>Manage works in consideration of heavy rainfall events.</li> </ul> <p>Areas of disturbed soil would be rehabilitated promptly and progressively during construction.</p>			
<b>SO2</b>	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents. It would detail appropriate risk control measures that would need to be implemented to safely mitigate potential risk to health and safety of firefighters and first responders in the case of a hazardous spill.	<b>C</b>	<b>O</b>	<b>D</b>
<b>SO3</b>	<p>A Spill and Contamination Response Plan (SCRIP) would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to:</p> <ul style="list-style-type: none"> <li>Manage the storage of any potential contaminants onsite.</li> <li>Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation).</li> </ul> <p>A protocol would be developed in relation to discovering buried contaminants within the development site (e.g. pesticide containers, if any). It would include stop work, remediation and disposal requirements.</p>	<b>C</b>	<b>O</b>	<b>D</b>
<b>SO4</b>	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored to original condition or re-vegetated with native plants.	<b>C</b>	<b>O</b>	<b>D</b>
<b>SO5</b>	Soil should be treated with gypsum where required.	<b>C</b>		
<b>SO6</b>	<p>Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation control:</p> <ul style="list-style-type: none"> <li>Integrate project design with any site constraints.</li> <li>Preserve and stabilise drainageways.</li> <li>Minimise the extent and duration of disturbance.</li> <li>Control stormwater flows onto, through and from the site in stable drainage structures.</li> <li>Install perimeter controls.</li> <li>Stabilise disturbed areas promptly.</li> <li>Protect steep slopes.</li> <li>Employ the use of sediment control measures to prevent off- and on-site damage.</li> <li>Protect inlets, storm drain outlets and culverts.</li> <li>Provide access and general construction controls.</li> <li>Inspect and maintain sediment and erosion control measures regularly.</li> </ul>	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA1</b>	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA2</b>	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA3</b>	Adequate incident management procedures will be incorporated into the construction, operation and decommissioning Environmental Management Plans, including requirement to notify the relevant agencies of pollution incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA4</b>	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA5</b>	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	<b>C</b>		<b>D</b>

No.	Safeguards and mitigation measures	C	O	D
<b>WA6</b>	Emergency management procedures will be prepared in consultation with Council.	<b>C</b>	<b>O</b>	
<b>WA7</b>	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	<b>C</b>	<b>O</b>	<b>D</b>
<b>WA8</b>	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents in consultation with Narrandera Shire Council in accordance with the NSW Government's Flood Prone Land Policy and the Floodplain Development Manual. It would detail appropriate risk control measures that would need to be implemented to safely mitigate potential risk to health and safety of firefighters and first responders in the case of a hazardous spill or flood risk.	<b>C</b>	<b>O</b>	<b>D</b>
<b>TT1</b>	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: <ul style="list-style-type: none"> <li>• Assessment of road routes to minimise impacts on transport infrastructure.</li> <li>• Scheduling of deliveries of major components to minimise safety risks (on other local traffic).</li> </ul> <p>Traffic controls (signage and speed restrictions etc.).</p>	<b>C</b>	<b>O</b>	<b>D</b>
<b>TT2</b>	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan would include, but not be limited to: <ul style="list-style-type: none"> <li>• Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network, to be undertaken in consultation with Council.</li> <li>• Assessment of road condition prior to construction on all local roads that would be utilised.</li> <li>• A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic.</li> <li>• The designated routes of construction traffic to the site.</li> <li>• Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction.</li> <li>• Scheduling of deliveries.</li> <li>• Community consultation regarding traffic impacts for nearby residents.</li> <li>• Consideration of cumulative impacts.</li> <li>• Traffic controls (speed limits, signage, etc.).</li> <li>• Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts.</li> <li>• Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.</li> <li>• Water to be used on unsealed roads to minimise dust generation through increased traffic use.</li> </ul> <p>Following construction, a post condition survey of the relevant sections of the existing road network to be undertaken to ensure it is of similar condition to that prior to construction.</p>	<b>C</b>		<b>D</b>
<b>TT3</b>	The proponent would consult with Narrandera Shire Council regarding the proposed addition of three passing bays along Sandigo Road on the eastern boundary between Sturt Highway and Muntz Road.  The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.  See Appendix J for proposed passing bay design.	<b>C</b>		
<b>TT4</b>	The proponent would consult with Narrandera Shire Council regarding the proposed widening of the S-bend on Muntz Road and the addition of four passing bays to the west of the S-bend, prior to site access.  The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	<b>C</b>		

No.	Safeguards and mitigation measures	C	O	D
	See Appendix J for proposed passing bay design.			
<b>TT5</b>	The proponent would consult with RMS and Narrandera Shire Council regarding the proposed BAR and BAL turning treatments for the Sturt Highway at the intersection with Sandigo Road.  The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.  See Appendix J for proposed intersection design.	<b>C</b>		
<b>TT6</b>	The proponent would consult with Narrandera Shire Council regarding the proposed widening of the southern boundary of Muntz Road from the intersection with Sandigo Road.  The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.  See Appendix J for proposed intersection design.	<b>C</b>		
<b>TT7</b>	<ul style="list-style-type: none"> <li>• The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.</li> </ul>	<b>C</b>		<b>D</b>
<b>TT8</b>	A flood response plan to be prepared that will include an access contingency plan in times of flooding when the Sturt Highway could be closed.	<b>C</b>	<b>O</b>	<b>D</b>
<b>AQ1</b>	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	<b>C</b>	<b>O</b>	<b>D</b>
<b>AQ2</b>	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	<b>C</b>	<b>O</b>	<b>D</b>
<b>AQ3</b>	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the development site. This includes dust from stockpiled materials.	<b>C</b>	<b>O</b>	<b>D</b>
<b>SE1</b>	A Community Consultation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: <ul style="list-style-type: none"> <li>• Protocols to keep the community updated about the progress of the project and project benefits.</li> <li>• Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.).</li> </ul> Protocols to respond to any complaints received.	<b>C</b>	<b>O</b>	
<b>SE2</b>	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	<b>C</b>	<b>O</b>	
<b>SE3</b>	Liaison with local representatives regarding accommodation options for staff to minimise adverse impacts on local services.	<b>C</b>		<b>D</b>
<b>SE4</b>	Liaison with local tourism industry representatives to manage potential timing conflicts or cooperation opportunities with local events.	<b>C</b>		<b>D</b>
<b>WM1</b>	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: <ul style="list-style-type: none"> <li>• Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy.</li> <li>• Quantification and classification of all waste streams.</li> <li>• Provision for recycling management onsite.</li> <li>• Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant).</li> <li>• Tracking of all waste leaving the site under the POEO Act.</li> <li>• Disposal of waste at facilities permitted to accept the waste.</li> </ul> Requirements for hauling waste (such as covered loads).	<b>C</b>	<b>O</b>	<b>D</b>

No.	Safeguards and mitigation measures	C	O	D
<b>HA1</b>	An Emergency Response Plan, incorporating an Evacuation Plan, Flood Response Plan and SCRP would be developed prior to commissioning the solar farm. A copy of the plan would be kept on site in a prominent position adjacent to the site entry point at all times.	<b>C</b>	<b>O</b>	<b>D</b>
<b>HA2</b>	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: <i>The storage and handling of flammable and combustible liquids</i> , and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and bunded.	<b>C</b>	<b>O</b>	<b>D</b>
<b>HA3</b>	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	<b>C</b>	<b>O</b>	<b>D</b>
<b>HA4</b>	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	<b>C</b>		
<b>HA5</b>	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	<b>C</b>		
<b>HA6</b>	Design of electrical infrastructure would minimise EMFs (underground).	<b>C</b>		
<b>HA7</b>	<p>A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to:</p> <ul style="list-style-type: none"> <li>• Management of activities with a risk of fire ignition.</li> <li>• Management of fuel loads onsite.</li> <li>• Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression.</li> <li>• The below requirements of Planning for Bush Fire Protection 2006: <ul style="list-style-type: none"> <li>○ Identifying asset protection zones.</li> <li>○ Providing adequate egress/access to the site.</li> <li>○ Emergency evacuation measures.</li> </ul> </li> </ul> <p>Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.</p>	<b>C</b>	<b>O</b>	<b>D</b>
<b>HA8</b>	<p>A comprehensive Emergency Fire Response Plan would be developed and implemented during construction, operation and decommissioning, and include but not limited to:</p> <ul style="list-style-type: none"> <li>• Address foreseeable on-site and off-site fire events.</li> <li>• Details appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders.</li> </ul> <p>Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.</p>	<b>C</b>	<b>O</b>	<b>D</b>
<b>HH1</b>	Should a relic be located, the NSW Heritage Council will be notified prior to further work being carried out in the vicinity.	<b>C</b>	<b>O</b>	<b>D</b>

## 9 CONCLUSION

NGH Environmental has prepared this EIS on behalf of the proponent RES. This EIS has assessed the broader Avonlie Solar Farm development site where infrastructure may be located. Overall, the Avonlie SF would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous agricultural capacity.

The key environmental risks have been investigated through specialist investigations:

- Biodiversity impacts – the BDAR concluded that no significant impacts to threatened species and ecological communities would result. No referrals under the EPBC or TSC Act are considered to be required.
- Aboriginal heritage impacts – the Aboriginal Heritage survey and assessment found that no impact to Aboriginal cultural heritage would occur from the proposal after update of design.
- Visual impact - the VIA concluded that the construction and operation would have a very low visual impact on the majority of people living in or travelling through the landscape surrounding the proposed solar farm.
- Noise impacts – the noise assessment concluded that noise impacts during construction, operation and decommissioning would be within the accepted noise criterion. Noise exceedances would not occur.
- Land use - While the agricultural output from the existing farmland would be reduced by the operation of the solar farm this would form a very small reduction in the agricultural output of the Farm is reversible and would not result in the permanent loss of agricultural land.

A suite of management measures has been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. Key management strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks. The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Impacts are considered justifiable and acceptable.



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# **APPENDIX A SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS**

## **APPENDIX B PROPOSAL MAPS AND DRAWINGS**

## **APPENDIX C CONSULTATION**



## **C.1 AGENCY CONSULTATION**

## **C.2 COMMUNITY CONSULTATION PLAN**

## **APPENDIX D BIODIVERSITY ASSESSMENT REPORT**

# APPENDIX E ABORIGINAL CULTURAL HERITAGE ASSESSMENT

## **APPENDIX F VISUAL IMPACT ASSESSMENT**

## **APPENDIX G NOISE ASSESSMENT REPORT**

## **APPENDIX H SOIL SURVEY ASSESSMENT**

## **APPENDIX I FLOOD MODELLING MAPS**



## **APPENDIX J TRAFFIC ACCESS ASSESSMENT**

## **APPENDIX K ECONOMIC IMPACT ASSESSMENT**