ibvogt

Environmental Impact Statement

YANCO SOLAR FARM

MARCH 2019

ngh environmental

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Yanco Solar Farm

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Amendment	Section	Page	Reason

www.nghenvironmental.com.au e: ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
8/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Brisbane
suite 4, level 5, 87 wickham terrace
spring hill qld 4000 (t 07 3129 7633)

Newcastle - Hunter and North Coast
2/54 hudson st
hamilton nsw 2303 (t 02 4929 2301)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Bega - ACT and South East NSW
Suite 11, 89-91 auckland Street (po box 470)
bega nsw 2550 (t 02 6492 8333)

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: ib vogt GmbH

Proposed development:

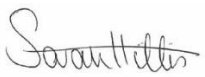
The Yanco Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce up to 72 Direct Current (DC) Megawatts of electricity. Associated infrastructure includes a substation, battery storage, staff amenities, internal access tracks and fencing.

Land to be developed:

Lots 142, 145 – 152, 287, 572 DP 751745, Lot 1700 DP 1181161, Lot 10 DP 844961 and Lot 6650 DP 1197165.

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 Regulations 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.

Name:	Sarah Hillis
Qualifications:	Bachelor Environmental Science (Land and Water), Master Environmental Management
Address	NGH Environmental 1/39 Fitzmaurice Street Wagga Wagga NSW 2650
Signature:	
Date:	29/03/2019

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Terms and definitions

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

ESD	Ecologically sustainable development
GA	Geoscience Australia
GHG	Greenhouse gas
GWh	Gigawatt hours
Ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
Hz	Hertz
ICNG	Interim Construction Noise Guideline
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
Km	kilometres
kV	kilovolts
L_{A90} (15 minutes)	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.
L_{Aeq}(15 minutes)	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.
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LCU	Landscape Character Unit
LEP	Local Environment Plan
LGA	Local Government Area
LMZ	Landscape Management Zone
LRET	Large scale Renewable Energy Target
M	metres
Mm	millimetres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory Renewable Energy Target
MVA	Megavolt-ampere
MW	Megawatt
MWh	Megawatt hours
NHMRC	National Health and Medical Research Council
NPI	*NSW Noise Policy for Industry*
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PCT	Plant Community Type
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)

PMF	Probable Maximum Flood
PV	Photovoltaic
RBL	Rating Background Level - the level of background noise
RDA	Regional Development Australia
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
REAP	Renewable Energy Action Plan (NSW)
RFS	NSW Rural Fire Service
RNP	NSW *Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
Sensitive Receptor	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
SEPP	State Environmental Planning Policy (NSW)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
Sound pressure level	The noise at a given distance from plant or equipment
sp/spp	Species/multiple species
SPRAT	EPBC Act Species Profiles and Threats Database
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State significant development
µT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WMP	Waste Management Plan
WSP	Water Sharing Plan
ZVI	Zone of Visual Influence
The proposal	The construction and operation of the proposed Solar Farm
The proponent	ib vogt GmbH
Subject land	All land within the affected lot boundaries. The subject land comprises Lots 142, 145 – 152, 287, 572 DP 751745, Lot 1700 DP 1181161, Lot 10 DP 844961 and Lot 6650 DP 1197165, and is approximately 187.33 ha.
Development site	The area of land that is subject to the proposal. The development site is made up of 210.13 ha and includes location of the proposed transmission line outside of the subject

	land. 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 183.13 ha.

EXECUTIVE SUMMARY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *A stand-alone executive summary.*

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction and operation of a proposed 72 Megawatt (MW) Direct Current (DC) (60 MW alternating current) photovoltaic (PV) solar farm at Yanco, central south NSW. The 210 hectare (ha) development site is located on freehold rural land with the proposed transmission line running through public land approximately 1 kilometre (km) west of Yanco.

NGH Environmental has prepared the EIS on behalf of the proponent, ib vogt GmbH (ib vogt). 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). It is considered State Significant Development (SSD). 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 March 2018.

PROPOSAL DESCRIPTION

The proposed Yanco Solar Farm (the proposal) would have a total installed capacity of up to 72MW (DC), and would include:

- Single axis tracker PV solar panels mounted on steel frames over most of the site (up to 205,000 PV solar panels up to 2.2 m high).
- Battery storage units.
- Electrical cables and conduits.
- Inverter/transformer units.
- Switching station.
- Site office, parking, access tracks and perimeter fencing.
- Electrical transmission infrastructure and overhead or underground transmission line to connect the proposal to the Yanco substation.
- Internal access tracks.
- Communications tower.
- Upgrade to existing roads.
- On-site vegetative screening.
- Upgrades at the Yanco TransGrid substation (including standard support structures, footings, connections, fittings etc.).

The development area is bound by Amato Road, Toorak Road, Hume Road, River Road, Yale Road and the Gogeldrie Branch Canal, and intersected by Research Road, Ronfeldt Road, Houghton's Road and the Junee – Hay railway line. The development site would be accessed from Toorak Road, which runs north-south through the development site, and Research Road, which runs east-west. Toorak Road connects to Main Street (Irrigation Way) via Canal Street and is the main access to and from Yanco/Leeton.

The proposal will connect into the Yanco Substation either via overhead or underground transmission line, that will run north of Houghton's Road.

An internal road system would be established for the construction and maintenance of the solar farm infrastructure.

Several irrigation canals are present within the development site. Gogeldrie Branch Canal borders the development site. Several farm buildings and dwellings also occur in the development site.

The proposal is expected to operate for 30 years. The construction phase of the proposal is expected to take 10 months and will commence in early 2020. After the operating phase, the proposal would either be decommissioned, removing all above ground infrastructure and returning the site to its existing land capability, or upgraded with new photovoltaic equipment.

PROJECT NEED

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.

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia (Department of Environment 2017). Once constructed, the proposal would provide around 232,606MWh per year of GHG emission-free electricity. This represents the power consumption of about 40,000 homes (assuming an average household consumption of 5,920kWh pa). Generation figures may change subject to final site design and technology selection. The proposal would save about 77,600 tonnes of GHG emissions per year.

There have been several government policies in place in Australia influencing the development of renewable energy. The Federal 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 33,000GWh by 2020.

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013a). 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 the least cost to the energy customer and with the maximum benefits to NSW. Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors.

The proposal would assist in reducing GHG emissions from electricity generation and contribute to renewable energy targets committed to by the NSW and Federal governments.

The proposal would contribute to the NSW Renewable Energy Action Plan (NSW Government 2013), which supports the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013a). The proposal would also further the three goals of the Action Plan:

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

The proposal would also contribute to the Commonwealth Government's objective to achieve an additional 33GW of energy from renewable sources by 2020 under the LRET.

PROJECT BENEFIT

In addition to reduced greenhouse gas emissions and meeting government energy policies, local social and economic benefits that would be associated with the construction and operation of the proposal include:

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 120 direct and 190 indirect full-time staff for the 3 to 4 month peak of construction and five operational staff for the life of the project. Maintenance contracts for panel cleaning, fence repair, road grading, etc. would also be required and would likely be met by local contractors.
- Direct business volume benefits for local services, materials and contracting (e.g. accommodation, food and other retail).
- It is estimated that $560,000 in wage spending would be directed at local and regional businesses and service providers during the construction period. Spending would include housing expenditure, retail, recreational spending, and personal, medical and other services.

To minimise the environmental costs of achieving the above benefits, the proposal would respond appropriately to the environmental constraints of the site. It would be designed to:

- Preserve biodiversity features through minimising native vegetation removal.
- Minimise impacts to items of Aboriginal significance.
- Minimise impacts to soil and water resources through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Retain existing site topography.
- Minimise visual impacts to neighbours, incorporating vegetation screenings located in consultation with any highly impacted neighbours.
- Retain some agricultural production value through managed stock grazing during operation.
- Preserve future agricultural production values, being highly reversible at the end of the project's life.

SITE SUITABILITY

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

Key considerations for site selection are detailed within the *NSW Large-scale Solar Energy Guideline for State Significant Development* (DPE 2018), including:

- The proposal is not highly visible, not located on high ground or within a valley. Screening is also proposed.
- Minimal impacts to biodiversity are expected due to historical disturbance and agricultural activities.
- There is unlikely to be any land use conflicts due to zoning.

- The proposal is not located on Strategic Agricultural Land, however, is located on Class 3 Agricultural Land:
    - The proposal is not expected to adversely affect the biophysical nature of the land.
    - The proposal would positively affect soils by providing many of the benefits of long-term fallow, including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving soil biota.
    - The proposal will not result in the permanent removal of agricultural land.
    - The proposal would not result in rural fragmentation given it will not alter the existing or surrounding environment.
    - Adjacent farming operations are compatible.
    - Strategic sheep grazing may be used within the development site. Grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.
- The site is not identified as bushfire prone and is defined as an area of potential flood storage area.
- The proposal is not located on prospective resource developments.
- Toorak Road is a shared Council/Crown Reserve.

KEY ENVIRONMENTAL ASSESSMENT ISSUES

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

- Biodiversity.
- Visual impacts.
- Land use and resources.
- Noise impacts.
- Socioeconomic and community.

Biodiversity

NGH Environmental prepared a Biodiversity Development Assessment Report (BDAR) to investigate and assess the potential impacts of the proposal on biodiversity. The development site is located in the Murrumbidgee subregion of the Riverina Bioregion. Cleared and highly modified agricultural land occupies about 97.7% of the development site. Three Plant Community Types (PCTs) were identified in the development site. The development site has been designed to minimise impact to these communities. No EPBC listed communities were present within the development site.

Seventeen threatened species required targeted survey. Of these, two species, the Superb Parrot and the White-bellied Sea-eagle, were detected within the development site. One species, the Small Scurf-pea, was unable to be surveyed during the recommended survey window and this species was assumed to be present (or recorded) on site.

Seven threatened species listed under the EPBC Act were considered likely to occur in the development site. Of these, one species, the Superb Parrot, was recorded during the field surveys. Assessments of significance were completed for these species. These concluded that a significant impact was unlikely.

No referral is considered necessary to the Federal Department of Environment and Energy (DOEE).

The development site has been selected to avoid or minimise impacts to biodiversity where possible. Most areas of EEC in the development site have been avoided through the iterative design process. Where biodiversity impacts could not be avoided, an offset credit requirement has been generated:

- Ecosystem credits – 11 Ecosystem credits were generated from the removal of 0.54ha of native vegetation.
- Species credits – 11 species credits were generated from impacts to the Small Scurf-pea.

These credits would be retired through an appropriate regulated offset mechanism.

Potential direct and indirect impacts to biodiversity values of the site could result from the proposal and have been considered. A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction phase are avoided where possible and minimised where they cannot be avoided.

Visual amenity

Xurban completed a Visual Impact Assessment (VIA) of the proposal, in compliance with the SEARs. This report assesses the visual impact implications of the proposal on viewers using the local road network and from residential properties, and the appropriateness of the proposed solar farm within the current landscape setting. The VIA also includes a Landscape Strategy to address identified impacts, including onsite vegetation screening and general design measures.

23 non-associated landowners are located directly adjacent to the subject land. Two Landscape Character Units (LCU) were identified within Yanco and surrounding areas:

- Private domain.
- Public domain.

The level of visual impact from the local road network would be Low to Negligible immediately after construction, but this would reduce to Nil or even Positive, once the proposed planting reached a height greater than the solar panels.

The range of viewpoints in the public domain from which a resident or viewer can see the solar panels is also limited because of the height. Minor topographical features such as the embankment running adjacent to the irrigation canal on the eastern boundary is sufficient in height to screen views to the solar farm.

The visual impact from the private domain is limited to very few houses, most of which are on rural properties. Where these houses are surrounded by vegetation, grape vines or orange groves, the visual impact is either Negligible or Nil. A medium impact was determined for one residential viewpoint along Toorak Road. Landscaping along the edge of the irrigation canal to the south of this property would quickly reduce the level of visual impact to Nil or Positive.

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited.

Some of the other onsite infrastructure may cause glare or reflections depending on the sun angle. This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to motorists or aircraft. Therefore, the impact would be assessed as Nil to Negligible.

The operational view of the solar farm may generate visual impact being in direct contrast with the surrounding agricultural views. The array site requires security fencing and steel dominated infrastructure.

Generally, adverse visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

Land use and resources

The current land use of the development site is for agriculture. 97% of the site is classes as high capability land (Class 3) with the remainder being low capability (Class 6). The site is not mapped as Biophysical Strategic Agricultural Land or Critical Industry Clusters.

There are no current mineral titles, licences or application relevant to the development site indicated on the MinView website, with the closest operating quarry located approximately 20 km north-east of Leeton.

The development site is zoned RU1 land for primary production. The land surrounding the development site is also RU1 (Primary Production) with low density residential (R1) located east of the proposal. Surrounding agricultural land consists of cropping and grazing activities, including the horticulture of oranges and grapes.

A land use conflict risk assessment was undertaken to consider potential conflicts between the solar farm and surrounding land uses. Potential construction conflicts such as the impacts of contaminated surface water runoff, fire/bush fire, traffic generation, noise, dust and visual amenity had moderate to high risk rankings. These potential conflicts have been addressed with appropriate management strategies and now have low revised risk ratings.

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.

Noise

Renzo Tonin & Associates Pty Ltd was engaged to complete a Noise Assessment (NA) for the proposal.

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). Construction road traffic noise levels were assessed against the Road Noise Policy (2011). Modelling was used to quantify project noise emissions to neighbouring receivers for typical construction activities and operations.

Construction activities are proposed to be progressive and would occur at several locations simultaneously.

Daytime construction noise levels were assessed for 23 neighbouring receivers. The highest predicted noise level is within the range for the Noise Management Levels (NMLs) within standard hours and complies at all 23 receivers. The NMLs at Receivers R01 to R10 and R20 to R21 may be exceeded when construction works are conducted within close proximity to the receivers. However, these exceedances would occur over a short-term, during normal working hours, and these activities would move progressively across the site, meaning that at any one receiver, worst case construction noise would typically last for 3-4 weeks only.

The predicted operational noise levels were assessed for the 23 neighbouring receivers and have been demonstrated to comply with the Project Intrusive Noise Levels (PNTLs) at all residential receivers.

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.

The predicted construction road traffic noise levels satisfy the RNP criteria for assessed receivers.

The results of the noise assessment demonstrate that construction noise levels satisfy relevant regulatory construction and operational noise levels for all nearby receivers. No specific mitigation is required however, several opportunities to further minimise the noise impacts form commitments of the proposal, as shown below.

Socioeconomic and community

The Leeton 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 the natural environment.

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 a significant boost to the local and regional economies through generation of employment, significant boost to the local and regional economies through increased demand for accommodation, goods and services, a range of employment and contracts including landscaping, fencing, security, catering, trenching, maintenance, piling, roads and electrical work, and an estimated $560,000 in wage spending would be directed at local and regional businesses and service providers during the construction period.

Likely adverse impacts include increased traffic on local roads and hazards associated with construction traffic, change in the rural landscape character and visual amenity of the area, influx of workers may put pressure on local accommodation, health and broader services, and demand for accommodation and increase in traffic movements may have an impact on tourism if the construction phase coincides with local festivals or events.

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.

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.

LOWER RISK ISSUES

The following lower risk issues were assessed for the proposal and are briefly outlined below:

Aboriginal heritage

Two Registered Aboriginal Parties registered their interest in site survey, which was conducted on 22 and 23 October 2018, and 11 December 2018.

Only one isolated find (YSF_IF_001) was identified within the development area. This site is outside the development footprint and would not be impacted.

The values potentially impacted by the development are any social and cultural values attributed to the development area by the local Aboriginal community. No specific site values were identified by the community. Values associated with the isolated find would be maintained through avoiding impact in this area.

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

Soil resources

DM McMahon Pty Ltd prepared a soil report to provide an assessment of the existing landforms, and the soil types and characteristics of the proposed development site. This was intended to confirm land capability and characteristics that may affect design, construction or rehabilitation of disturbed soils. It included a desktop and field study for the development site.

One soil characteristic was identified at the development site, Chromosols. Chromosol soils generally have a high risk of erosion, a moderate salinity risk, and a moderate risk of waterlogging.

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 also lead to the removal of vegetation and ground cover, increased compacted surfaces and decreased permeability. However, based on the soil samples taken from the site the risk of erosion is considered low due to the low relief and generally low salinity and sodicity of the soil.

Impacts during construction and decommissioning such as excavation and earthworks, have the potential to disturb soils, cause soil erosion and subsequent sedimentation.

Impact to soils during operation would be minimal, as maintenance activities and vehicles would be mostly confined to formalised tracks. 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 if ground cover is not maintained beneath the array infrastructure.

These potential impacts have been addressed with specific mitigation measures. Overall, the risk of erosion impacts resulting in soil loss is considered low during construction, operation and decommissioning.

Water use and quality, including groundwater

The development site is in the Riverina Local Land Services area, situated in the Murrumbidgee River Catchment. The development site is located approximately 3.5 km north of the Murrumbidgee River and approximately 300m north of Guises Creek, with manmade irrigation channels surrounding the development site.

The proposal site is located in the Murrumbidgee Irrigation Area, and several irrigation channels run throughout the development site. These irrigation channels are involved in existing agricultural activities on the subject land. In addition to irrigation channels, 3 farm dams are located within the development footprint.

The NSW DPI database of groundwater lists multiple bores within and adjacent to the development site. The development site is mapped as Groundwater Vulnerable in the Leeton LEP.

There are no listed aquatic or terrestrial Groundwater Dependent Ecosystems within the development site.

The site is not mapped in the Leeton LEP (2014) as flood prone land, or within a wetland, riparian land or watercourse. Flood depth mapping provided by Leeton Shire Council indicate that some areas as mapped as low hazard category, with some areas of the proposal impacted by flood water for a 1% Annual Exceedance Probability (AEP) event to a depth of less than 0.25 m.

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 an existing groundwater bore, to be purchased from the landowner (licensee of WAL 11905). The anticipated amount of non-potable water required during construction is 38 ML. This water is predominantly used for dust control.

During operation, water for panel washing and other maintenance activities would be sourced from an existing domestic bore located on the site (currently used for stock and domestic purposes). It is expected 54 kL of water would be required each year.

The proposal would not directly affect the surface water quality. Indirectly, the proposed works would involve a range of activities 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.

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

Climate and air quality

The Leeton LGA is part of the Riverina Bioregion of NSW, which generally experiences a dry semi-arid climate with hot summers and cool winters. Seasonal temperatures vary little across the bioregion. Highest rainfall occurs in May and September.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. However, construction will be responsive to local conditions to ensure impacts are managed. Haulage traffic, 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.

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 in comparison to the regular agricultural activities. 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 very limited period.

There is also a risk that unsealed access tracks may create dust during windy conditions. However, the access tracks will be regularly maintained. Dust creation is expected to be no more than the existing unsealed access roads that surround the site. As such, a noticeable increase in dust creation is unlikely.

Solar arrays will affect air and soil temperatures within the solar array perimeter, and that in relation to outside of the solar array perimeter that a heat island effect is unlikely to occur. It identified that any temperature increase within the solar array will be marginal.

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is not expected to be significant.

Traffic, transport and road safety

Access requirements can be separated into cars, buses, utility vehicles, trucks, standard articulated trucks and oversized and/or over-mass vehicles. 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.

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.

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 receivers.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by 'platooning' of construction traffic.

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. 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.

During operation, vehicles would use the designated road network to access the site and travel within the site during the operational phase (about 30-year period). Up to two light vehicles per day would be expected during normal operation of the proposal. 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 proposal area.

Overall, traffic impacts from the proposal are expected to be low and manageable. It is important to note that traffic numbers will decrease during the operational phase of the proposal, due to the cessation of agricultural activities in the immediate area.

It is anticipated that the delivery of PV panels will occur over an approximate 40 week construction period, generating up to 36 trucks daily and two overmass vehciles during the peak construction period (76 heavy vehicle movements). The largest design vehicle expected to access the site is a 19m AV (Articulated Vehicle as defined in AS2890.2:2002).

Hazards

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 does not include 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 Guideline is however a guide only, and final determination is made based on considerations if the development would fall under the definition of potentially hazardous in the actual SEPP 33.

SEPP 33 screening procedure considers 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 the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. For quantities that fall below the stated thresholds, 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 for the proposal include inert fire suppression gas, fuel, pesticides, and lithium-ion batteries. The closest battery storage location to the subject land boundary is 30 m and that transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, therefore would not be considered potentially hazardous. The proposal does not require a PHA.

The development site is flat, and laser levelled for horticulture. Little native vegetation remains in and around the development site, with remnant roadside native vegetation minimal along Toorak Road, Research Road and Houghton's Road. A planted row of vegetation exists on the western portion of the subject land. The majority of the development site has been cleared in the past. The site is not identified as bush fire prone land (NSW RFS 2018).

Specific construction and operational activities can cause or increase the risk of bush fire. Considering the low vegetation cover as a fuel source over the development site, mitigation measures and other factors, it is considered unlikely that construction of the solar farm would pose a significant uncontainable bush fire risk. The bush fire hazard associated with the activities listed above is considered highly manageable.

Electric Magnetic Fields (EMFs) consist of electric and magnetic fields and are produced whenever electricity is used. A number of EMF sources will be constructed within the proposal. Typical and maximum EMF levels for these types of infrastructure are expected to be low. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

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 achieve efficient use of resources and reduce 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 would be disposed of in accordance with the POEO Act.

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

Historic heritage

In the Leeton Local Government Area there is one listed item on the Commonwealth Heritage List, one listed item on the NSW State Heritage Register and nine listed items/places on the NSW State Agency Heritage Register. There are 119 listed items/places and 3 conservation areas in the *Leeton Local Environment Plan (LEP) 2014*. None of these known historic items or places occur within the development site.

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

Cumulative impacts

An adverse cumulative impact can occur when the proposal activities exacerbate the negative impacts on other infrastructure or activities occurring nearby.

During construction and decommissioning, the greatest potential for cumulative impacts is from biodiversity, visual, noise, traffic impacts. Impacts on local agriculture and increased pressure on local facilities, goods and services may also occur.

There is one active major project listed on the Major Projects Register within the Leeton LGA (Leeton Solar Farm – 29 MW). There are five active major projects listed on the Major Projects Register within the surrounding LGAs:

- Griffith Solar Farm: 60 MW – construction commenced.
- Yarrabee Solar Farm: 900 MW – development application.
- Avonlie Solar Farm: 200 MW – submissions.
- Sandigo Solar Farm: 100 MW – approved, construction mid-2019.
- Darlington Point Solar Farm: 275 MW - approved, construction early to mid-2019

Any adverse cumulative visual and noise impacts are anticipated to be manageable.

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 known Aboriginal heritage items where possible.
- Incorporation of screening and landscaping elements to reduce visual impact.
- 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 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 would 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 proposal would represent an important contribution to Australia's transition to a low emission energy generation economy and will potentially provide substantial economic benefits to the local area. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its current 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. The impacts are considered justifiable and acceptable.

1 INTRODUCTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The EIS should fully describe the proposal, the existing environment and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity values. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data.

DPI REQUIREMENTS

Assessment against the DPE's Large Scale Solar Energy Guidelines (draft or soon to be released)

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 72 Megawatt (MW) Direct Current (DC) Yanco Solar Farm SSD 9515 ('the proposal').

This 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 79C of the EP&A Act. It is considered State Significant Development (SSD). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPE on 30 August 2018 (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).

ib vogt GmbH (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 would 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

Established in 2002, ib vogt specialises in the development, design & engineering, financing, operation and maintenance, and asset management of solar power plants. The company provides high-quality turnkey solar power plant solutions, designed and engineered in Germany, to end investors internationally.

ib vogt is a manufacturer-independent integrated developer, focusing on tailor-made solar power plant solutions that maximise lifecycle performance and investor returns. The company employs over 100

experts in all areas along the solar power plant value chain. The company operates internationally from offices in Australia, Germany, the United Kingdom, the USA, Panama, Eastern Europe, India and southeast Asia, as well as several joint ventures across Africa.

Some of the major solar projects being developed in Australia by ib vogt include Williamsdale, Carisbrook, Dunedoo and Sebastopol solar farms.

1.2.2 Development site location

The proposal is in the Leeton Local Government Area (LGA) approximately 1 km west of Yanco and on the south-western outskirts of Leeton (Figure 1-1). The development area is bound by Amato Road, Toorak Road, Hume Road, River Road, Yale Road and the Gogeldrie Branch Canal, and intersected by Research Road, Ronfeldt Road, Houghton Road and Junee – Hay railway line. A proposed transmission line would connect to the existing TransGrid Yanco Substation adjacent to the proposal located 1 km to the south-east.

The Development site (210 ha) and development footprint (183 ha) comprises of Lots 142, 145 – 152 DP751745, Lot 1700 DP 1181161, Lot 10 DP 844961 and Lot 6650 DP 1197165 (Figure 1-2). The railway is comprised of Lot 1700 DP 1181161, and will only be utilised for crossing of the transmission line to the adjacent Houghton's Road reserve. Additional council and rail owned land will be utilised for the proposed transmission line route.

The development site is primarily an irrigated cropping landscape, used as grape and orange orchards. The paddocks have been deep ripped and cultivated in past management practices. Most of the native vegetation has been removed with no native paddock trees present. Native vegetation mostly occurs only along roadsides and fence lines. Some planted vegetation occurs along fence lines as windbreaks. Several irrigation canals occur throughout the development site. Gogeldrie Branch Canal borders the development site to the east. Several farm buildings and dwelling also occur within the development site.

The development area is located within the Murrumbidgee River Catchment, and the Murrumbidgee Irrigation Area (MIA). Local land use is primarily agricultural, including cropping, orchards and grazing.

The locality

Leeton LGA is located within the Riverina area, approximately 584km from Sydney, 470km from Melbourne and 371km from Canberra. The LGA is 1,167km² (116,200ha), and encompasses the towns of Leeton, Yanco and Whitton and the villages of Murrami and Wamoon (Leeton Shire Council 2017).

Leeton LGA also forms part of the Murrumbidgee Irrigation Area (MIA), and the town of Leeton was purposely built as part of the irrigation scheme. The MIA contributes to 38% of NSW's vegetable production.

Murrumbidgee Irrigation Area

The MIA covers an area of 660,000ha of which about 170,000ha is irrigated. Water is supplied by Burrinjuck and Blowering Dams in the upper Murrumbidgee Catchment. Water released from Burrinjuck and Blowering Dams flows down the Murrumbidgee and Tumut Rivers to their junction near Gundagai, then continues to flow down the Murrumbidgee river to Berembed Weir. Water is diverted from the weir to Bundidgerry Storage, which is the start of the irrigation canal system owned by Murrumbidgee Irrigation. The main canal feeds supply channels that take irrigated water to farms (Murrumbidgee Irrigation 2017).

The next significant point is the Yanco Regulator. The Gogeldrie Branch Canal diverts water off the Main Canal through the back of Yanco to Leeton.

Yanco

The town of Yanco, 5km south of Leeton, came into existence when the railway line was extended from Narrandera to Hay (Leeton Shire Council 2017). The population is approximately 500 people, and is home to the Yanco Powerhouse Museum, McCaughey Park, Murrumbidgee Rural Studies Centre and Yanco Agricultural High School.

1.2.3 Key components of the proposed Yanco Solar Farm

The solar farm development footprint would occupy around 183 hectares (ha) of the 210 ha development site, including the proposed transmission line route. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar array generating around 72 MW DC of renewable energy. The power generated would be exported to the national electricity grid.

Key development and infrastructure components would include:

- Single axis tracker photovoltaic solar panels (approximately 205,000) mounted on steel frames over most of the site.
- Battery storage units to store energy on site (approximately 81 MW/57 MW rated capacity).
- Electrical cables and conduits.
- Inverter/transformer units.
- One site switching station (control room and switchgear) to connect the solar farm to a new underground or overhead powerline, including synchronous condenser, other associated structures, lightening protection masts, control and protection equipment;
- Communications tower.
- Site office, compound, parking, access tracks and perimeter fencing.
- Operations and maintenance buildings with associated car parking.
- Access points via Research Road.
- Internal access tracks.
- Lighting, CCTV system, security fencing.
- Vegetative screening.
- An overhead or underground 33kv electrical transmission line to connect the proposal to the Yanco Substation.

Works would be required at the Yanco TransGrid substation, which would involve the construction of a new 33kV switchbay, comprising of the following:

- Standard support structures.
- Footings.
- High Voltage connections.
- Fitting and structure earthing.
- Conduits for 33 kV cabling.
- Associated secondary system works including control, monitoring, and protection equipment.

The works would be restricted to the existing concrete hardstand at the Yanco Substation, with no additional excavation or disturbance works required.

The proposed solar farm infrastructure maps (Figure 1-3 and Figure 1-4) illustrate the indicative layout, including a concept development footprint for the solar arrays. Detailed design would allow for avoidance of sensitive features on the site. Rows of the existing exotic vegetation (oranges and grapes) may be

retained as a vegetation buffer to minimise visual impacts in specific locations. In areas where existing exotic fruit trees are not suitable, vegetative screening will be provided in the form of local, native species.

In total, the construction phase of the proposal is expected to take approximately 10 months, and the facility would be expected to operate for around 30 years. Two to three operations and maintenance staff and up to 6 service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All above ground infrastructure and below ground infrastructure less than 500 mm deep, would be removed in consultation with the landowner, and the site returned to its existing land capability.

1.2.4 Capital investment

The proposal would have a capital investment of around $99 million.

1.2.5 Land ownership

The subject land is owned by a private landholder. The proposal will operate through purchase of approximately 50% of the site upfront and annual lease payments for the remaining 50% of the site through a lease agreement.

1.2.6 Development history

A search of the Leeton Shire Council Development Application Tracker website was conducted in February 2019. It was determined that no Development Applications of relevance were recorded within the proposal area.

A search for State Significant Development on the Major Projects website (accessed February 2019) of Leeton LGA did not indicate any Development Applications on the development area.

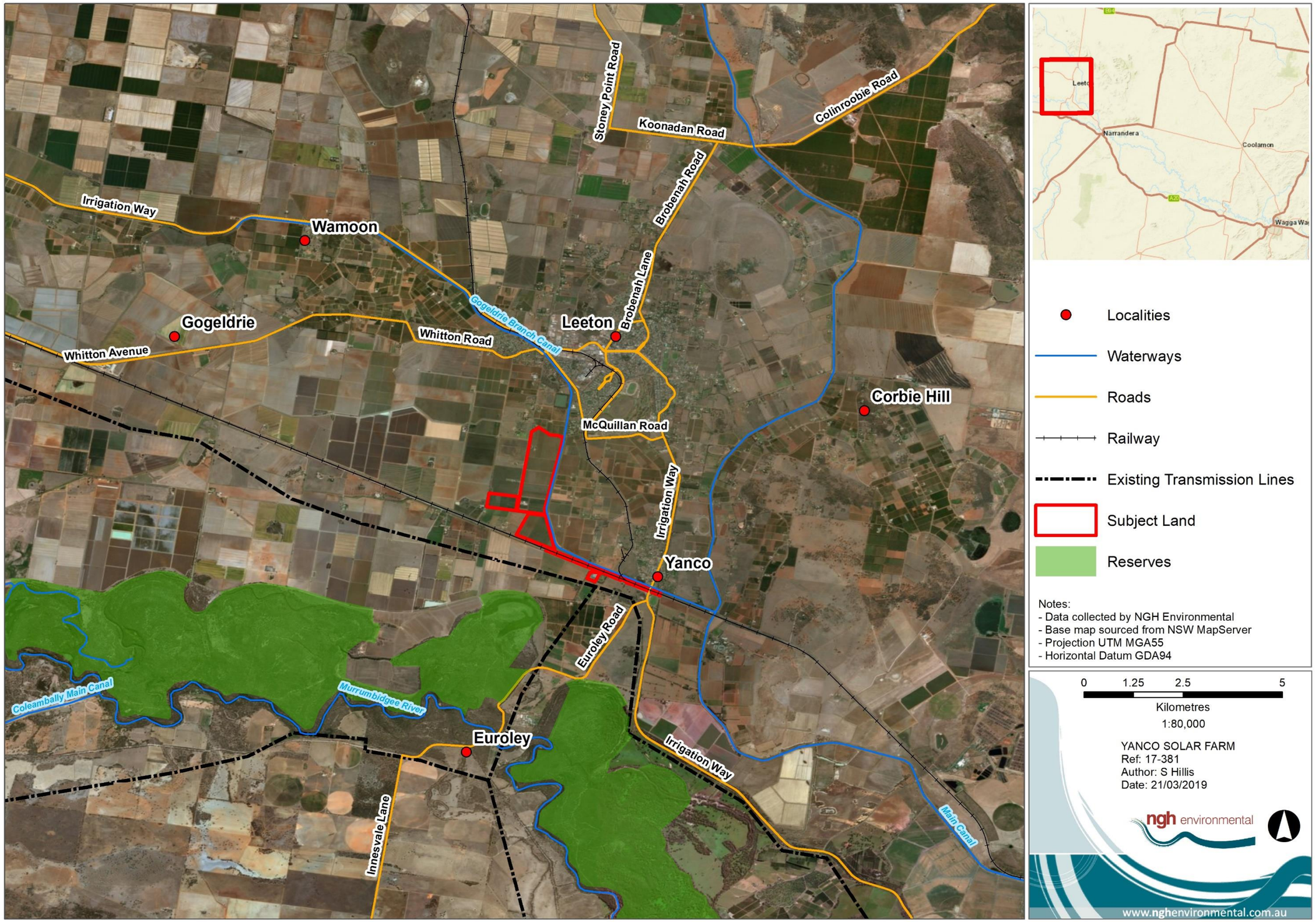

Figure 1-1 General location of the subject land

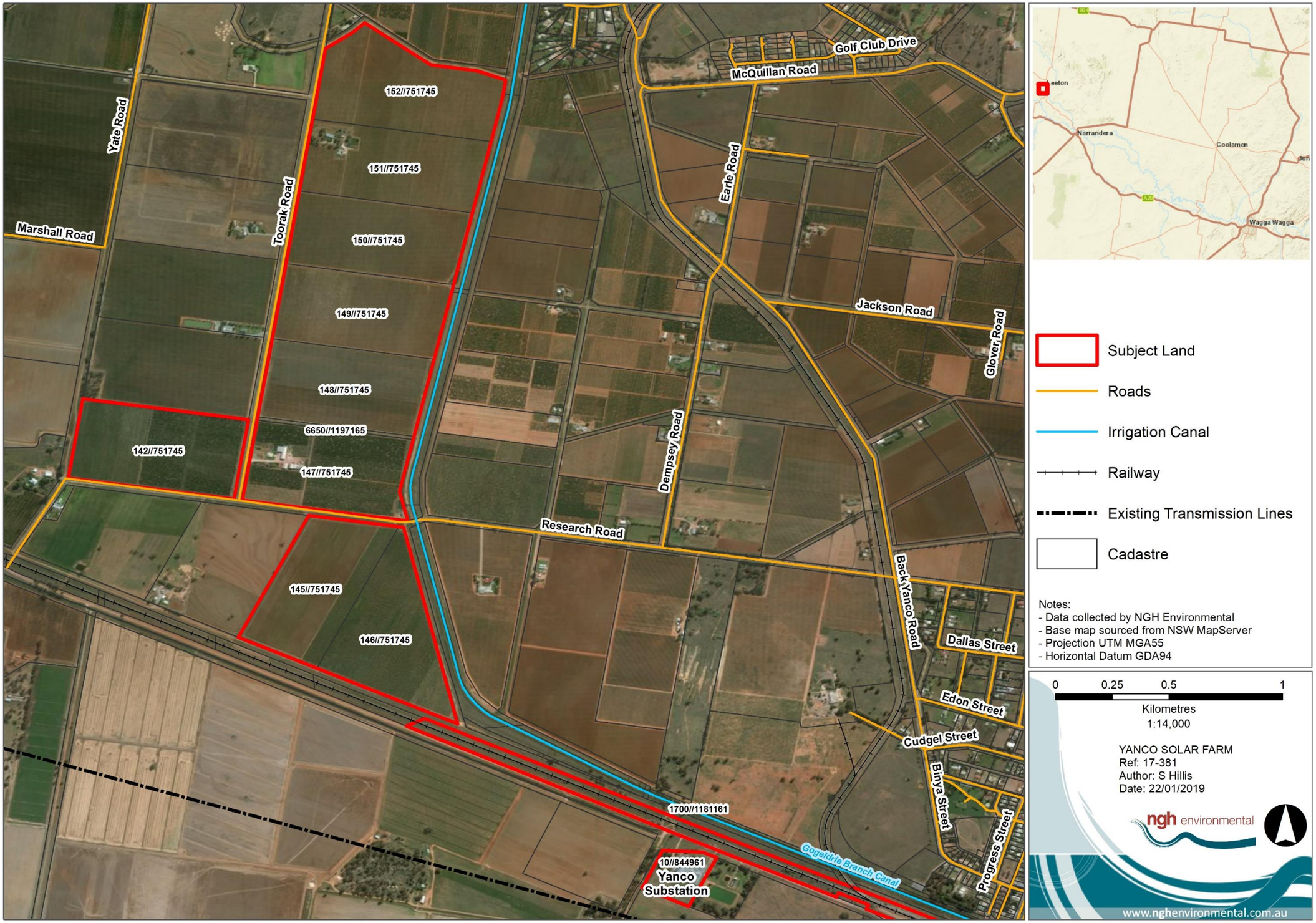

Figure 1-2 Subject land.

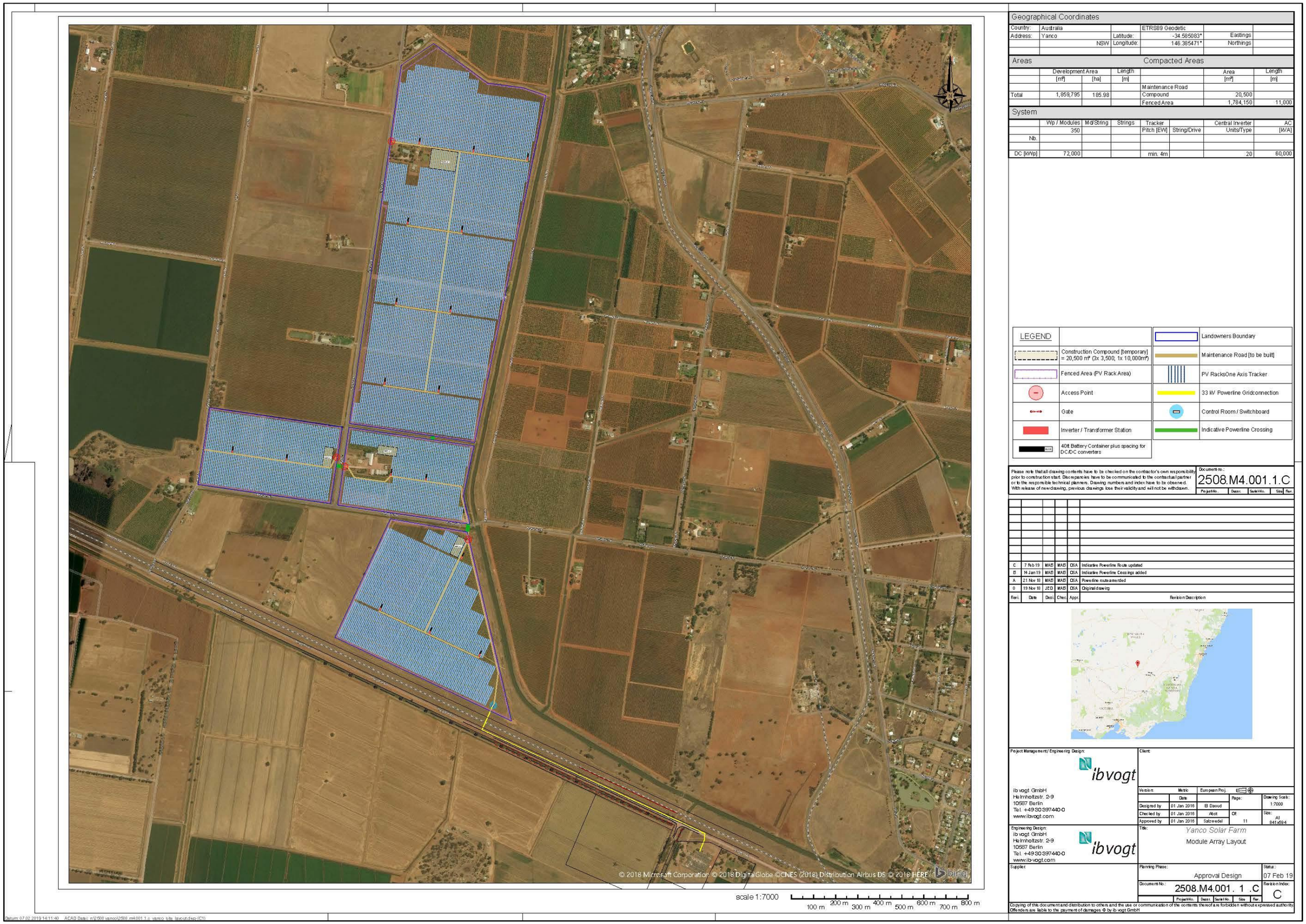

Figure 1-3 Proposed infrastructure

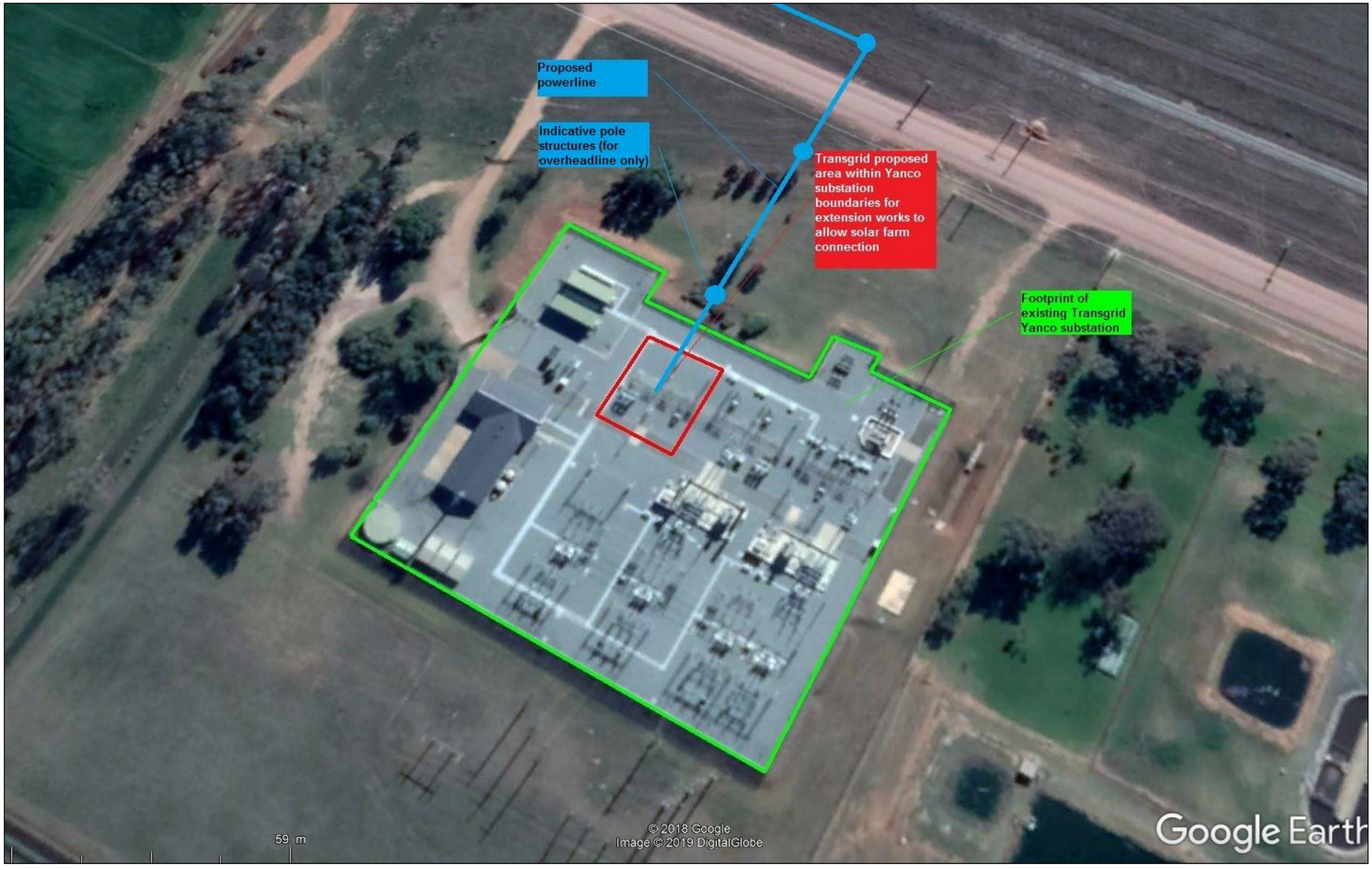

Figure 1-4 Proposed infrastructure at the Yanco substation (TransGrid 2019)

2 STRATEGIC JUSTIFICATION AND ALTERNATIVES CONSIDERED

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *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 proposed or approved solar farms, rural residential development and subdivision potential);*

2.1 STRATEGIC NEED

2.1.1 Global warming

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and alter 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). Federally, Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE 2017).

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia, representing 35 per cent of emissions (DOEE, 2016). The transition to low carbon renewable energy sources would be critical to enable Australia to meet its Paris commitments.

In terms of renewable energy technologies, solar projects have the capacity to provide faster results in reducing greenhouse gas emissions than other options because of shorter potential construction and commissioning times (CER, 2017). Rapidly improving technology in this sector is also seeing the improved performance of solar energy projects.

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 a number of 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 Australian to provide 9500 gigawatt hours (GWh) of new renewable energy generation by 2010.

This target was revised and from January 2011 an expanded the target to 45,000 GWh of additional renewable energy between 2001 and 2020. The MRET was split into a Small-scale Renewable Energy Scheme and Large-scale Renewable Energy Target (LRET) components 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 would 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 Federal 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 Federal MRET scheme due to expire in 2020. The report modelled the outcomes required to achieve the trajectory committed to by the Federal 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 off 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 Federal 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 federal 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 would help NSW make the transition to net zero emissions 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 three priority investment areas that would form the basis of future action plans:

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

The advanced energy priority strategies focus 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 analysis can be used to consider the 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, NREL 2012).

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 solar 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 energy generation based on fossil fuels 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 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 Federal and NSW Governments to reach Australia's LRET and other energy and carbon mitigation goals.
- Embed electricity generation supply into the Australian grid, closer to identified consumption centres.
- Diversification of land use and economic activity in regional NSW.

Specifically, the proposal would:

- Generate approximately 154,000 MWh of renewable electricity per year.
- Supply enough power each year to service approximately 36,500 households (assuming average household consumption of 4,215 kWh p.a.).
- Save around 51,000 tonnes of carbon dioxide (CO_2) per year, assuming generation would otherwise use brown coal with a carbon factor of 0.33372 tonnes per MWh (DOEE 2017).
- A solar energy facility that displaces 51,000 tonnes of CO_2 per annum is the equivalent of taking about 22,500 cars off the road each year, based on an average car in NSW travelling 14,000 km per year with CO_2 emissions of 162 g/km (DIT, 2011).

2.2.2 Electricity reliability and security benefits

The Proposal would enhance electricity reliability and security.

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life (DIS 2015). Nine coal-fired power stations have closed since 2011-2012, representing around 3,600MW of installed capacity (AER 2016).

The retirement of old power stations would require the development of new, reliable and low-emissions energy supply. Given the high levels of solar irradiance in NSW, the strong transmission network in the region and the declining cost of solar power over the last decade, the proposal is an important source of new power generation.

The transition to renewable energy sources based on variable wind and solar PV generators has implications for reliability and security; these sources lack usable inertia to support power system security (Finkel *et al.* 2017). The NEM grid is long and linear, with much less network meshing than many international systems. Geographic and technological diversity in the network can improve security and smooth out the impacts of variability (Finkel *et al.* 2017).

While grid-supplied electricity consumption is expected to remain stable (AEMO 2016), the proposal would benefit network reliability and security by providing embedded electricity generation closer to local consumption centres, contributing to a more diverse mix of energy sources and potentially regulating inputs (including improving the security of supply).

2.2.3 Downward pressure on electricity prices

Household electricity bills increased 61% between 2008-09 and 2012-13, due mainly to network expenditure (ABS 2016). Australian households would pay $510 million more for power in 2020 without renewable growth through the RET and up to $1.4 billion more per year beyond 2020 (Roam Consulting

2014). Renewables increase diversity and competition in the wholesale energy market – and as in any market, less competition means higher prices.

Variable renewable energy generation such as PV solar operates with no fuel costs and can, with the right policy framework and technological development to manage variability, be used to reduce overall wholesale prices of electricity (Finkel *et al*., 2017).

Several studies on the impacts of increased large-scale renewable energy generation under the RET have indicated that this is likely to put downward pressure on electricity prices (Australia Institute 2015).

2.2.4 Local benefits

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 120 employees at the peak of construction (up to 4 months) and two to three operational staff for the life of the project.
- The proposal would provide significant participation opportunities for businesses and workers located in the area.
- Direct business volume benefits for local services, materials, and contracting (e.g. accommodation, food, rental and other retail).
- Assistance in meeting the future national electricity demands.
- Council rates revenue associated with the solar farm would be subject to negotiations between Leeton Shire Council and the proponent.

The Leeton LGA has also been rated the fourth largest user of power in the Riverina Region, which created an opportunity to reduce reliance of traditional fossil fuel power suppliers (Leeton Shire Council 2018). On average, the Leeton LGA received 307 sunny days per year. The Council's *Tourism and Economic Development Plan: Envisage 2024* (Leeton Shire Council 2018) has also identified partnering with industry and private renewable investors to facilitate and attract projects to Leeton in relation to power and gas usage and attract investment and business partners in the renewable energy space with strong business environmental ethics as an opportunity. As such, the proposal would meet the objectives of the Councils *Tourism and Economic Development Plan*.

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

- Preserve biodiversity features through minimising tree and vegetation community removal.
- Preserve Aboriginal cultural heritage through maintaining important features.
- 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, where required.
- 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.
- Partner with surrounding business for maintenance of exotic vegetation screening (grapes and oranges).

2.3 PROPOSAL OBJECTIVES

The objectives of the 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 the project in a manner which is acceptable to the local community.
- Provide local and regional employment opportunities and other social benefits during all stages of the project.
- Provide a clean and renewable energy source to assist in reducing greenhouse gas (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 an identified 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 proposal area locations, and developing different renewable technologies.

2.4.1 The 'do nothing' option

The consequences of not proceeding with the proposal would be to forgo 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 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 however 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

Generation Technology

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

Photovoltaic solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site.

Australia has the highest average solar radiation per square metre of any continent in the world. NSW has an abundance of excellent solar resources and established electricity infrastructure that, along with declining technology costs, provides excellent opportunities for solar projects (DPE 2017).

Energy Storage Technology

There are several alternative technologies that could be used for the proposed energy storage facility. 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 battery (LIB) 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 LIB 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). LIB have a very long lifetime compared to other battery technologies, with 5,000 or more charge cycles (Finkel *et al.* 2017).

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

2.4.3 Alternative site locations

During the site selection process for the proposal, the proponent reviewed the solar generation potential of many areas in NSW using a combination of computer modelling and analysis, on the ground surveying, and observation and experience of the proponent. The proposed site was selected because it provides the optimal combination of:

- Low environmental constraints (predominantly cleared cropping and grazing land).
- Level terrain for cost effective construction.
- High quality solar resource.
- Compatible land use zoning (on the development site and considering adjacent land holdings).
- Low flood risk.
- Existing road access.
- Onsite connection to the transmission network.
- High levels of available capacity on the grid transmission system.
- Land availability and support from the landowner.

The development site is of a scale that allows for flexibility in the design, allowing site constraints identified during the EIS process to be avoided or effectively mitigated.

The design of the proposal is the result of an iterative process. The design 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 investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall.

Available grid capacity at a suitable voltage to connect to TransGrid's Yanco Substation south east of the site was also instrumental in making Yanco an ideal choice for a renewable energy development.

2.4.4 Scale of the proposal

The scale of the proposal has been influenced by:

- Property boundaries.
- The location of irrigation infrastructure, roads, vegetation and plant communities.
- Consideration of Aboriginal Cultural Heritage values.
- Demand for new renewable electricity generation to meet generation targets.
- Commercial investment and viability considerations.
- Transmission grid capacity.

The proposed scale of the solar farm successfully responds to the constraints and opportunities inherent in these factors. The proposal seeks to maximise the use of available land within the development site, whilst considering the environmental, cultural, and community impacts identified through the development of this EIS.

2.4.5 Grid connection and capacity

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 proposal would connect to the 132 kV grid system via a 33 kV connection at the Yanco substation). The modelling also considered other committed future generation. The proponent has entered into a Connection Process Agreement and consultation regarding a grid connection is ongoing.

2.4.6 Site suitability and justification

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

Key considerations for site selection are detailed within the *NSW Large-scale Solar Energy Guideline for State Significant Development* (DPE 2018). The key site constraints with justification as to why the site is suitable is detailed in Table 2-1 below:

Table 2-1 Site conditions and constraints

Areas of constraint	Site justification
Visibility and topography - Sites with high visibility, such as those on prominent or high ground positions, or sites which are located in a valley with residences with elevated views looking towards the site. This is particularly important in the context of significant scenic, historic or cultural landscapes.	The proposal does not have high visibility. The site does not have prominent or high ground positions or located within a valley with residences with elevated views looking towards the site. It is also proposed to screen the proposal with a mixture of native vegetation or to incorporate the existing orchards and vineyards. This will retain the existing scenic and historic nature of the area.
Biodiversity - Areas of native vegetation or habitat of threatened species or ecological communities within and adjacent to the site, including native forests, rainforests, woodlands, wetlands, heathlands, shrublands, grasslands and geological features.	The design of the proposal is the result of an iterative process. The design 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. The land has been heavily disturbed from past and current agricultural activities and there are low environmental constraints. Given the location, site attributes and the heavy disturbance of the land, the proposal would have low impacts on the environment. Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall. The final design avoids the majority of native vegetation, habitat of threatened species or ecological communities. The proposed site does not include any native forests, rainforests, wetlands, heathlands, shrublands or geological features.
Residences - Residential zones or urbanised areas.	The proposal is not likely to generate land use conflicts with surrounding land uses and is compatible with land use zoning. The proposed development site is within land zoned RU1, with up to 23 sensitive receivers adjacent to the site. It proposed to screen views of the proposal with a mixture of native vegetation or to incorporate the existing orchards and vineyards. This will minimise impacts to residential receivers.
Agriculture - Important agricultural lands, including Biophysical Strategic Agricultural Land (BSAL), irrigated cropping land, and land and soil capability classes 1, 2 and 3. Consideration should also be given to any significant fragmentation or displacement of existing agricultural industries and any cumulative impacts of multiple developments.	The proposal is not located on Strategic Agricultural Land, including industry clusters and biophysical strategic agricultural land. The proposal is however located on land and soil Capability Class 3 land. However: • The proposal is not expected to adversely affect the biophysical nature of the land. • The proposal would positively affect soils by providing many of the benefits of long-term fallow, including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving soil biota. • The proposal will not result in the permanent removal of agricultural land. • The proposal would not result in rural fragmentation given it will not alter the existing or surrounding environment. • Adjacent farming operations are compatible. • Strategic sheep grazing may be used within the development site. Grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.
Natural Hazards – Areas subject to natural hazards, such as flooding and land instability.	The site was not identified as flood or bushfire prone in the Leeton Local Environmental Plan (LEP) or the Rural Fire Service Bush Fire Prone Mapping Tool (RFS 2018).

Areas of constraint	Site justification
	The Leeton Shire Flood Study (LSC 2015) does however define areas of the proposal as flood storage areas. These are defined as parts of a flood plain that are important for temporary storage of floodwaters during a passage of a flood but are not categorised as a flood way.
Resources - Prospective resources developments, including areas covered by exploration licences and mining and petroleum production leases, Solar development applicants should seek advice from the Department of Planning, Division of Resources and Geoscience (GSNSW) about the coverage of resources-related licences.	The development site is not located on prospective resource developments, as determined by GSNSW Refer to Appendix C for correspondence.
Crown Lands – If any part of the project or associated transmission or distribution infrastructure will cross Crown Lands, it may be subject to legislative requirements that restrict access to the land.	Toorak Road is a shared Council/Crown road. Any works for the transmission line within the Crown road reserve would require an easement or licence under the *Crown Lands Management Act 2016.* However, if all infrastructure was contained within the adjacent freehold land, Crown Lands would only require notification of works. As such, the proposed transmission line to connect parcels 147 and 142 of DP751745 will be overhead with no works in the crown reserve. Council is the dedicated road authority under the provisions of the *Roads Act 1993.* Notification for works and any consent from the Council should be provided to DoI – Lands and Water Division prior to construction for their comment.

3 PROJECT DESCRIPTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must include:

- *A full description of the development, including:*
  - *details of construction, operation and decommissioning;*
  - *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);*
  - *a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.*

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The assessment must include all ancillary infrastructure, such as transmission lines, parking facilities, equipment sheds and new vehicle tracks. The EIS should also include Rural Fire Service requirements for asset protection.

3.1 PROPOSAL AREA DESCRIPTION

The subject land comprises about 187 ha of freehold land, identified as Lots 142, 145 – 152, 287, Lot 572 DP 751745, Lot 1770 DP 118161 and Lot 6650 DP 1197165. The development footprint is contained within Lots 142, 145 – 152, 287, Lot 572 DP 751745 and Lot 6650 DP 1197165, with the transmission line on the Ronfeldt Road reserve, Lot 1770 DP 118161, and the Houghton's Road reserve. The proposed transmission lines would connect to the existing TransGrid Yanco Substation adjacent to the proposal area, around 1km to the south-east.

Toorak Road runs north-south through the development site, with Research Road running east-west through the southern end of the site (Figure 1-2).

The development footprint of the proposal comprises around 183 ha of freehold land. The majority of the development site is primarily irrigated cropping, used as orange orchards and grapevines (Figure 3-1 and Figure 3-2). The paddocks have been deep ripped and cultivated in past management practices and most of the native vegetation has been removed. Some planted vegetation occurs along fence lines as windbreaks.

Several irrigation canals are present in the development site (Figure 3-3), with Gogeldrie Branch Canal bordering the development site. Four storage dams are also located within the development footprint (Figure 3-4). Several farm buildings and dwellings also occur in the development site.

Remnant native vegetation in the form of paddock trees, small mixed stands of remnant native woodlands and native grassland is present within the proposed transmission line route (Figure 3-5).

There are no residences within the development footprint. The subject land and most adjoining properties are used for agriculture, including grazing and cropping. 23 sensitive receptors are located directly adjacent the proposal, with an additional approximate 250 residences/receptors location within 1 km of the site (Figure 3-6 and Table 3-1). There are an additional approximate 900 within 2 km.

Access to the proposal would be off Toorak Road and Research Road. Toorak Road is dedicated as shared Council/Crown road, while Research Road is wholly under the jurisdiction and management of Leeton Shire Council. Toorak Road is expected to currently experience a low to moderate level of traffic, predominantly local traffic, fruit trucks and agricultural machinery.

Table 3-1 Sensitive receivers located adjacent to the proposal

Receiver Identification	Distance to Development Site
Receiver R01	300 m southwest of the project area
Receiver R02	110 m southwest of the project area
Receiver R03	130 m southwest of the project area
Receiver R04	110 m west of the project area
Receiver R05	140 m west of the project area
Receiver R06	250 m northwest of the project area
Receiver R07	30 m northwest of the project area
Receiver R08	250 m north of the project area
Receiver R09	300 m north of the project area
Receiver R10	240 m northeast of the project area
Receiver R11	410 m northeast of the project area
Receiver R12	390 m east of the project area
Receiver R13	420 m east of the project area
Receiver R14	420 m east of the project area
Receiver R15	480 m east of the project area
Receiver R16	560 m east of the project area
Receiver R17	910 m east of the project area
Receiver R18	760 m southeast of the project area
Receiver R19	450 m southeast of the project area
Receiver R20	240 m southeast of the project area
Receiver R21	130 m northeast of the project area
Receiver R22	1,030 m southeast of the project area, and approximately 430 m south of the powerline easement
Receiver R23	1,600 m southeast of the project area and approximately 550 m southeast of the powerline easement

Figure 3-1 Example of orange orchard within the development site

Figure 3-2 Example of vineyards within the development site.

Figure 3-3 Example of irrigation channels

Figure 3-4 Example of storage dams within the development site

Figure 3-5 Example of remnant native grassland and vegetation within the transmission line route

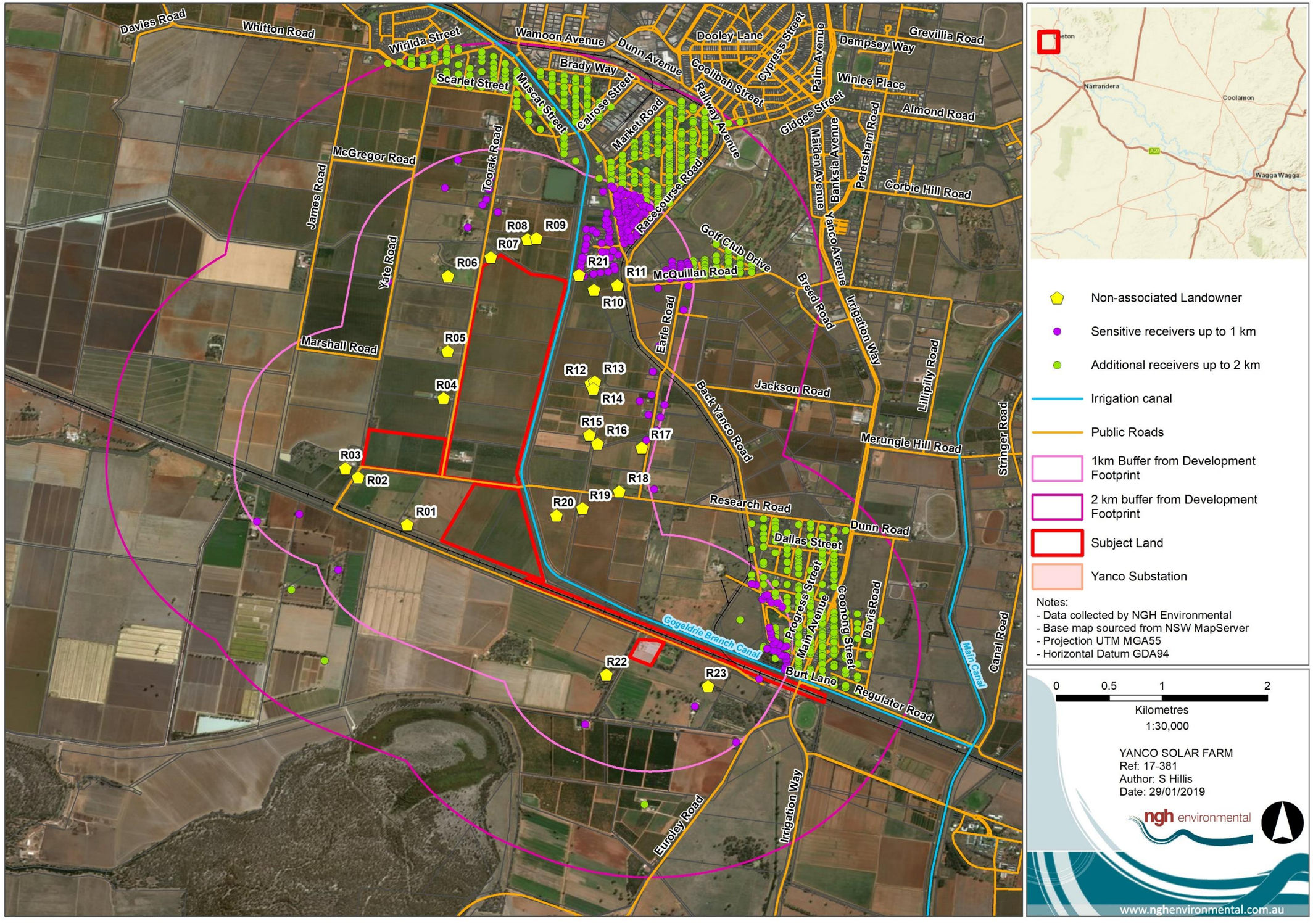

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Figure 3-6 Sensitive residence within 2 km of the subject land, including consulted adjacent neighbours and all other residential homes.

3.2 PROPOSED YANCO SOLAR FARM

Key features of the proposal are summarised in Table 3-2. Component specifications are subject to detailed design and product selection:

Table 3-2 Key features of proposed Yanco Solar Farm.

Proposal element	Description
Proposal	Yanco Solar Farm
Proponent	ib vogt GmbH (ib vogt)
Capacity	72 MW DC / 60 MW AC Note: 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	187 ha.
Development site	210 ha
Development footprint	183 ha (including transmission line route in Houghton Road reserve)
Site description	Lots 142, 145 – 152, 287, Lot 572 DP 751745, Lot 1770 DP 118161 and Lot 6650 DP 1197165. Freehold agricultural land zoned RU1 (Primary Production) under the Leeton Local Environmental Plan.
Local Government Area	Leeton.
Solar array	Up to 205,000 solar panels mounted in arrays, with 5 – 10 m row spacing. The 2 m x 1 m solar panels would be arranged in single rows mounted on single axis trackers with a maximum height not exceeding 2.2 m above the natural ground level. The PV mounting structure would comprise steel posts driven approximately 2.5 m into the ground using a small pile driver.
Battery Storage	Subject to economic and technical considerations, the proposal would include approximately 81/57 MW rated capacity units. The facility would comprise of lithium-ion batteries housed across the site in up to 17 customised containers with inverters.
Inverters/transformers	The proposal would include 17 containerised inverter/transformer units across the site.
Switching Station	An on-site switching station to connect the solar farm to a new powerline, associated structures and lightening protection masts occupying around 1 ha with gravelled hardstand and security fencing. Approximately 1.4 km of 33 kV of overhead or underground cabling would connect the substation to the existing TransGrid Yanco Substation.
Electrical connection	The proposal would connect to the existing TransGrid Yanco Substation via an approximately 1.4 km long 33 kV overhead or underground powerline. The overhead powerline would be made up of concrete power poles up to 20 m high. The underground powerline would be installed in trenches 80 cm deep and approximately 1.5m wide. Where the underground powerline needs to be drilled (for example, under the railway line and under Houghton's Road), the depth would be up to 3m.
Internal access tracks	Internal access tracks would be constructed of engineered fill topped with crushed stone pavement. Internal access roads to material storage compounds and the substation would be approximately 4–6 m width (including shoulders and any required drainage), whilst general internal roads would be approximately 3.5–5 m width.
Operations and maintenance buildings	Buildings would be constructed to provide a control room, 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.

Proposal element	Description
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. In general, no construction activities would occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. Leeton Shire Council and surrounding landholders would be notified of any exceptions.
Construction timing	Approximately 10 months commencing early 2020
Workforce	Construction – peak of around 120 workers Operation – 2 – 3 full time equivalent staff and up to 6 service contractors
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.
Capital investment	Estimated $99 million

3.3 PROPOSAL LAYOUT

The proposed layout has been developed iteratively in tandem with the environmental assessment and community 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 three classes; high, medium and low. Environmental constraint classes are described in Table 3-3.

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 3-7 and Figure 3-8). In terms of biodiversity values, Endangered Ecological Community (EEC) vegetation and threatened flora and fauna habitat were avoided as far as practicable.

Table 3-3 Environmental constraints at Yanco development site

High constraint
Near neighbours A number of non-associated residences are located directly adjacent the subject land boundary.
Local Environmental Plan Zoning The proposal is located adjacent to land zoned Low Density Residential, and at its closest point within 650 m of land zone General Residential.
Moderate constraint
Water storage dams Four dams are present on the property, which present a practical constraint for the solar farm.
Murrumbidgee Irrigation Infrastructure The site is surrounded by MI irrigation canals and other irrigation infrastructure.
Access The current proposed access to the site is not an approved B double vehicle route on the Roads and Maritime Services Approved Heavy Vehicle Access maps. Roads are classified by Council for General mass and dimension limits including heavy vehicles up to 19 m articulated vehicles / semi-trailers.

Low constraint
Cleared, cultivated paddocks with no paddock trees These area does not contain native vegetation and have low habitat value.

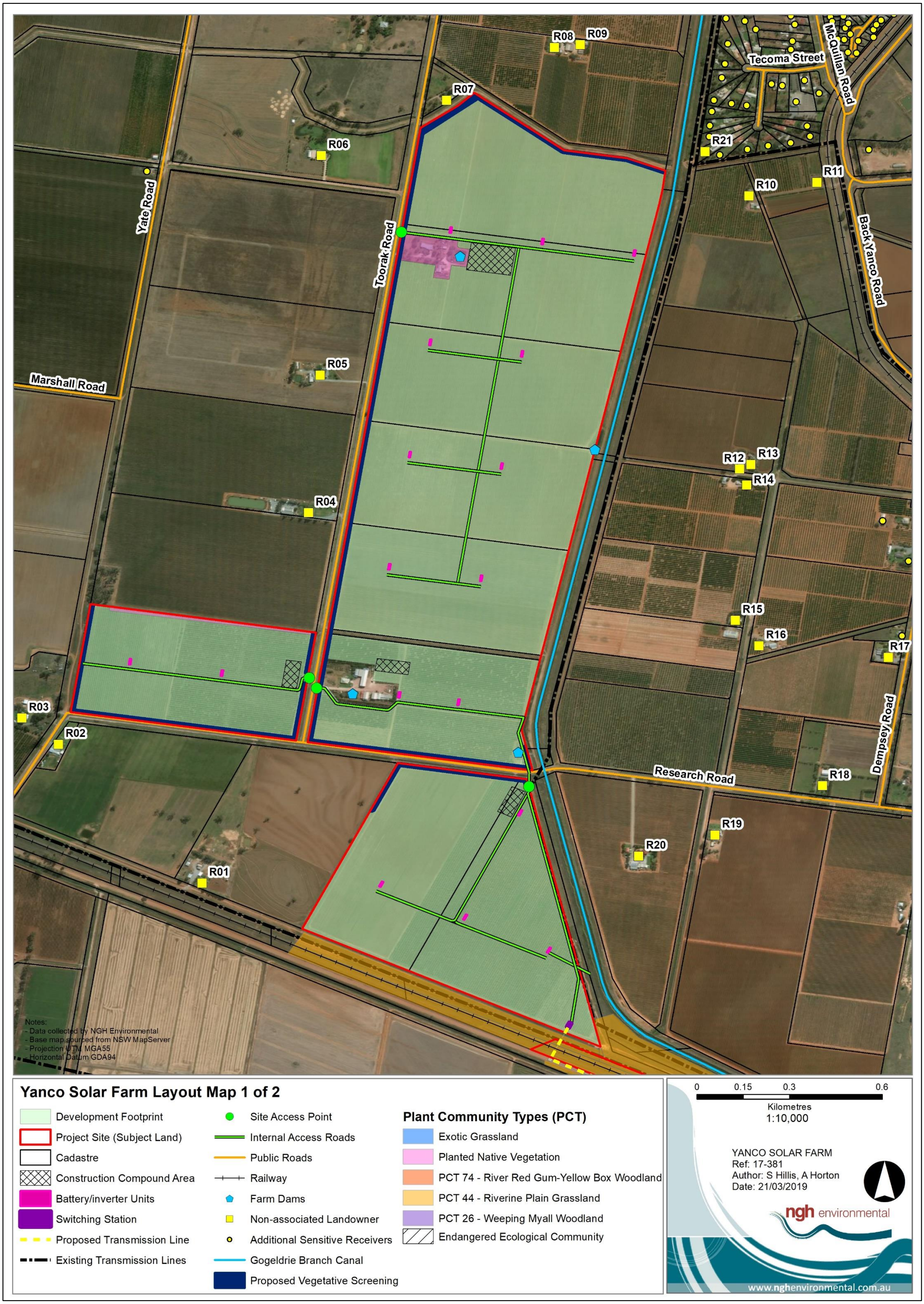

Figure 3-7 Proposal infrastructure layout and site environmental constraints (Map 1 of 2)

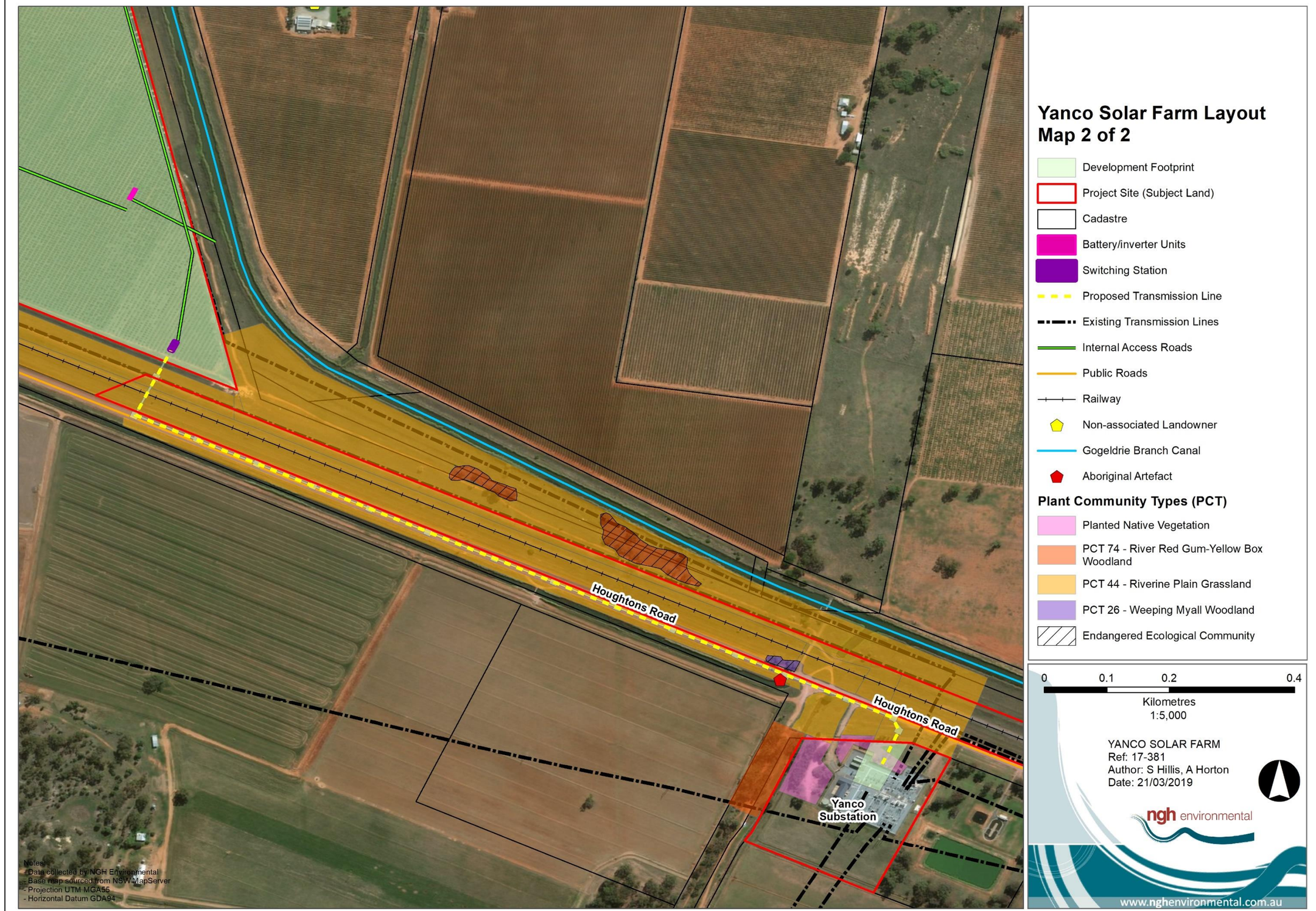

Figure 3-8 Proposal infrastructure layout and site environmental constraints (Map 2 of 2)

3.4 PROPOSED INFRASTRUCTURE

The proposal involves the construction of a ground-mounted photovoltaic solar array which would generate around 72 MW (DC) of renewable energy. The solar farm would connect (via the switching station and transmission line) into the TransGrid Yanco substation.

The proposal infrastructure includes:

- Single axis tracker photovoltaic solar panels (approximately 205,000) mounted on steel frames over most of the site.
- Battery storage to store energy on site (approximately 81.09 MWh /57.12 MW rated capacity).
- Electrical cables and conduits.
- Inverter/transformer units.
- On site switching station containing associated structures and control and protection equipment.
- Communications tower (20m high), adjacent to the switching station.
- Site office, compound, parking, access tracks and perimeter fencing.
- Operations and maintenance buildings with associated car parking.
- Access points via Research Road.
- Internal access tracks.
- Lighting, CCTV system, security fencing.
- Vegetative screening.
- 33kv electrical transmission line to connect the proposal to the Yanco substation.

The layout of the infrastructure components is shown on Figure 1-3 and the components are described in detail below. Indicative plans and drawings of infrastructure components are provided in Appendix B. The plans and specifications of the components are subject to detailed design and product selection which will occur pending project approval, when Engineering, Procurement and Construction (EPC) contractors are appointed to the project.

3.4.1 Solar arrays

It is expected that the array would comprise up to around 205,000 single axis tracker photovoltaic (PV) solar panels mounted in rows on steel frames. The 2 m x 1 m solar panels would be arranged in single rows (Figure 3-9) mounted on single axis trackers with a maximum height not exceeding 2.2 m above the natural ground level (Appendix B).

A single axis system illustrated in Figure 3-10 would be powered by approximately 2,500 tracker motors. A single axis tracker would have a typical maximum height of three metres, based on a two-metre vertical height panel and support posts. Row lengths would depend on the detailed design but could be up to 100 metres. Spaces between rows (edges of panel) may vary between three metres and nine metres. The indicative size of each PV panel is two metres by one metre, installed in either portrait or landscape orientation.

Approximately 27,000 piles would be driven or screwed into the ground to support the solar field's single axis tracker mounting system and solar panels. The pile depth would be determined following detailed geotechnical site investigation; depths are typically 1.5 - 1.7 m but may be up to 2.2 m. Pile heights would vary according to topography.

Figure 3-9 Example of an ib vogt solar array arranged in single rows

Figure 3-10 NexTracker single axis tracking system

3.4.2 Inverter/transformers

The proposal includes 17 containerised inverter/transformer units across the site (locations illustrated in Figure 3-7) approximately 12 m long, 2.5 m wide and 3 m high. Appendix B provides diagrams of the proposed inverter/transformer units and Figure 3-11 illustrates an example of the internal elements of the equipment. The inverter/transformer units would be constructed on concrete footings approximately 300mm above ground level.

Power from the solar panels would generate direct current (DC) electricity that would be inverted to alternating current (AC) via the inverter, with the voltages stepped up to 33kv by the transformer.

Figure 3-11 Containerised inverter/transformer unit with battery storage (SMA)

3.4.3 Energy 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.

Subject to economic and technical considerations, the proposal would include approximately 81.09 MWh /57.12 MW rated capacity units. The facility would comprise lithium-ion batteries housed across the site in up to 17 customised containers approximately 16 m long, 2.5 m wide and 3 m high. The batteries would be containerised and would be actively cooled by air-conditioning units, with spare air-conditioning units in storage on-site for replacement. If all aircon units fail or temperatures exceeds pre-set levels, an automatic battery shutdown system would prevent overheating. The battery storage units would be constructed on concrete footings approximately 300mm above ground level.

Each container would be temperature monitored, and the automated control system would stop their operation if the temperature exceeds pre-set levels. The facility would include an integrated fire suppression system involving the storage and release of an 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. The battery and inverter/transformer units 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.

3.4.4 Overhead and underground cabling

Most cabling at the site would be buried and located along the access tracks.

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, replacing the soil profile to assist revegetation of the disturbed areas. Cables would be protected in accordance with *Australian Standard (AS) 3000:2007 Electrical Installations*.

3.4.5 Transmission network connection

The solar farm would include a new overhead or underground transmission line to connect the solar farm into the TransGrid transmission network via the existing Yanco substation, located approximately 1.2 km to the south east of the site. Figure 1-3 shows the location of the switching station, and connection point to the transmission network. Connection would be via the proposed substation and an underground or overhead powerline approximately 1450 m long on the northern side of Houghton's Road. The overhead powerline would be made up of concrete power poles up to 20m high (Figure 3-12). The underground powerline would be installed in trenches 80cm deep and approximately 1.5m wide. Where the underground powerline needs to be drilled (for example, under the railway line and under Houghton's Road), the depth would be up to 3m.

Figure 3-12 Example 33 kv overhead powerline

3.4.6 Switching station

A new switching station (with control room and switchgear) would be constructed on the development area to connect the solar farm to a new powerline. While the design is yet to be finalised, it is expected that the station would be an area occupying approximately 80 m by 80 m and contain associated switchgear and control and protection equipment, a synchronous condenser, other associated structures, lightening protection masts, control and protection equipment and may include a control building, switch room and drainage and oil containment system. The switching station would be surrounded by a security fence. Gravel hardstand would be placed under and around the compound to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards (Appendix B).

Site office

A single storey building approximately 12 m long, 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 Site Office building would contain an office and staff amenities (toilet, kitchen).

Switch room

A building approximately 20 m long, 3.5 m wide and 4 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.

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 monoclad sheeting and include steel roller doors and windows with fixed metal louvers. Guttering and a water tank would be installed to collect rainwater. A fire extinguisher and hose reel would be installed at the shed.

Synchronous condenser

A synchronous condenser and associated auxiliary supply is required within the switching station. The maximum height is approximately 5m, with a footprint up to 20 m x 30 m contained within a generator house, up to 8 m high.

Lightning protection mast

A 20 m high lightening protection mask would also be housed within the switching station.

Figure 3-13 Example control room

Figure 3-14 Example communications tower and lightening mast

3.4.7 Site access and internal tracks

The development site would be accessed from Toorak Road that runs north-south through the development area, and Research Road that runs east-west. The four-access entrances consist of existing internal driveways/gated access to the property, and are approximately 3.3 km from Irrigation Way. 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 Leeton Shire Council following approval of the proposal.

Toorak Road is dedicated as shared Council/Crown Road, with Council being the dedicated road authority under the provisions of the *Roads Act 1993* for the trafficked surface within the road corridor. The remaining land is managed by the NSW Department of Industry (DoI) – Lands and Water division. Consent and conditions for the development of the access points/turn in points from Toorak Road to the freehold property is already administered by Council, with no precedent or process for DoI to issue consent.

The internal access roads would involve upgrading the existing entrance and connecting with a network of tracks accessing the solar farm infrastructure for maintenance. Approximately 5.7 km 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 4-6 m wide (including shoulders and any required drainage), whilst general internal roads would be approximately 3.5 –5 m width. The locations of proposed internal tracks are shown on Figure 1-3 and Figure 3-7.

The site access road and all internal tracks would be maintained throughout the construction and operation of the proposal. 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.

3.4.8 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 (Appendix B).

3.4.9 Landscaping and revegetation

Landscaping and screen planting would be incorporated in some sections of the perimeter of the site, as required to 'break up' or 'soften' views of the infrastructure from key locations. This would entail at least 10m wide buffers of native species planted to break up views of the infrastructure from specific receivers. Native tree and shrub species suited to site conditions would be used, placed and selected to avoid shading impacts on the array and to achieve effective screening of the solar farm infrastructure. Potential screening opportunities are discussed in the Visual Impact Assessment (Appendix E). Rows of existing orange trees or grape vines to break up views of the infrastructure from specific receivers may be considered in some locations.

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

The ten-metre minimum bushfire protection setback from solar farm infrastructure would be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm, as well as remnant woodland vegetation, 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 grass species immediately after construction. Groundcover species would be selected to facilitate sheep grazing at the site to control grass height and bushfire hazard.

3.4.10 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 fenced construction compound 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. A hardstand area 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 (estimated at 120 workers).

3.5 CONSTRUCTION

3.5.1 Construction activities

The construction phase is expected to last approximately 10 months with a peak construction period of 4 months. 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, switch room and storage building.
- Construction of the substation and connections.
- Construction of battery storage units.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently. Temporary construction facilities would be housed in four compounds situated throughout the site (Figure 1-3).

Battery storage

The construction of the battery storage would be concurrent with construction of the other solar farm infrastructure. 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 containers/units.
- Augmenting and connecting into inverters and site solar substation.
- Removal of any temporary works and/or replacement of hardstand areas.

3.5.2 Site preparation and earthworks

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

- Removal and clearing of existing oranges and grapevines.
- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of 1.5 – 2.4 m.
- 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 up to 1000 mm deep.
- 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 would 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 would be undertaken prior to earth works commencing to reduce the potential for spread of these species within the proposal footprint.

3.5.3 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 120 construction personnel would be required on-site during the peak construction period of approximately 4 months. 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 be local, and those who were not would use existing accommodation within the local area such as Yanco, Leeton, Narrandera and Griffith. 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.
- Light vehicles.
- Large transit vehicles, including delivery and waste removal vehicles.
- Forklifts.
- Cable trencher or excavator.
- Cable laying equipment.

- Cranes including 50 T mobile crane.

Materials

Construction materials would be sourced as locally as possible. Leeton is the nearest towns which are a possible source of the bulk of the aggregate material required for construction, followed by Narrandera, Griffith, and Wagga Wagga.

Approximately 5,400 m^3 of gravel would be required to surface the access road and internal service track network, inverter/battery storage areas and substation hardstand. Approximately 1,000 m^3 of sand may be required for the bedding of underground cables, depending on electrical design and ground conditions. Approximately 265 m^3 of concrete would be required to construct the inverter, substation, CCTV and battery storage foundations.

Approximately 38 ML of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, on-site amenities and landscaping. This water would be commercially available via an existing groundwater bore located in the eastern portion of the site. This would be a temporary commercial arrangement between ib vogt and the solar farm landowner.

A small amount of potable (drinking) water (approximately 0.09 ML) would be imported to the site during the construction period on an as needs basis and stored within temporary water tanks at the staff amenities area.

3.5.4 Transport and access

A Construction Traffic Management Plan (CTMP) would be prepared following proposal approval to manage haulage traffic during the construction phase. Stantec (formally TDG) have conducted a Traffic Assessment of the proposal (Appendix J).

Haulage route

Where possible, goods and services for the solar farm would be sourced locally. Items such as solar panels, posts and racking systems which can't be sourced locally would likely come by road from either Melbourne or Sydney. 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.

The proposed haulage route to the site includes the use of Irrigation Way, McQuillan Road, Racecourse Road, Poplar Avenue and Canal Street, Whitton Road, Toorak Road and Research Road.

The following roads along the proposed construction traffic route are approved RMS 19 m AV routes:

Heading toward the site from Irrigation Way:

- Left turn onto McQuillan Road.
- Travel along McQuillan Road as it transitions to Racecourse Road, Poplar Avenue and Canal Street.

Canal Street, Whitton Road, Canal Street, Toorak Road and Research Road are not RMS approved 19 m AV routes. However, it is understood that a development toward the southern end of Toorak Road currently has a permit with the National Heavy Vehicle Register (NHVR) to operate heavy vehicles along Toorak Road. While the exact details of this permit are unknown, heavy vehicle activity of the existing operations is considered to be similar to the proposed construction vehicle activity.

The heaviest construction vehicles expected to access the site could be up to 50 tonnes. Any over mass vehicles would require a NHVR permit to travel along the necessary sections of Toorak and Research Roads.

The use of these roads by larger vehicles delivering plant to the site would not be dissimilar to the existing use of the roads by trucks associated with other industrial uses in the surrounding areas. Refer to Figure 3-15 for the haulage route into the site.

Figure 3-15 Proposed haulage route

Whitton Road Bridge

A swept path assessment has been undertaken for the AV for the Whitton Road bridge. The assessment was undertaken using the software package AutoTurn, to determine whether the design vehicle could safely travel from Canal Street to Toorak Road and vice versa without crossing the road centrelines (Figure 3-16). Traffic management measures will be implemented where possible to mitigate the number of opposing heavy vehicles associated with the construction along Toorak Road, specifically by regulating the outbound vehicles during periods where no inbound vehicles are scheduled.

Notwithstanding this, it is recommended that traffic management measures are implemented to assist with the bridge crossing manoeuvres, in order to ensure safe and efficient vehicle movement, and minimise impact on the existing road network. Construction traffic management measures will be implemented to ensure that only one inbound and/or outbound vehicle is along the section of road that would fall under the NHVR Permit

Toorak Road

Toorak Road for the majority of its length has a straight alignment, however, towards the northern end of the road there is an approximate 50 metre radius curve. A swept path assessment was undertaken for simultaneous 19m AV movements and it was found that road widening would be required in order to accommodate these movements.

While it is not likely that simultaneous opposing movements will occur (due to the above-mentioned traffic management measures), it is considered that both northbound and southbound movements should be able to be comfortably accommodated by the road geometry without impacting other road users.

A swept path assessment has been undertaken for these movements and is included in Figure 3-17.

Toorak Road / Research Road Intersection

Heavy vehicles accessing the Research Road site are required to travel through the Toorak Road / Research Road intersection. A swept path assessment has been undertaken for these movements, and is included in Figure 3-18. Traffic management measures will be implemented to ensure that only one inbound or outbound vehicle is travelling through this intersection. The traffic management measures proposed to be implemented are described in greater detail below.

Road condition surveys

Prior to construction, a pre-condition survey of the relevant sections of the existing road network would be undertaken, in consultation with Leeton 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, any faults attributed to construction of the solar farm would be rectified in consultation with Leeton 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

Construction activities would be undertaken during standard daytime construction hours (7:00am to 6:00pm Monday to Friday, and 7:00am to 1:00pm on Saturdays). Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

It is anticipated that the delivery of PV panels will occur over an approximate 40 week construction period, generating up to 36 trucks daily during the peak construction period. The largest design vehicle expected to access the site is a 19m AVs (Articulated Vehicles as defined in AS2890.2:2002). It is noted that majority of construction vehicles are expected to be 19m AVs or smaller. Any vehicle exceeding the general mass or size limit will require a permit from the NHVR.

The total expected peak construction traffic generation resulting from the proposed development is 96 vpd, comprising 20 light vehicle movements per day and 76 heavy vehicle movements per day. It is understood that the heavy vehicle movements will be scheduled throughout the day, resulting in a steady distribution of construction traffic to/from the site, and minimising simultaneous heavy vehicle movements. Assuming an eight-hour delivery window, this results in approximately nine heavy vehicle movements to/from the site during peak construction periods, or 9 vph.

The majority of light vehicle movements are expected to occur prior to and following the delivery window, with a tidal flow of arrivals during the morning and departures during the afternoon/evening. The estimated delivery schedule for the construction phase is shown in Figure 3-19,. With the expected daily trips generated during peak construction and typical operation phase detail in Table 3-4.

Table 3-4 Expected trip generation during site construction and operation

Phase	Max vehicles per day	Max vehicle movements per day (vpd)
Construction	36 heavy vehicles	72 vpd
	10 light vehicles	20 vpd
	2 over-mass vehicles	4 vpd
Total		**96 vpd**
Operation	2 heavy vehicles	4 vpd

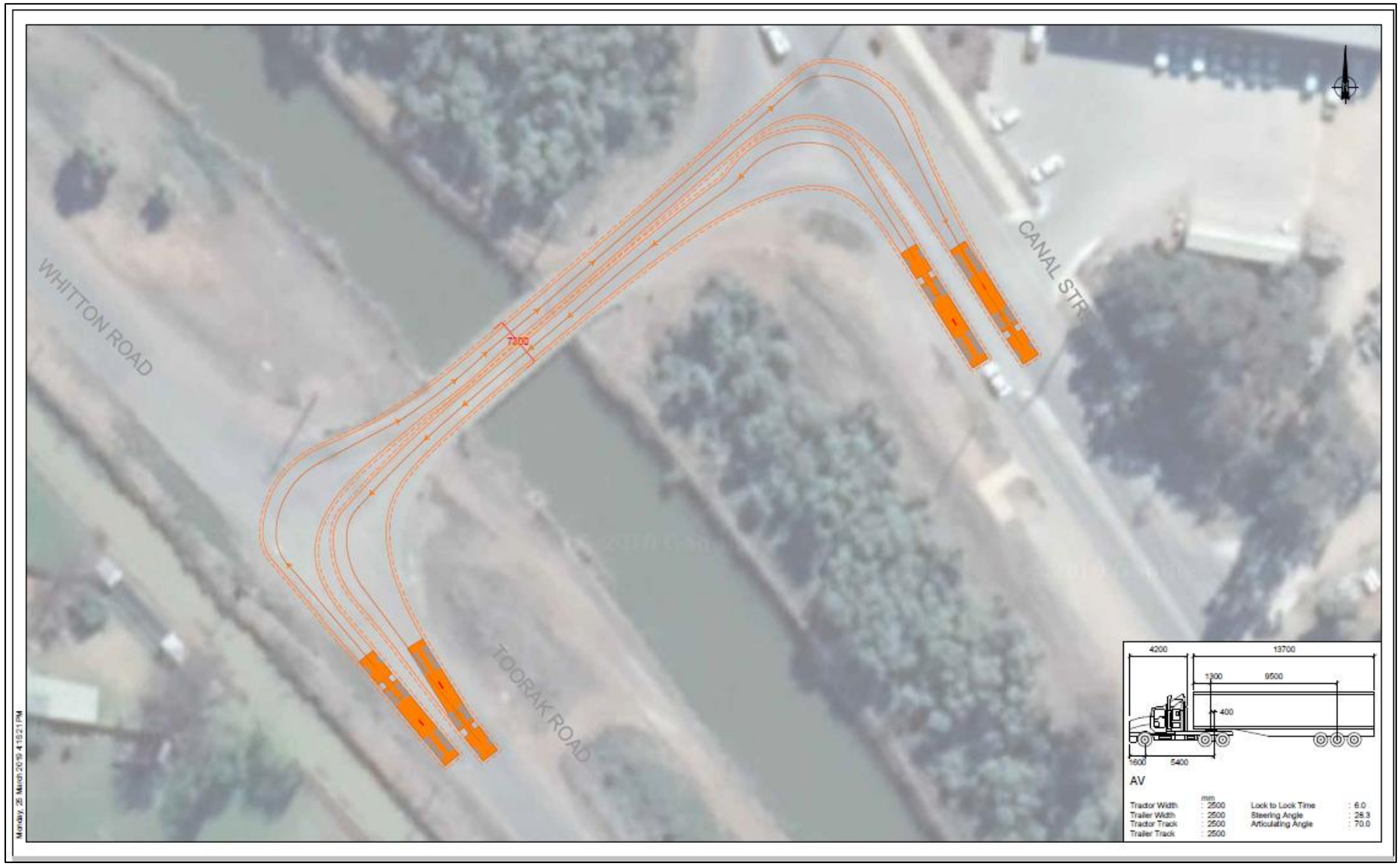

Figure 3-16 Swept path assessment Whitton Road Bridge

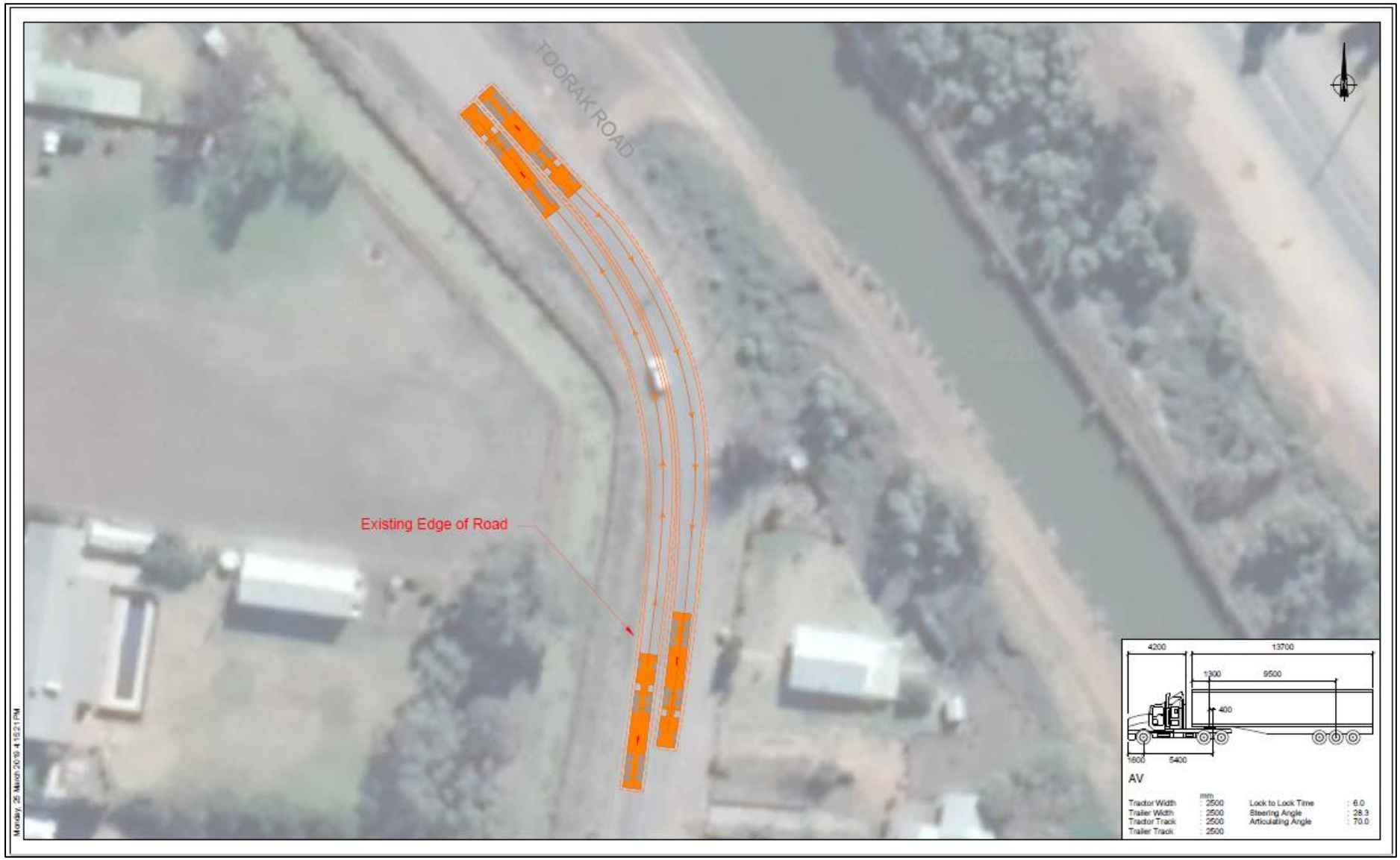

Figure 3-17 Swept pass assessment Toorak Road

Figure 3-18 Swept path assessment for Toorak / Research Roads

	Week of construction period																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Total
Purpose																																									
Site facilities	4	4	2																																				5	5	20
Ground works	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	70	50	50	50	50	50	50	50	50	50	50	50	20	20	20	20	20	20	20	2860
Fence	10	5	5	5	5	4																																	1		35
Mounting systems, racks etc.			20	20	20	20	20	20	20	20	20	20	15	15	15	15	10	10	10	10																				300
Modules																			30	30	30	30	30	30	30	20	20	20	20												290
Electrical installation, cables, trenching		30	20	20	20	20	20	20	20	20	5																														195
Inverter stations and crane						5		5		5		5		2																												22
Substation works			5	5	5	5	5																																		25
Site maintenance, waste disposal	15	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	15	15	15	15	10	5	5	5	5	5	5	5	5				565
other / people movements	10	20	30	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	10	10	1820
Water Supply	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	80
Estimated deliveries per week	141	176	204	212	222	226	217	217	212	217	197	197	187	189	187	187	182	182	212	212	202	167	147	147	147	137	137	137	132	107	107	107	107	77	77	77	77	72	38	37	6212
Estimated average deliveries per day	29	36	41	43	45	46	44	44	43	44	40	40	38	38	38	38	37	37	43	43	41	34	30	30	30	28	28	28	27	22	22	22	22	16	16	16	16	15	8	8	32
Estimated average movements per day	58	72	82	86	90	92	88	88	86	88	80	80	76	76	76	76	74	74	86	86	82	68	60	60	60	56	56	56	54	44	44	44	44	32	32	32	32	30	16	16	64

Figure 3-19 Proposed construction vehicle delivery schedule

3.5.5 Work hours

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.

3.6 OPERATION

3.6.1 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, soil protection or destocking) undertaken as required.
- Site security response (24 hr) if required.
- Site operational response (24 hr) if required.
- Replacement of equipment and infrastructure as required.
- Maintenance of landscaping and screening plantings as required.
- Pest plant and animal control as required.

3.6.2 Materials and resources

During operation, non-potable water would be required for cleaning panels, landscaping and animal care. Around 54 kL per year would be required for cleaning. The water is proposed to be sourced from an existing domestic groundwater bore with a 2 ML allocation. 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 L reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rain water collected from tanks beside site buildings.

3.6.3 Transport and access

During the operational phase of the project, there is expected to be in the order of two light vehicles accessing each of the Toorak Road sites (the same two vehicles) per day, reducing to an expected average of one vehicle per day after the first year following completion of construction.

For the Research Road site, this is expected to be in the order of two vehicles per week for the first year, reducing to one vehicle per week afterward.

3.6.4 Personnel and work hours

The solar farm would be monitored and operated remotely and would require a small number of maintenance personnel (2 to 3 full time equivalent staff) to be based at the site.

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 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 7.00 am to 6.00 pm
- Saturday 8.00 am to 1.00 pm

Outside of emergencies or major asset inspection or maintenance programs, night works or work on Sundays or public holidays would be minimised. During summer months, the PV panels would produce electricity prior to 7.00 am and after 6.00 pm. Tracker units would similarly operate outside standard hours in summer.

3.6.5 Lighting

There would be no permanently lit 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.

3.6.6 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 DECOMMISSIONING AND REHABILITATION

The proposal 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. Before the site is decommissioned, a Rehabilitation and Decommissioning Management Plan (RDMP) will be prepared and approved by the relevant authorities.

3.7.1 Plan objectives

The objectives of the RDMP are to describe how project infrastructure will be removed after operations cease, and to establish methodology by which the post development soil condition is capable of being returned to its previous agricultural use. This includes:

- Identifying the final agricultural land use following decommissioning of the proposal.
- Provides a description of the development process and how it will be integrated with rehabilitation.
- Identifies a benchmark site that is used to determine realistic performance criteria.
- Includes a timeline for rehabilitation activities.
- Outlines a program for monitoring rehabilitation success using appropriate indicators.

3.7.2 Timeline and methodology

Decommissioning would aim to return the site to its pre-works state, specifically irrigated agriculture. Certain aspects of the development may be retained by mutual agreement with the landowner at time of decommissioning, as they may be of value to ongoing agricultural activities. This may include site fencing, vegetative buffers, operation and maintenance buildings, access roads and established pasture grasses.

Typically, the reclamation of the proposal proceeds in reverse order of installation. All above and below ground infrastructure would be removed. 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 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.
- Gravel pavement materials will be recovered and recycled as general fill in an appropriate location.
- Areas subject to compaction will have the topsoil ripped to a depth suitable for cropping and nourished using composted organic matter from the removed vegetation buffer.
- Pasture grasses will be eliminated using glyphosate (unless otherwise directed by the landowner), and the land cultivated and allowed to lay fallow prior to establishment of cropping activities.
- Sodic soil will be treated as necessary with lime or gypsum.

All areas of soil disturbed during decommissioning would be rehabilitated in consultation with the landowner consistent with post-solar farm land use requirements. The site would be left stabilised, under a cover crop or other suitable ground cover. This will depend on what the landholder intends to use the land for at the time – i.e. irrigated agriculture. The DRP would reference:

- *The Australian Soil and Land Survey Handbook* (CSIRO, 2009).
- *The Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008).
- *The land and soil capability assessment scheme: second approximation* (OEH, 2012).

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 (for example, some internal access is likely to be retained). A Decommissioning Traffic Management Plan would be captured as part of the DMP.

3.7.3 Performance criteria

The site rehabilitation activities will be deemed successful if the following criteria are achieved:

- Decommissioning of the proposal occurs in one stage.
- All above ground infrastructure is removed from the site and recycled or disposed of in an appropriate manner, with minimal disturbance to the land.
- All belowground infrastructure is removed and reinstated so that subsoil material is not places in the infilled land surface.
- After soil conditioning, an appropriate dry-land cover crop is capable of being maintained on the site for one cropping season, subject to drought or other extenuating circumstances at time of decommissioning.

3.8 INDICATIVE TIMELINE

An indicative timeline for the proposal is outlined in Table 3-5. 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 12-month construction period.

Table 3-5 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	Early 2020	10 months
Operation	Early 2021	30 years
Decommissioning	Early 2051	6 months

3.9 CAPITAL INVESTMENT

The proposal would have an estimated capital investment of $99 million. A Capital Investment Valuation Report has been provided to DPE separately to the EIS, breaking down costs and fees associated with the proposal.

4 PLANNING CONTEXT

4.1 PERMISSIBILITY

The proposed development is defined as **electricity generating works** and is permissible with consent under clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP). 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 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 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 (formally section 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 under the EP&A Act.

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 (DCP);	Leeton Shire Council do not have any DCPs but are currently in the process of developing one to determine the appropriate flood planning levels in the Shire. In addition, clause 11 of the SRD SEPP provides that DCPs do not apply to SSD.
Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under 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: • The Government Coastal Policy, for development applications in certain local government areas; and • The provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters are relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates;	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 0 and 6.6 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.
Any submissions made in accordance with this Act or the regulations; and	Feedback and direction from the public during the preparation of the EIS to maximise opportunities for public engagement. Public submissions would be sought and responded to as part of the EIS

Provision	Relevance to the proposal
	determination process. The proponent would consider and respond to any submissions made in relation to the proposal in a Submissions Report or Preferred Project Report following the public exhibition period.
The public interest.	A number of public benefits are relevant to the proposal as discussed in Section 2.2. Specifically, these relate to: • Reducing fossil fuel emissions that that contribute to climate change. • Meeting State and Australian Government policies to increase renewable energy supply. • Providing local employment and regional development opportunities.

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) would be placed on public exhibition by DPE for a period not less than 30 days.

4.2.3 Leeton Local Environmental Plan 2014

The development area is located within Leeton LGA and is subject to the provisions of the *Leeton Local Environmental Plan 2014* (Leeton LEP). The Leeton LEP aims:

a) to encourage sustainable economic growth and development,
b) to preserve rural land for all forms of primary production,
c) to identify, protect, conserve and enhance Leeton's natural assets,
d) to identify and protect Leeton's built and cultural heritage assets for future generations,
e) to allow for the equitable provision of social services and facilities for the community,
f) to provide housing choices for the community,
g) to minimise land use conflicts and adverse environmental impacts,
h) to promote ecologically sustainable development.

It is considered that the proposal is compatible with the aims of the Leeton LEP, especially in regards to encouraging sustainable economic growth and development, minimising adverse environmental impacts and promoting ecologically sustainable development.

The proposal is located within land zoned as water sensitive under the LEP, with the proposed transmission line within biodiversity sensitive land. The proposal is not mapped as flood prone.

Land zoning

The development area is zoned RU1 - Primary Production under the Leeton LEP. Electrical generation is not listed among developments that are permitted within the zone. However, the 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 Leeton 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 to:

a) to encourage sustainable primary industry production by maintaining and enhancing the natural resource base.

b) to encourage diversity in 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.
e) to provide opportunities for intensive and extensive agriculture in appropriate locations consistent with the environmental capability of the land and access to irrigation water.
f) to allow the development of processing, service and value-adding industries related to agriculture and primary industry production.
g) to protect and enhance the water quality of receiving watercourses and groundwater systems so as to reduce land degradation.

For the life of the proposal, the development site would harness a renewable natural resource (solar energy). The activity would impact on land availability for primary production, however; would be developed in a way that would minimise fragmentation and alienation of resource land, minimise land use conflict and protect the water quality of receiving watercourses. Being 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.

4.2.4 Development Control Plans and Council policies

There are no Development Control Plans that apply to the proposal area.

4.2.5 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.

The proposal is defined in ISEPP clause 33 as electricity generating works, meaning a building or place used for the purpose of making or generating electricity.

Part 3 Division 4 of ISEPP relates to electricity generating works. Clause 34(1) states that *'Development for the purpose of electricity generating works may be carried out by any person with consent on the following land: (a) in the case of electricity generating works comprising a building or place used for the purpose of making or generating electricity using waves, tides or aquatic thermal as the relevant fuel source – on any land; (b) in any other case – any land in a prescribed rural, industrial or special use zone'*.

Under the ISEPP, a prescribed rural, industrial or special use zone is defined as all land zoned RU1 Primary Production, RU2 Rural Landscape, RU3 Forestry, RU4 Primary Production Small Lots, IN1 General Industrial, IN2 Light Industrial, IN3 Heavy Industrial, IN4 Working Waterfront, SP1 Special Activities and SP2 Infrastructure.

As the proposal is on land zoned RU1 under the Leeton LEP, works are permissible with consent under Part 3 Division 4, Clause 34(1)b of the ISEPP.

4.2.6 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 (SDD)

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 proposal has an estimated capital investment value of $99 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.

4.2.7 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 Environment Protection Authority (EPA) contaminated land public record (NSW EPA 2018) was undertaken for contaminated sites within the Leeton LGA on 13 September 2018. One result was returned, which was a former service (petrol) station in Yanco – 14 Main Ave. At its closest point, the former service station is over 900 m from the development site.

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.

4.2.8 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 7.6.

A preliminary risk screening in accordance with SEPP 33 was undertaken and determined based on the spread of storage capacity and site-specific hazard mitigation measures that the proposal was not potentially hazardous. Therefore, a PHA was not completed (refer Section 7.6).

4.2.9 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 proposal area is

not identified in schedule 2, it is not identified as state significant agricultural land and Part 4 does not apply.

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 30 MW of electrical power. General electricity generation 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 30 MW 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 road authority under section 138 of the Roads Act. Leeton Shire Council is the roads authority for all local roads surrounding the proposal (including Research Road and Irrigation Way) and NSW Roads and Maritime Services (RMS) is the roads authority for the Sturt Highway, being the major access route to the area.

Toorak Road is dedicated as shred Council/Crown Road, with Council being the dedicated road authority under the provisions of the *Roads Act 1993* for the trafficked surface within the road corridor. The remaining land is managed by the NSW Department of Industry (DoI) – Lands and Water division. Consent and conditions for the development of the access points/turn in points from Toorak Road to the freehold property is already administered by Council, with no precedent or process for DoI to issue consent.

Given the proposal would involve work within the road reserve for access to the site, section 138 consent would be required.

4.2.12 Crown Lands Management Act 2016

The main aims of the *Crown Lands Management Act 2016* is to provide for the ownership and management of Crown land in NSW, and provide clarity concerning the law applicable to Crown land. Works within a Crown reserve require environmental, social, cultural heritage and economic considerations to be considered, and must facilitate the use of land by the NSW Aboriginal people.

Toorak Road is dedicated as shred Council/Crown Road, with Council being the dedicated road authority under the provisions of the *Roads Act 1993.* Notification for works and any consent from the Council should be provided to DoI – Lands and Water Division prior to construction for their comment.

4.2.13 Water Management Act 2000

The *Water Management Act 2000* (WM Act), currently administered by the 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 for construction and operation of the solar farm would be sourced from an existing groundwater bore and existing domestic bore, respectively. As agreed in principle with the landowner (the current licensee of the bores), the proponent would purchase the water for construction requirements and would take over the rights to the domestic bore to source operational water needs. As such, any water sources specified under the WM Act is not required.

4.2.14 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 process 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.

4.2.15 National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act 1974* (NPW Act), the Director General of OEH is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. The Director General of OEH is also responsible under this legislation for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW.

The provisions of the NPW Act have been considered for the proposal. The proposal area is located within 10 km of a number of unnamed Murrumbidgee Irrigation Area State Forests (Figure 1-1), but no impact on these areas are expected.

An assessment of impacts to Aboriginal Heritage is provided in Section 6-3 and Appendix E. It is noted that under section 89J(d) of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for SSD.

4.2.16 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. A number of items are listed within the Yanco area; however, 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.

4.2.17 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 would 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 would be developed and implemented by the proponent.

4.2.18 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. A BDAR has been prepared as part of this EIS (Appendix D).

4.2.19 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.

Subdivision is not required; therefore the *Conveyancing Act* is not applicable.

4.2.20 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 (Section 7.7).

4.3 COMMONWEALTH LEGISLATION

4.3.1 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 would require an export permit under Section 40 of the Hazardous Waste Act. The Proponent would coordinate this activity and the associated commercial arrangements with the selected battery supplier.

4.3.2 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 September 2018 indicated that there are no World Heritage Properties or National Heritage Places within the proposal area. Search results listed five Wetlands of International Importance that are either known to occur or have potential to occur in the area, with the RAMSAR listed Fivebourgh and Tuckerbil Swamps located approximately 6.5 km north-east of the proposal; however, these are not relevant to the site or proposal. 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
World Heritage Properties	N/A
National Heritage Places	N/A
Wetlands of International Significance	N/A
Great Barrier Reef Marine Park	N/A
Commonwealth Marine Areas	N/A
Threatened Ecological Communities	Section 6.2 and Appendix D – significant impacts not anticipated.
Threatened Species	Section 6.2 and Appendix D – significant impacts not anticipated.
Migratory Species	Section 6.2 and Appendix D – significant impacts not anticipated.

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
Commonwealth Lands	5
Commonwealth Heritage Places	N/A

Other Matters Protected by the EPBC Act	Addressed in this EIS
Listed Marine Species	N/A
Whales and Other Cetaceans	N/A
Critical Habitats	N/A
Commonwealth Reserves	N/A

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

Extra Information	Addressed in this EIS
Place on the RNE	N/A
State and Territory Reserves	1
Regional Forest Agreements	N/A
Invasive Species	Section 6.2 – significant impacts not anticipated.
Nationally Important Wetlands	1

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in the Biodiversity section (Section 6.2) and the BDAR in 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.

4.3.3 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 in September 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 at this time. Toorak Road is dedicated as shred Council/Crown Road, with Council being the dedicated road authority. Native title over public works, which includes public roads, has been extinguished.

4.3.4 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 a 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:

i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

ii. an assessment of the risk-weighted consequences of various options.

The precautionary principle has been adopted in the assessment of expected impacts. All potential impacts have been considered and mitigated commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty. Generally, a worst-case assessment is undertaken to account for unknowns.

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. The proposal is considered to be reversable in terms of protecting the natural values of the site. 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 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 have been reduced as much as possible in this context and to be justified.

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 proposal area 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 development would be ecologically sustainable within the context of ESD and is justifiable.

4.4.2 NSW Large-scale Solar Energy Guideline – For SSD (2018)

The guideline provides the proponent and regulators with general guidance on the planning framework for the assessment and determination of state significant large-scale solar energy projects under the EP&A Act.

The objectives of the guideline are to:

- Provide guidance to the community, applicants, industry and regulators on how DPE assess environmental, social and economic impacts of state significant solar energy projects.
- Encourage industry to select suitable sites for projects to reduce the likelihood and extent of land use conflicts and environmental and social impacts.
- Facilitate better on-ground outcomes by promoting early identification of potential impacts.
- Promote meaningful, respectful and effective community and stakeholder engagement.
- Support the development of a sustainable solar industry in NSW by providing a clear, consistent and responsive policy framework.

The proposal has addressed the requirements of the guidelines through the assessment of environmental impacts (Sections 0 and 6.6), site suitability (Section 2.4.6), community and agency consultation (Section 5) and policy and framework requirements (Section 4).

4.5 SUMMARY OF LICENSES

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

Table 4-5 Summary of licenses required.

Instrument	Licence or approval requirement
EP&A Act, Part 4	SSD 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.
Roads Act, section 138	Any works to public or classified roads requires consent under this act from the road authority. Leeton Shire Council is the roads authority for public roads within the Yanco and Leeton area, including the traffickable surface of Toorak Road and any site entry/turn off points and NSW RMS is the roads authority for the Sturt Highway.
Local Government Act, Section 68	Approval is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Leeton Shire Council would be required for use of a standpipe and to operate an onsite sewage management system.
Workcover Notification	Exceedance of 10,000 kg of lithium-ion batteries requires Workcover notification.
MIA	Easement required to cross MI lot in central southern portion of the site for internal power cable to cross the MI canal.
Transport for NSW	Licence required for powerline to cross rail corridor.

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

5 STAKEHOLDER CONSULTATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Consultation –

During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, 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 Leeton Shire Council.

The EIS must describe the consultation process and the issues raised and identify there the design of the development has been amended in response to these issues. Where amendments have not been made to address and issue, a short explanation should be provided.

Further consultation after 2 years –

If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS.

Under the NSW Large-scale Solar Energy Guideline (2018), the proponent is encouraged to engage with relevant stakeholders at all stages of the EIS, from scoping through to post-approval. These include:

- Government – including local council, NSW Government agencies and Commonwealth Government.
- Community – including local land owners, special interest groups, Aboriginal community members, and other potentially affected stakeholders.
- Mineral title holders.
- Network service providers.

5.1 AGENCY CONSULTATION

Secretary's Environmental Assessment Requirements (SEARs)

As the proposal is classified as SSD, a Preliminary Environmental Assessment (PEA) was prepared, and the SEARs requested for a 60 MW PV solar farm at Yanco. The SEARs were issued by DPE on 30 August 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 each agency's specific matters 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 prior to EIS lodgement.

Department of Planning and Environment

Issue summary	Addressed in EIS
The EIS for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*	
In particular, the EIS must include:	
• A stand-alone executive summary;	Page xviii
• A full description of the development, including:	
- details of construction, operation and decommissioning;	Section 3

Issue summary	Addressed in EIS
- 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); - a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development; • 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 proposed or approved solar farms, rural residential development and subdivision potential);	Section 2
• An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: - A description of the existing environment likely to be affected by the development; - 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, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; - 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 - A description of the measures that would be implemented to monitor and report on the environmental performance of the development.	Section 0 and 7
• A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and	Section 8
• The reasons why the development should be approved having regard to: - Relevant matters for consideration under the E*nvironmental Planning and Assessment Act 1979*, 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;	Section 4.4.1
- The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and	Section 6.4
- Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	Section 2.4
The EIS must also be accompanied by a report from a suitably qualified person providing: • A detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived; and • Certification that the information provided is accurate at the date of preparation. The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).	
Biodiversity –	

Issue summary	Addressed in EIS
• An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016 (NSW)* the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values; • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and • An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.	Section 0 Appendix D Section 7.3
Heritage – Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*;	Section 7.1 and 7.8
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, 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; • An assessment of potential land use conflicts, including completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide*; and • Measures to remediate the land following decommissioning in accordance with *State Environmental Planning Policy No 55 - Remediation of Land*	Section 6.4
Visual – Including 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;	Section 6.3
Noise – Including an assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and cumulative noise impacts (considering other development in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	Section 6.5

Issue summary	Addressed in EIS
Transport – Including an assessment of the site access route (including Sturt Highway, Newell Highway, Irrigation Way, Research Road, Main Avenue, Audley Street and Toorak Road), site access point, 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);	Section7.3
Water – • An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including the Murrumbidgee River, Guises Creek, irrigation canals, drainage channels, wetlands, riparian land, farm dams, 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);	Section 7.3
Hazards and Risks – • A preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (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 *Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DoP, 2011) and *Multi-Level Risk Assessment* (DoP, 2011); and • An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure;	Section 7.6
Socio-Economic – Including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	Section 6.6
Consultation – During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, 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 Leeton Shire Council. The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendment have not been made to address an issue, a short explanation should be provided. **Further consultation after 2 years –** If you do not lodge a development application and EIS for the development 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

Leeton Shire Council

Issue summary	Addressed in this EIS
The Transport Assessment report is to also include a review on the possible use and impact on the following additional local roads; Houghton Road and Binyah Street. The proposed inclusion of Audley Street is considered to not be warranted at this stage.	Section7.3 and Appendix J
The Socio-Economic assessment is to also include a review and comparison of the loss of economic value from the existing horticultural production currently undertaken on the site against the economic value of the proposed solar farm.	Section 6.6 and Appendix G
The EIS is to include a detailed assessment on the management of the waste generated by the development, in particular, but not limited to, the treatment of the waste generated from the removal of orange trees, grape vines and associated vine structures and waste from packaging materials associated with the solar equipment.	Section 7.7

Department of Industry (DOI)

Issue summary	Addressed in this EIS
DOI Water – • The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased. • A detailed and consolidated site water balance. • Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts. • Proposed surface and groundwater monitoring activities and methodologies.	Section 7.3
DOI Crown Lands – There is potential that a Crown Road is affected by the proposal (located between lots 147 and 142 in DP751745). The proponent should consider any related restrictions or constraints in title of the Subject Land. As such, the proponent should ensure that any subsequent reports correctly consider and reference the *Crown Land Management Act 2016*.	Section 4.2.12 and Section 4.5

Correspondence between NGH Environmental and Melva Robb from the Griffith Crown Lands Office (17 December 2018) confirm that Toorak Road is a shared council/crown road. Any works for the transmission line within the crown road reserve would require an easement or licence under the *Crown Lands Management Act 2016.* However, if all infrastructure was contained within the adjacent freehold land, Crown Lands would only require notification of works. As such, the proposed transmission line to connect parcels 147 and 142 of DP751745 will be overhead with no works in the crown reserve.

Further correspondence with the proponent and Bec Byrne from the Griffith Crown Lands Office (7 February 2019) indicates Toorak Road is dedicated as shared Council/Crown Road, with Council being the dedicated road authority under the provisions of the *Roads Act 1993*. Notification should be provided to DoI – Lands and Water of any works, but they are not the consent authority and do not have any precedent or process for approval.

Department of Primary Industries (DPI)

Issue summary	Addressed in this EIS
The SEARs should require an accurate assessment of the impacts to current and surrounding agricultural uses and industries and these impacts need to be acknowledged and factored into the development of the EIS. To justify the project's location the SEARs should request: • A full soil survey and analysis to ground truth the true nature of the soils. • An assessment of the forgone irrigation-based production over the project lifespan. • Assessment against the DPE's Large Scale Solar Energy Guidelines (draft or soon to be released) • Feedback from Murrumbidgee Irrigation Ltd on the implications of stranded assets likely from cumulative impacts of more such developments within the gazetted irrigation areas. If proponents are considering further proposals in gazetted irrigation areas managed by Murrumbidgee Irrigation Ltd (MI), Coleambally Irrigation Co-operative Limited (CICL) and Murray Irrigation Ltd (MIL), feedback should be sought from the appropriate company on the implications of stranded assets likely from cumulative impacts of more such developments.	Section 7.2 and Appendix I Section 7.3 Sections 6.6, Section 2.4.6, Section 5 and Section 4. Section 7.9

DPE (Resources and Geoscience)

Issue summary	Addressed in this EIS
GSNSW has no resource sterilisation concerns to raise regarding the proposed Yanco Solar Farm Project at this stage and have no additional issues to be addressed. However, the proponent should ensure that the results of the above search are documented in the exhibited EIS.	Section 6.4

Fire and Rescue (FR) NSW

Issue summary	Addressed in this EIS
Should a fire or hazardous material incident occur, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matter are recommended to be addressed: • That a comprehensive ERP is developed for the site. • That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents. • That the ERP detail the 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 (including electrical hazards). 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 a safe method for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment). • Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. • That two copies of the ERP (detailed in recommendation above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.	Section 7.6

Issue summary	Addressed in this EIS
• One constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council.	

NSW Rural Fire Service (RFS)

Issue summary	Addressed in this EIS
• The preparation of the EIS should incorporate a bush fire hazard assessment report prepared by a suitably qualified person which includes site-specific recommendation for the proper design of: - Asset protection zones (APZs); - Measures to prevent a 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 local NSW RFS District Fire Control Centre; and - Vehicular access and defendable space around the solar array. • Protection for the facilities from bush fires can be achieved through a combination of strategies which will: - Minimise the impact of radiant heat and direct flame contact by separating development from bush fire hazards; - Minimise the vulnerability of buildings to ignition and fire spread from flames, radiation and embers; - Enable appropriate access and egress for the public and firefighters; - Provide adequate water supplies for bush fire suppression operations; - Focus on facility preparedness, including emergency planning and property maintenance requirements; and - Facilitate the maintenance of APZs, fire trails, access for firefighting and on-site equipment for fire suppression and prevention of fire spreading from the site.	Section 7.6

Local Land Services (LLS)

Issue summary	Addressed in this EIS
The proposal, including vegetation clearing, is being assessed under Part 4 of the EP&A Act. Accordingly, as the PEA gives consideration for such clearing, LLS does not provide any additional consent as an agency. In summary, the PEA completely addresses matters with respect to vegetation clearing, offsetting and biodiversity requirements and authorises activities via the Planning legislation pathway. Local Land Services has no further comment in respect to matters under Part 5 of the *Local Land Services Act 2013.*	N/A

Murrumbidgee Irrigation (MI)

Issue summary	Addressed in this EIS
MI provide Development Rules for access to and construction and planting near the boundary of MI infrastructure, which includes the following: **Construction and planting near boundary of Company Works (MI infrastructure) –**	Development layout

Issue summary	Addressed in this EIS
• The proponent must not, without prior written consent, undertake any construction works, erect a fence, erect a power pole, plant vegetation, stockpile vegetation, chemicals or other materials, or allow any of those things to remain within 10 m of the toe of the bank or 5 m of MI infrastructure. • 10 m minimum clearance from the channel crest is required for overhead transmission lines (if required). • 1.5 m clearance between the channel bed level and the under bored electricity cable is required (if required). • The proponent must not construct or permit to remain any shallow bore within 40 m or deep bore within 20 m of MI infrastructure without prior written consent. • Despite the above, MI may determine the minimum distance required between construction and MI infrastructure.	
Pests – • The proponent must control pests in accordance with the *Biosecurity Act 2015* and provide details to MI in weed control activities. Anything which is reasonably likely to pollute MI Infrastructure is not permitted. • Pesticide and herbicides are not permitted in the flow area of MI infrastructure, unless MI states otherwise. • If the proponent fails to control peats and it would be detrimental to MI or their customers within a reasonable time, MI may undertake works to control relevant pests at a cost to the proponent.	Section 6.1
Fencing – Where the proponent intents to erect a fence adjacent to MI infrastructure, the proponent is responsible for ensuring that the fence is constructed in accordance with specified distance buffers and that the fence is not places on MI owned land and confirmed by a registered surveyor.	Development layout
Land or environment contamination – • The proponent must not place or permit to remain anything including chemicals, hazardous materials, trash or rubbish if it will breach or is likely to breach any licence held by MI, contravene MIs obligations under a legal requirement or contaminate the landholding. • Where a written notice from MI for a contamination breach is received and failed to be rectified within 28 days, MI is entitled to remove material at a cost to the proponent.	Section 7.7.3
Removal of material from MI infrastructure – The proponent must not remove, construct or dig any fill or other materials from any part of any supple or drainage channel owned of controlled by MI.	Section 7.3.3

Office of Environment and Heritage

Issue summary	Addressed in this EIS
OEH recommends that the EIS appropriately address the following • Biodiversity • Aboriginal cultural heritage The assessment must include all ancillary infrastructure associated with the project, including, but not limited to: • Items listed in section 3.2 of the PEA	Section 6.2 and 7.1

Issue summary	Addressed in this EIS
• Activities associated with landscaping (screen plantings) and vegetation management during operation, such as herbicide use for maintaining vegetation under panels. • Rural Fire Service requirements for asset protection. The EIS should fully describe the proposal, the existing environment and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity values. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data. Please note that for projects not defined as pending or interim planning applications under Part 7 of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* the Biodiversity Assessment Methodology (BAM) must be used to assess impacts to biodiversity in accordance with the *Biodiversity Conservation Act 2016* (BC Act), unless the Planning Agency Head and the Environment Agency Head determine that the project is not likely to have any significant impact on biodiversity values. For this project the BAM must be used. There are large parts of NSW that have not been subject to archaeological survey and as such there may be unrecorded Aboriginal sites within or near the project area. Desktop assessment and site survey should investigate the landscape for any evidence of prior streams, which may indicate areas of archaeological potential. All Aboriginal objects identified must be reported to the OEH through registration on AHIMS in accordance with the mandatory notification requirements of section 89A of the *National Parks and Wildlife Act 1974*.	
Biodiversity - • Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the BC Act using the BAM and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the BC Act (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values. • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM. • The BDAR must include details of the measures proposed to address the offset obligation as follows; - The total number and classes of biodiversity credits required to be retired for the development/project; - The number and classes of like-for-like biodiversity credits proposed to be retired; - The 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. • If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. • The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM. • The BDAR must be prepared by a person accredited in accordance with the *Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017* under s6.10 of the BC Act.	Section 6.2 and Appendix D
Aboriginal cultural heritage –	Section 7.1 and Appendix H

Issue summary	Addressed in this EIS
• 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 these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (OEH 2010), and be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011) and consultation with OEH regional branch officers. • Consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). 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. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH. • The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR. • The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts. • The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	
Historic heritage – The EIS must provide a heritage assessment including but not limited to an assessment of impacts to *State and local heritage* including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall: • Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the *NSW Heritage Manual* (1996), • Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria), • Include a statement of heritage impact for all heritage items (including significance assessment), • Consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and • Where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including	Section 7.8

Issue summary	Addressed in this EIS
research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.	

Roads and Maritime Services (RMS)

Issue summary	Addressed in this EIS
Given the scale and operational characteristics of the proposed development RMS considers that 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. RMS 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. For such a development an assessment of the potential traffic impacts on the surrounding road network due to the development, particularly during the construction phase, should be submitted with the Development Application. The required contents and detail of the Traffic Impact Assessment (TIA) will depend on the scale of the proposed development, the characteristics of the potential traffic generation and the traffic volumes and other traffic generating influences on the surrounding public road network. Given the potential volume of traffic and the need for deliveries of the components to the development site during the construction period a Transport Management Plan for the construction activity should also be prepared for the proposed development. Details for deliveries of ancillary materials such as gravel and concrete should also be considered as part of the submitted documentation. The TIA 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. Where road safety concerns are identified at a specific location along the haulage route/s, the TIA may be supported by a targeted Road Safety Audit undertaken by suitably qualified persons. For guidance in the preparation of the TIA the applicant 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 *Austroads Guide to Traffic Management Part 3 – 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 motorist be addressed in the development submission. Consideration could be given to the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.	Section 7.3 and Appendix J

SafeWork NSW

Issue summary	Addressed in this EIS
Safework NSW will not be making comment on the Development Application and Environmental Impact Statement for the proposed Yanco Solar Farm.	N/A

TransGrid

Issue summary	Addressed in this EIS
The EIS must include details of connection with the National Grid, and infrastructure required for the development is to be included in the scope of works and mapped within the project boundary.	Section 3.3 and section 3.4

5.2 ABORIGINAL COMMUNITY CONSULTATION

5.2.1 Local Aboriginal Land Council and Registered Aboriginal Parties

The consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the ACHCRP 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 of the ACHAR. The area investigated is covered by the Leeton & District Local Aboriginal Land Council (LALC), which covers an area of approximately 3.3% of the wider Murrumbidgee Province.

Formal Aboriginal community consultation was undertaken as outlined in NSW Office of Environment and Heritage's (OEH) *Aboriginal cultural heritage consultation requirements for proponents 2010.* This included advertising in the *Leeton Irrigator* on 13 July 2018 and writing to prescribed agencies including OEH seeking interested parties, which also occurred on 13 July 2018.

One Aboriginal groups registered their interest in the project, the Leeton & District LALC. No other parties registered their interest, including the other entities and individuals recommended by OEH (Griffith LALC).

The Leeton & District LALC were consulted with respect to the proposal in accordance with the OEH Consultation Requirements. A draft methodology was sent for comment and review on 13 September 2018. No comments were received.

The process for the additional survey areas was as follows:

- A proposed methodology was provided to the registered party for comment, allowing a minimum 28-day review period.
- An ACHA survey was conducted from 22 October to 23 October 2018 and two representatives from the Leeton & District LALC attended the fieldwork.
- The draft ACHA report (this document) was provided to the registered party for comment with a minimum 28-day review period.

5.2.2 Aboriginal Community Feedback

Community consultation occurred throughout the preparation of the ACHA. 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. The period for RAPs comments on the draft assessment closed on 17 January 2019. No feedback was received.

5.3 BROADER COMMUNITY CONSULTATION

The proponent has undertaken consultation with the local community in accordance with the requirements of the SEARs and 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 proposal 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 Yanco 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.

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://yancosolarfarm.com.au/. The website went live in August 2018 and is updated regularly. An online feedback form can be filled in to submit feedback regarding the solar farm proposal.
- Establishment of a dedicated email address for feedback to: info@yancosolarfarm.com.au.
- Direct engagement with neighbours through phone calls, letters, emails, face to face meeting and community open day events:
- ib vogt staff made contact with neighbours to the solar farm proposal site during June 2018 to advise of the proposal and provide staff contact details should people have any further queries. Contact was made via phone calls, door knocking and letters.

- In late July 2018 ib vogt mailed out letters to immediate neighbours to notify residents of the solar farm proposal and offer to meet and/or answer questions about the solar farm. The letter included a proposal factsheet, an invitation to attend a private information session in Yanco on 8 August 2018 (for near neighbours to the site), notification of the public Information Drop-In Session in Leeton on 9 August 2018, assessment and project timeline, ib vogt staff contact details and a community feedback form with a reply-paid envelope (Appendix C.2) to allow neighbours to provide their opinions regarding the solar farm proposal.
- A private information session for near neighbours to the proposal site was held at the Yanco All Serviceman's Club on 8 August 2018 to provide information about the solar farm proposal (letters were issued during July to invite neighbours to the session). Layout plans were displayed at the information session, with information about the proposed height of the solar panels and vegetation screening options. Seven people attended.
- Information about the proposal was presented to Leeton Shire Councillors on 8 August 2018.
- A community Information Drop-In Session was held by the proponent in Leeton on 9 August 2018 to provide proposal information, to gain feedback from the local community regarding the proposal and to answer questions. The open day was advertised in the Leeton Irrigator newspaper and a media release was issued in late July. Around 25 people dropped in to view plans of the solar farm proposal and provided feedback.
- In late November 2018 a newsletter was mailed out to all residences Yanco and Leeton. This newsletter included an update on the progress of the proposal (reduction in development footprint so that the area east of the Gogeldrie Branch Canal is not proposed to be developed and reduction in proposed height of panels from 4m to 2.2m maximum height), environmental assessments and details of the 10 December 2018 public Information Drop-In Session. The newsletter was made available on the proposal website.
- ib vogt staff held face to face meetings with site neighbours on 10 December 2018 to provide an update regarding the proposal, including the landscape plan and photomontages of the solar farm infrastructure and proposed vegetation screening options. Neighbours were invited to meet via phone calls and letters.
- The proponent held second a public Information Drop-In Session in Leeton on 11 December 2018. The open day was used to provide an update on the progress of the solar farm proposal and results of completed environmental investigations (with plans and photomontages of the solar farm proposal on display and members of the proponent staff available to answer questions). The open day was advertised in the Leeton Irrigator newspaper.
- Specific concerns raised by residents were followed up individually by the proponent via face-to-face meetings, phone calls, letters and/or emails.
- In April 2019 a second newsletter will be mailed out to residences in Yanco and Leeton. This newsletter will include an update on the proposal, information about the State Significant Development process, timing for the public exhibition of the EIS and places where the EIS will be available for viewing during the public exhibition period. The newsletter will provide information about making a submission about the Yanco Solar Farm Development Application. The newsletter will be made available on the proposal website.

5.3.3 Results of community consultation

Private information sessions and community information drop-in sessions

During the private information sessions and the community Information Drop-In Sessions (held in August and December 2018), neighbours to the site and members of the general community raised issues of concern regarding the solar farm proposal including the following:

- Risk of spreading silverleaf nightshade as a result of the solar farm.
- Visual impact of the solar panels. Many commented during the August 2018 information sessions that single rows of panels would be preferable to double rows of panels.
- Proximity to dwellings. Several neighbours to the east of the site questioned during the August 2018 private information session whether the development needed to extend east beyond the Gogeldrie Branch Canal, noting that the canal embankments would provide visual buffer.
- Use of irrigated agricultural land for a solar farm.
- Glare and reflectivity from solar panels.
- Increased heat in the surrounding area.
- Decrease in land values.

As a result of the early community consultation feedback, the proposal development footprint was reduced to exclude the area east of the Gogeldrie Branch Canal and the solar panels reduced to single rows (2.2m maximum height). The other concerns are discussed below.

Feedback forms

Feedback forms were completed by 19 respondents across the period of community consultation between July and December 2018. Feedback forms were completed at the Yanco Solar Farm open days held in Leeton on 8 and 9 August 2018, returned via mail or filled in from the proposal website. The majority of respondents live within 2 km of the proposal.

Responses include:

Values of the local area

Landscape and views (nine respondents), community and family ties (12 respondents), work opportunities (eight respondents) and natural values (eight respondents) were selected as holding the most value to respondents in the local area.

Additional comments or concerns from respondents included use of prime agricultural land for a solar farm, loss of agricultural employment, visual intrusion, increase in erosion and environmental issues, glare, heat island effect, loss of family from the area, decrease in land values, height of panels,

Landscape characters enjoyed by residents in the area include uninterrupted views of farm surroundings, change in view from orchards and blossoms to solar panels and food production.

Positive outlook on solar farms

Renewable energy (12 respondents), local economic opportunities (six respondents) and diversification of land use/income streams (four respondents) were selected as positives of solar farms.

A number of respondents showed support for renewable energy and solar farms in general, but not where it was proposed. Concerns were raised again over the value of agricultural land, devaluation of properties and closeness to homes.

There were also a number of respondents (six) who were in full support of the proposal.

Concerns about solar farms

General concerns about solar farms were selected, these included community impacts (five respondents), visual impacts (seven respondents) and effects on land use or land values (eight respondents).

Additional concerns raised included clearing of trees, increased air particle matter and dust, unknown effects, health, use of pesticides and herbicides and what is done at the end of the operation life.

Reflecting on local value and character

As mentioned above, generally residents in the Yanco area are supportive of solar development. However, some people believe the site is not suitable, and the proposal should be moved to more unsuitable farming land and away from homes.

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. Specifically:

- Visual impact has been addressed in Section 6.3.
- Impact on the community has been addressed in Section 6.6.
- Impacts to biodiversity has been addressed in Section 6.2.
- Land use impacts has been addressed in Section 6.4

Specific concerns raised about the Proposal include:

- Use of prime agricultural land has been addressed in Section 6.4.4.
- Loss of agricultural employment has also been addressed in Section 6.4.4.
- Visual intrusion is addressed in Section 6.3.7.
- Increase in erosion and environmental issues is addressed in Sections 6.2, 7.2, 7.3 and 7.5.
- Glare is addressed in Section 6.3.8.
- Heat islands is addressed in Section 7.5.2.
- Decrease in land values is addressed in Section 6.6.3.

5.3.4 Continued engagement

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

The CCP would 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 would continue to guide engagement activities at all stages of the project, ensuring that engagement is appropriate and in line with good practice.

Continued consultation would also be carried out with the nearest neighbours regarding a further visual impact assessment and vegetation planting where required following commissioning of the solar farm, as discussed in Section 6.3.

5.3.5 TransGrid

ib vogt has been in constant contact with TransGrid regarding the connection to the proposed Yanco Solar Farm. TransGrid has provided a Connection Process Agreement and studies for the detailed connection works have commenced.

TransGrid advised in January 2019 that the solar farm development application should include minor works within Yanco substation (which would be required to connect the substation). TransGrid advised that the construction of a new 33kV switchbay at TransGrid Yanco substation would be required to accommodate

the solar farm transmission connection. TransGrid would be responsible for constructing the switchbay and secondary systems works within Yanco substation, and the Proponent would be responsible for the construction of the solar farm and associated transmission connection to Yanco substation.

5.3.6 Junee – Hay Railway

ib vogt began consultation with Transport for News South Wales and John Holland Rail (the owner and operator of the railway line, respectively) in 2018 regarding a proposed easement over the railway corridor to the south of the site. The easement is required to connect the proposed Yanco Solar Farm to the Yanco substation. Discussions are ongoing.

6 ENVIRONMENTAL IMPACT ASSESSMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

In particular, the EIS must include:

- *A stand-alone executive summary;*
- *A full description of the development, including:*
  - *details of construction, operation and decommissioning;*
  - *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);*
  - *a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development;*

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

OEH recommends that the EIS appropriately address the following:

1. *Biodiversity and offsetting*
2. *Aboriginal cultural heritage*

6.1 IMPACT ASSESSMENT APPROACH

Following the preparation of the PEA, a risk assessment was undertaken to characterise the likely adverse environmental risks associated with the construction, operation, upgrade and decommissioning of the proposal. 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 receivers.
  - 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 detailed assessment, or any mitigation being applied and is therefore precautionary and worst case.

Table 6-2 Risk analysis of adverse environmental issues.

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

In summary, the following environmental risks were considered to be key issues for detailed assessment and consideration of mitigation strategies within the EIS:

- Biodiversity.
- Visual impacts.
- Land use impacts.
- Noise impacts.
- Socioeconomic and community.

Biodiversity, socioeconomic, visual and noise impacts were investigated by specialists. Summaries of these reports are included in Section 0 of this EIS. The full reports are attached as Appendices (Appendix D, E, F, and G). Land use has been assessed in Section 6.4 and addresses guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI 2013) and the *Land and soil capability assessment scheme* (OEH 2012). Lower risk issues are addressed in Section 7.

6.2 BIODIVERSITY (FLORA AND FAUNA)

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Biodiversity –

- An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016 (NSW)* the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values;
- The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and
- An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

Projects not defined as pending or interim planning applications under Part 7 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 the Biodiversity Assessment Methodology (BAM) must be used to assess impacts to biodiversity in accordance with the Biodiversity Conservation Act 2016 (BC Act), unless the Planning Agency Head and the Environment Agency Head determine that the project is not likely to have any significant impact on biodiversity values. For this project the BAM must be used.

Biodiversity –

- *Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the BC Act using the BAM and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the BC Act (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values.*
- *The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.*
- *The BDAR must include details of the measures proposed to address the offset obligation as follows;*
  - *The total number and classes of biodiversity credits required to be retired for the development/project;*
  - *The number and classes of like-for-like biodiversity credits proposed to be retired;*
  - *The 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.*
- *If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.*
- *The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM.*
- *The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act.*

6.2.1 Approach

A specialist Biodiversity Assessment Report (BDAR) was prepared by NGH Environmental to investigate and assess the potential impacts of the proposal on biodiversity. The aims of the report were to address the biodiversity matters raised in the SEARs and to address the requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act). The BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It also provides a 'credit requirement' in order that impacts that are not avoided are offset in accordance with the BC Act and Biodiversity Assessment Methodology (BAM).

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

6.2.2 Existing environment

Landscape features

The development site is located in the Riverina bioregion, in the Murrumbidgee subregion. The bioregion is characterised by a dry semi-arid climate with hot summers and cool winters. The geology is dominated by Quaternary alluvial sediments, with characteristic landforms of complex alluvial fans with numerous distributary channels and floodplains, depression plains, abandoned lake beds with lunettes, and limited source-bordering dunes. The pre-European vegetation type is dominated by:

- Black Box and River Red Gum on channels
- Black Box, Lignum and Cane Grass in swamps
- Saltbush and Bluebush with Old Man Saltbush, Cottonbush, Myall and Grasses on plains
- White Cypress Pine on sandhills

As determined by GIS mapping from aerial imagery, around 114.3 ha of native vegetation occurs in the 1500 m buffer area. This native vegetation in the landscape surrounding the development is predominantly Yellow Box – River Red Gum tall grassy riverine woodland (26 ha), Black Box Grassy Open Woodland Wetland of rarely flooded depressions (10 ha) and Riverine Plain Grassland (51ha).

Around 2115 ha (97.7% of land within the boundary of the subject land) is cleared of native vegetation. Cleared areas in the subject land are primarily irrigated, levelled agricultural land used for citrus and grape production (50/50 split over the site). These areas provide limited foraging habitat for native species including disturbance-tolerant fauna and introduced species such as foxes and rabbits.

Agricultural land does not provide any threatened species habitat, will not be suitable for offsets and therefore do not require further assessment.

There are no prescribed streams within the development site. The development site contains four farm dams. The proposal is located in the MIA, and several irrigation channels run throughout the development site. These irrigation channels are involved in existing agricultural activities on the subject land. Irrigators in the MIA have licences which allow them to use a prescribed amount of water each year. The natural hydrology of the site has been largely replaced by irrigation and drainage channels, and storage dams. There would be no removal of irrigation channels throughout the development site.

No wetlands occur in or adjacent to the development site. The nearest important wetland listed under the EPBC Act are the Fivebough and Tuckerbil Swamps, which are located 5 km North West of the development site.

There are no significant connectivity features in or adjacent to the development site. The remnant and planted vegetation and orchard/vineyard plantings provide some habitat connectivity for more disturbance-tolerant and mobile species to travel across the landscape. The irrigation channels provide some aquatic connectivity.

No karsts, caves, crevices or cliffs or other areas of geological significance occur in or adjacent to the development site.

No areas of Outstanding Biodiversity Value occur within the development site.

Native vegetation

The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 4.70%. The total area of the 1500 m^2 buffer area is 2430 ha. The area of native vegetation in the 1500 m buffer area is 114.3 ha.

Around 26.6 ha of native vegetation occurs within the development site. This is comprised of (Figure 6-1):

- 0.68 ha of remnant River Red Gum – Yellow Box Woodland,
- <0.1 ha of remnant Weeping Myall Woodland,
- 3.15 ha of planted native vegetation, and
- 22.7 ha of Riverine Plain Grassland.

6.2.3 Plant community types (PCTs)

Methods to assess PCTs

Review of existing information

A search was undertaken of the OEH Vegetation Information System (VIS) database and NSW SEED mapping to access existing vegetation mapping information within the development site. Two relevant existing vegetation maps were assessed.

- **SEED Mapping – Sharing and Enabling Environmental Data (2017).** One Plant Community Type (PCT) (*PCT 44: Forb-rich Speargrass – Windmill grass – White top grassland of the Riverina Bioregion*) was mapped occurring along Houghton Road. No other vegetation communities were mapped within the development site. Small patches of native vegetation occurring in the surrounding areas were PCT 74: *Yellow Box – River Red Gum tall grassy riverine woodland of NSW South Western Slopes and Riverina Bioregion* to the south and *PCT 16: Black Box grassy open woodland of rarely flooded depressions in South Western NSW* to the north.
- **Riverina Regional Native Vegetation Map _VIS_ID 4469.** No vegetation communities were mapped within the development site. Six PCTs were mapped in the 1500m buffer area with the dominant communities being PCT 74, PCT 16 and PCT 10: *River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.*

Floristic survey

A site overview was undertaken on 7 September 2017. The entire subject land was surveyed by car and on foot by an ecologist with NGH Environmental. The aim of this survey was to determine the extent of native vegetation present in the development site, its condition and vegetation type. Random meander searches were conducted in areas of native vegetation to determine the plant species present. PCTs were identified from the native species present, landforms and physiography and location in the IBRA subregion using the BioNet Vegetation Classification Database. The subject land was then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Detailed floristic surveys of vegetation plots were undertaken on 9 August and 24 August 2018. The surveys were undertaken using the methodology presented in the BAM (2017). The required number of vegetation integrity plots of 20 m by 50 m were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation. Personnel undertaking the field work have been trained in the BAM and were directed by persons accredited under the BAM (Appendix D).

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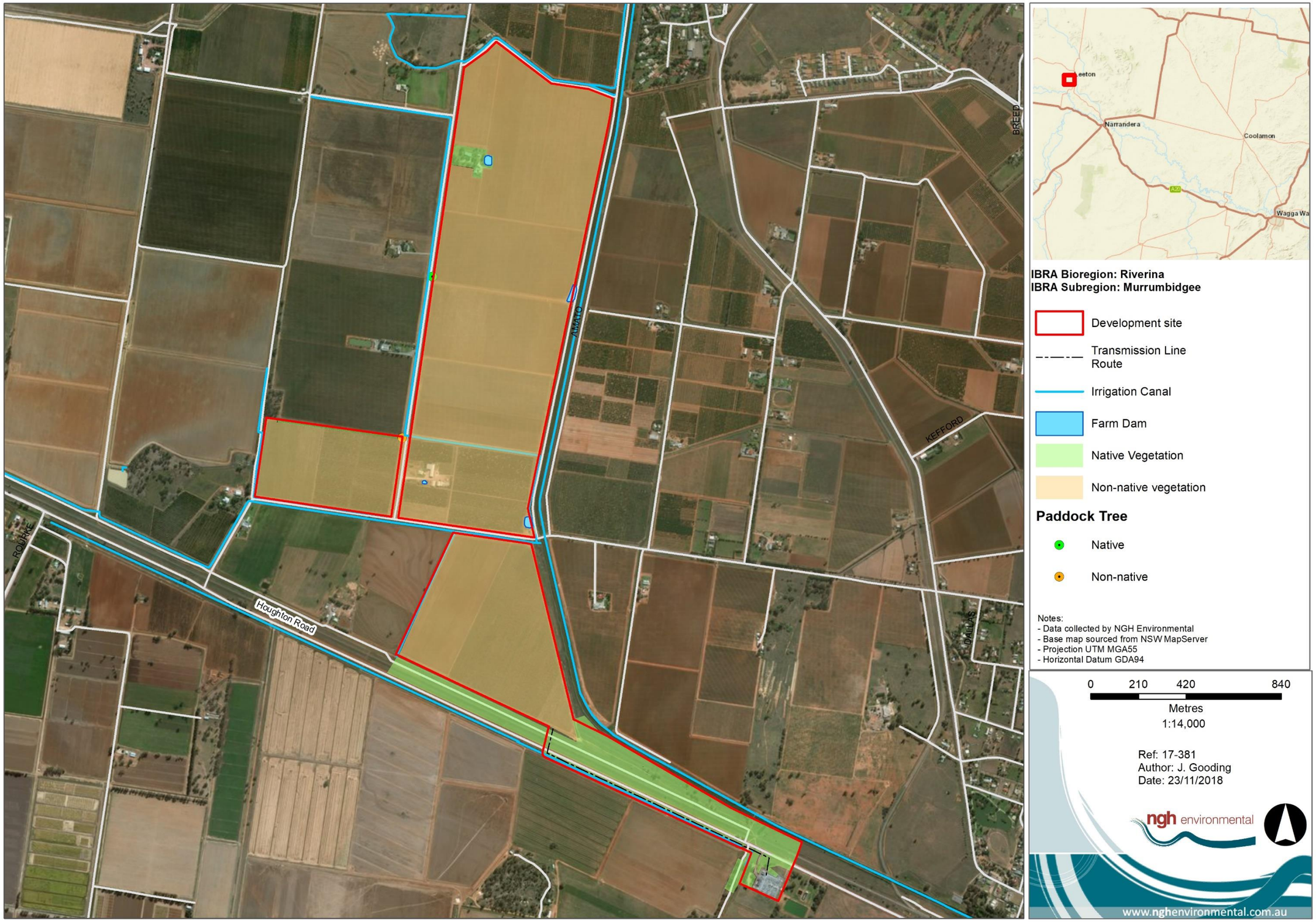


Figure 6-1 Native vegetation extent within the development site

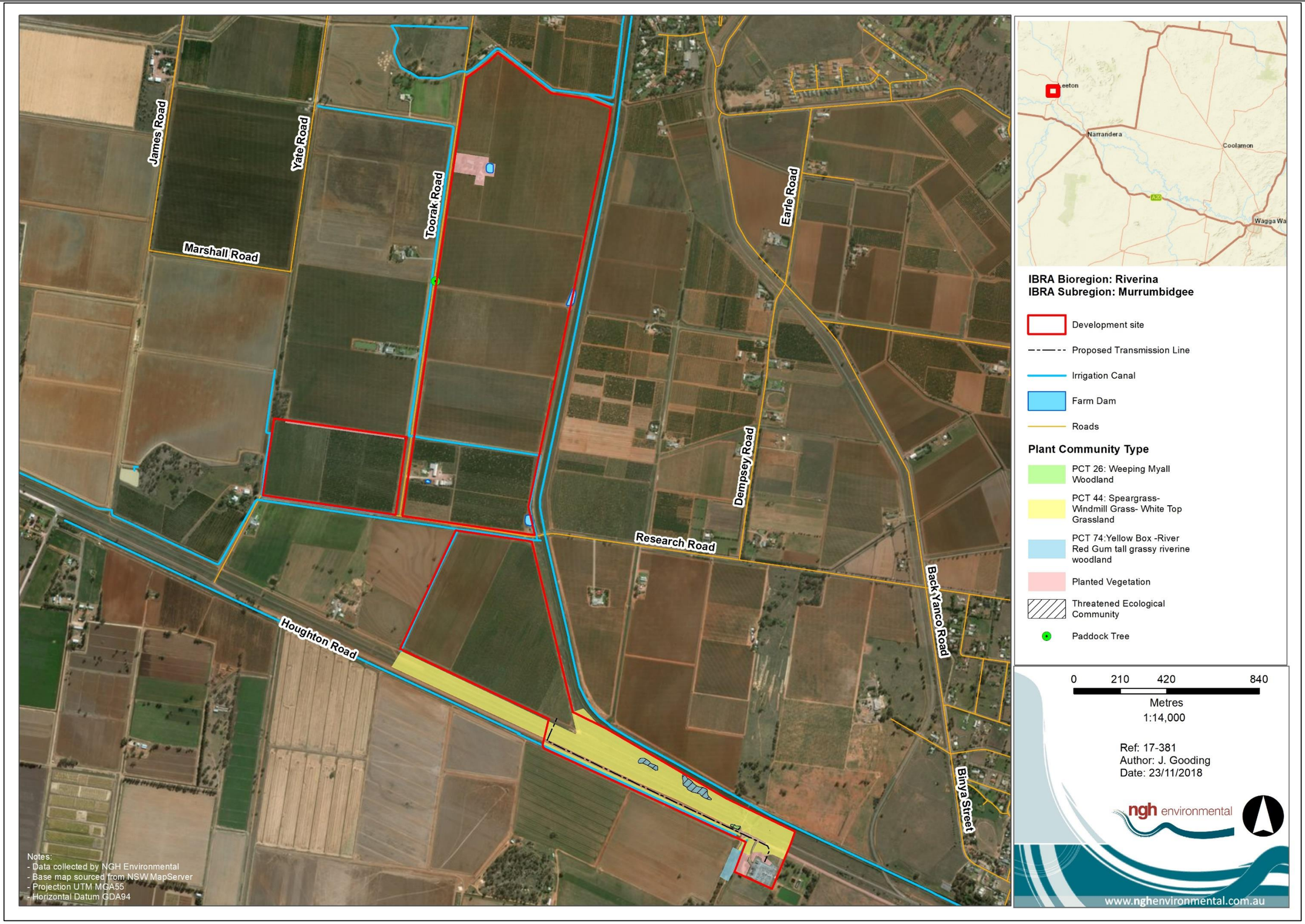


Figure 6-2 PCT's and Threatened Ecological Communities at the development site

PCTs identified on the development site

Three PCTs were identified during the floristic surveys (Figure 6-2);

- 44 - Forb-rich Speargrass – Windmill Grass – White Top Grassland of the Riverina Bioregion
- 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- 74 – Yellow Box -River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion

Threatened species

The following ecosystem credit species were returned by the calculator as being associated with the PCTs present on the development site. These are assumed to occur and generate credits:

Table 6-3 Threatened species returned from the BCC as requiring survey

Ecosystem credit species	Vegetation type(s)	NSW Listing Status	National Listing Status
Major Mitchell's Cockatoo *Lophochroa leadbeateri*	PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	PCT 44 - Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
White-fronted Chat *Epthianura albifrons*	PCT 44 - Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Vulnerable	Not listed
Grey Falcon *Falco hypoleucos*	PCT 44 - Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Endangered	Not listed
White-bellied Sea-Eagle *Haliaeetus leucogaster*	PCT 44 - Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion PCT 26 – PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
Hooded Robin *Melanodryas cucullata cucullata*	PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
Scarlet Robin *Petroica boodang*	PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
Superb Parrot *Polytelis swainsonii*	PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Vulnerable
Grey Crowned Babbler *Pomatostomus temporalis temporalis*	PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Vulnerable	Not listed
Diamond Firetail *Stagonopleura guttata*	PCT 44 - Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion	Vulnerable	Not listed

Ecosystem credit species	Vegetation type(s)	NSW Listing Status	National Listing Status
	PCT 26 – PCT 26 – Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion		

No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits.

The BAM calculator predicted the following species credit species (Table 6-4) for the development site.

Table 6-4 Candidate species credit species requiring assessment

Species Credit Species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status
FAUNA				
Australian Bustard *Ardeotis australis*	Tussock and hummock grasslands, low shrublands and low open grassy woodlands; occasionally pastoral and cropping country, golf courses and near dams.	High	Endangered	Not listed
Major Mitchell's Cockatoo *Lophochroa leadbeateri* (Foraging)	Living or dead tree with hollows greater than 10 cm diameter	Moderate	Vulnerable	Not listed
Superb Parrot *Polytelis swainsonii* (Foraging)	Breeding habitat can be identified by the presence of habitat features and observed nest or two or more birds seen on site.	High	Vulnerable	Vulnerable
White-bellied Sea-eagle *Haliaeetus leucogaster* (Foraging)	Breeding habitat includes trees up to 30 m, rocks and high ground, where trees are not available.	High	Vulnerable	Not listed
Koala *Phascolarctos cinereus*	Areas identified via survey as important habitat. Important habitat defined by density of koalas and quality of habitat determined by on-site survey	Moderate	Vulnerable	Vulnerable
FLORA				
Mossgiel Daisy *Brachyscome papillosa*	Clay soils on Bladder Saltbush and Leafless Bluebush plains; also grassland and Inland grey Box – Cypress Pine woodland.	Moderate	Vulnerable	Vulnerable
Claypan Daisy *Brachyscome muelleroides*	Floodplains on grey-brown or red-brown clays and claypans	Very high	Vulnerable	Vulnerable
Bindweed *Convolvulus tedmoorei*	Grows on self-mulching grey clay. Thrives on soil flooded periodically	High	Endangered	Not listed

Species Credit Species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status
Small Scurf-pea *Cullen parvum*	Grassland, River Red Gum woodland or Box-Gum woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses, in areas with rainfall 450 – 700 mm.	High	Endangered	Not listed
Winged Peppercress *Lepidium monoplocoides*	Land containing seasonally damp or waterlogged sites	High	Endangered	Endangered
Lanky Buttons *Leptorhynchos orientalis*	Woodland or grassland, sometimes on margins of swamps. Communities include Bimble Box plain in red-brown soil, dense *Acacia pendula* woodland with herbaceous understorey on red clay to clay loam, open grassland areas on red soils, and red clay plains at edge of Canegrass Swamp.	High	Endangered	Not listed
Chariot Wheels *Maireana cheelii*	Heavy grey clay soils and claypans or shallow depressions.	Moderate	Vulnerable	Vulnerable
Austral Pillwort *Pilularia novae-hollandiae*	Strongly ephemeral - dependent on rain. Only found in drying mud. Presume seedbank based on similar species but unsure; dispersal assumed based on spores but no research to support.	High	Endangered	Not listed
Slender Darling Pea *Swainsona murrayana*	Clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Bladder Saltbush, Black Box and grassland communities on level plains, floodplains and depressions and often with *Maireana* species. Remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	High	Vulnerable	Vulnerable
Silky Swainson-pea *Swainsona sericea*	Natural Temperate Grassland and Snow Gum Woodland on the Monaro; Box-Gum Woodland in the Southern Tablelands and South West Slopes.	High	Vulnerable	Not listed

Two species were added to the Credit Calculator based on the presence of suitable habitat and nearby known records (Table 6-5). These species are the Sloane's Froglet and Southern Bell Frog.

Table 6-5 Additional candidate species included for assessment.

Species Credit Species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status
Sloane's Froglet *Crinia sloanei*	Periodically inundated areas in grassland, woodland, and disturbed habitats. Known in subregion.	Moderate	Vulnerable	Not listed
Southern Bell Frog *Litoria raniformis*	Requires habitat that contains water for at least four months for tadpole development.	Moderate	Endangered	Vulnerable

Three candidate species were excluded from the credit calculator based on the development site being outside their known range (Table 6-6).

Table 6-6 Candidate species excluded for assessment.

Species Credit Species	Habitat components and geographic limitations	Reason for exclusion	Sensitivity to gain class	NSW listing status	National listing status
A Spear-grass *Austrostipa wakoolica*	South of Murrumbidgee	Development site North of Murrumbidgee River	Moderate	Endangered	Endangered
Turnip Copperburr *Sclerolaena napiformis*	Hay Plain	Development site not within Hay Plain	Moderate	Endangered	Endangered
Red Darling Pea *Swainsona plagiotropis*	Hay Plain	Development site not within Hay Plain	High	Vulnerable	Not listed

6.2.4 Targeted surveys

Australian Bustard

SURVEY EFFORT

Grassland within the development area was surveyed during daytime hours on 24 and 25 October 2018, with an effort investment of 16-person hours, including transects along the entire grassland area at 10 m intervals. The same grassland was subject to two spotlight fauna transects at dusk on 10 August 2018 and 25 October. The weather during the survey period was fine and sunny with very little wind. The evening of 25 October was also clear with very little wind and a full moon.

SURVEY RESULTS

No indication of Bustard nesting or activity was observed.

Major Mitchell's Cockatoo

SURVEY EFFORT

A 20-minute targeted survey for this species was undertaken in the area of Yellow Box – River Red Gum Riverine woodland on 25 October 2018. Opportunistic surveys were undertaken over the four days the development site was surveyed. Potential nesting tree hollows were observed at dusk for a 20-minute period on 24 and 25 October 2018 to see if they were utilised by this species or other birds. The weather during the survey period was clear with little wind with a maximum daytime temperature in the mid-20^{o}C.

SURVEY RESULTS

No Major Mitchell's Cockatoos were observed during the four days the development area was surveyed. Only one tree within the development site contains hollows larger than 10 cm that are suitable for Major Mitchell's Cockatoo. No activity was observed around this tree. This tree is being avoided by the development and no mature trees would be removed by the proposal. Thus, it is unlikely any breeding Major Mitchell's Cockatoos would occur within the development site.

Superb Parrot

SURVEY EFFORT

A 20-minute targeted survey was undertaken in the area of Yellow Box – River Red Gum Riverine woodland on 25 October 2018. Opportunistic surveys were undertaken over the four days the development site was surveyed. Potential nesting tree hollows were observed at dusk for a 20-minute period on 24 and 25 October 2018 to see if they were utilised by this species or other birds. The weather during the survey period was clear with little wind with a maximum daytime temperature in the mid-20^{o}C.

SURVEY RESULTS

A flock of 10 Superb Parrots were observed flying over the development site on 9 August 2018. Only one tree within the development site contains hollows larger than 10cm that are suitable for Superb Parrot. No activity was observed around this tree. This hollow bearing tree is being avoided by the proposal. Thus, it is unlikely any breeding superb parrots would occur within the development site as the development site provides foraging habitat only.

White-bellied Sea-eagle

SURVEY EFFORT

Opportunistic surveys were undertaken over the four days the development site was surveyed. Tall trees within the development area were checked for stick nests on 24 and 25 October 2018. The weather during the survey period was clear with little wind with a maximum daytime temperature in the mid-20^{o}C.

SURVEY RESULTS

Two small stick nests were observed on 25 October 2018 in the Yellow Box – River Red Gum Woodland, one occupied by Australian Ravens (*Corvus coronoides*) and one by Australian Magpies (*Gymnorhina tibicen*). One White-bellied Sea-eagle was observed high in the sky, circling over grassland of the development site, on 10th August 2018. No large stick nests that could be used by a raptor were observed in the development site. Thus, it is unlikely any breeding White-bellied Sea-eagle occurs within the development site and the development site provides foraging habitat only.

Koala

SURVEY EFFORT

Eucalyptus trees within the development area were surveyed twice on 10 August 2018 and 25 October 2018 by checking around the base of each tree for scats and characteristic scratches. A total of 2 hours was spent surveying around the trees. The weather during the August survey was cold and overcast but fine. Weather during the October survey was clear, with a maximum in the mid-20^{o}C, with very little wind.

SURVEY RESULTS

There was no evidence observed that koalas were or have recently been within the development area.

Sloane's Froglet

SURVEY EFFORT

A survey for Sloane's Froglet was carried out over two mornings on 9 and 10 August 2018 consisting of frog call playback at three dams and four irrigation canals within the development area. Each session lasted 2.5 hours, for a total of 5 hours of survey effort comprising three separate points at each dam and 200 m transects along the canal. The weather on both days was sunny with no rain. Surveys were undertaken in accordance with the *Threatened species survey and assessment guidelines: field survey methods for Amphibians* (DECC, 2009) and Bionet Threatened Species Database (OEH, 2018).

SURVEY RESULTS

No Sloane's Froglets responded to the frog call playback at any of the locations surveyed. The Beeping Froglet (*Crinia parinsignifera*) was heard at various survey points and did respond to playback of their respective calls.

Southern Bell Frog

SURVEY EFFORT

A survey for the Southern Bell Frog was carried out over two nights on 24 and 24 October 2018 consisting of frog call playback at two dams (the third was dry) and four irrigation canals within the development area. Each session lasted 3.5 hours, for a total of 7 hours of survey effort comprising two separate points at each dam and 200 m transects along the canal. The weather on both nights was clear with no wind and a full moon. Surveys were undertaken in accordance with the *Threatened species survey and assessment guidelines: field survey methods for Amphibians* (DECC, 2009) and Bionet Threatened Species Database (OEH, 2018).

SURVEY RESULTS

No Southern Bell Frogs responded to the frog call playback at any of the locations surveyed. Other frog species such as the Beeping Froglet (*Crinia parinsignifera*), Spotted Marsh Frog (*Limnodynastes tasmaniensis*), Barking Frog (*Limnodynastes fletcheri*) and Peron's Tree Frog (*Litoria peronii*) were heard at various survey points and did respond to playback of their respective calls.

Flora:

Mossgiel Daisy (*Brachyscome papillosa*), Claypan Daisy (*Brachyscome muelleroides*), Bindweed (*Convolvulus tedmoorei*), Winged Peppercress (*Lepidium monoplocoides*), Lanky Buttons (*Leptorhynchos orientalis*), Chariot Wheels (*Maireana cheelii*) Austral Pillwort (*Pilularia novae-hollandiae*), Slender Darling Pea (*Swainsona murrayana*) & Silky Swainson-pea (*Swainsona sericea*).

SURVEY EFFORT

Suitable habitat for the threatened flora occurs in the Native Grassland (PCT 44) along Houghton's Road. This area was surveyed in the form of transects every 10 m over the entire grassland area. This is in accordance with the *NSW Guide to surveying Threatened Plants* (OEH, 2016). Areas of damp depressions were surveyed more intensely for Austral Pillwort. Five biometric plots were also undertaken in this area covering a thorough 20 m by 20 m area surveyed for flora. The surveys were undertaken over 24 and 25 October 2018, with an additional area on the Southern side of Houghtons Road surveyed on 26 November 2018.

SURVEY RESULTS

No candidate flora species were recorded during the survey. One convolvulus species was detected in abundance throughout the grassland. It was sent to the herbarium for confirmation and determined that *Convolvulus angustissimus*, which is a common and widespread species with no conservation status.

Flora: Small Scurf Pea (*Cullen parvum*)

SURVEY EFFORT

Suitable habitat for the threatened flora occurred in the Native Grassland (PCT 44) along Houghton's Road. The survey was undertaken over 24 and 25 October 2018, with an additional area on the southern side of Houghtons Road surveyed on 26 November 2018. Surveys were not undertaken during the optimal survey time between December and February when the species is flowering.

SURVEY RESULTS

This species was not surveyed during the targeted survey period and as such is assumed to occur on site. The area of impact is determined as the area of native grassland (PCT 44) that would be impacted.

6.2.5 Survey results

The species listed in

Table 6-7 are those that are considered to have habitats present at the development site. Targeted surveys were conducted for most of these species. One species, the Small Scurf-pea (*Cullen parvum*) was not surveyed during the appropriate survey periods and so was presumed to be present within areas of potential habitat for the purpose of this assessment.

The results from the surveys are summarised below in

Table 6-7. Details of the survey methods and results for each surveyed species are provided below. Where relevant, the methods for defining areas of potential habitat are also included.

Table 6-7 Summary of species credit species surveyed at the development site

Species Credit Species	Biodiversity risk weighting	Survey Period	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Fauna					
Australian Bustard *Ardeotis australis* (Breeding)	2.00	All Year	Surveyed Aug & Oct 2018	No	0
Major Mitchell's Cockatoo *Lophochroa leadbeateri* (Breeding)	2.00	Sept -Dec	Surveyed Oct 2018	No	0
Superb Parrot *Polytelis swainsonii* (Breeding)	2.00	Sept - Nov	Surveyed Oct 2018	Yes – however no breeding habitat present on site. Foraging habitat only	0
White-bellied Sea-eagle *Haliaeetus leucogaster* (Breeding)	2.00	July - Dec	Surveyed Aug & Oct 2018	Yes – however no breeding habitat present on site. Foraging habitat only	0
Koala *Phascolarctos cinereus* (Breeding)	2.00	All year	Surveyed Aug & Oct 2018	No	0
Sloane's Froglet *Crinia sloanei*	1.50	July - Aug	Surveyed Aug 2018	No	0
Southern Bell Frog *Litoria raniformis*	2.00	Oct - Jan	Surveyed Oct 2018	No	0
Flora					
Mossgiel Daisy *Brachyscome papillosa*	2.00	Sept - Nov	Surveyed Oct & Nov 2018	No	0
Claypan Daisy *Brachyscome muelleroides*	3.00	Sept - Nov	Surveyed Oct & Nov 2018	No	0
Bindweed *Convolvulus tedmoorei*	2.00	Aug - Nov	Surveyed Oct & Nov 2018	No	0
Small Scurf-pea *Cullen parvum*	2.00	Dec - Feb	Not surveyed for during survey period	Assumed Present	0.54 ha
Winged Peppercress *Lepidium monoplocoides*	2.00	Nov - Feb	Surveyed Oct & Nov 2018	No	0
Lanky Buttons *Leptorhynchos orientalis*	2.00	Sept - Nov	Surveyed Oct & Nov 2018	No	0
Chariot Wheels *Maireana cheelii*	2.00	Sept - Feb	Surveyed Oct & Nov 2018	No	0

Species Credit Species	Biodiversity risk weighting	Survey Period	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Austral Pillwort *Pilularia novae-hollandiae*	3.00	All year	Surveyed Oct & Nov 2018	No	0
Slender Darling Pea *Swainsona murrayana*	2.00	Sept - Feb	Surveyed Oct & Nov 2018	No	0
Silky Swainson-pea *Swainsona sericea*	2.00	Sept - Feb	Surveyed Oct & Nov 2018	No	0

6.2.6 Potential impacts

Direct impacts

The construction and operational phases of the proposal have the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure.

Table 6-8 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	0.54 ha	Regular	Construction	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Displacement of resident fauna	Unknown	Regular	Construction, operation	• Direct loss of native fauna • Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction	• Direct loss of native fauna • Decline in local fauna populations
Removal of habitat features e.g. HBTs	0.54 ha	Regular	Construction	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	143 ha (70% of solar array)	Regular	Operation, long-term	• Modification of native fauna habitat • Potential loss of groundcover resulting in unstable ground surfaces and sedimentation of adjacent waterways

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Existence of permanent solar infrastructure	204 ha	Regular	Operation, long-term	• Modification of habitat beneath array (mostly exotic) • Reduced fauna movements across landscape due to fencing • Collision risks of fencing to birds and microbats

Changes in vegetation integrity scores

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 6-9 below.

Table 6-9 Table of current and future vegetation integrity scores for each vegetation zone within the development site.

Zone ID	PCT	EEC and/or threatened species habitat?	Area (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
1	44	No	0.49	36.4	0
2	26	Myall Woodlands in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes EEC	0.05	86.5	0

Loss of species credit species habitat or individuals

The loss of species credit species habitat or individuals as a result of clearing is documented in Table 6-10 below.

Table 6-10 Summary of species credit species loss at the development site.

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost
Small Scurf Pea *Cullen parvum*	2.00	0.54 ha

Loss of hollow-bearing trees

Six Hollow-bearing Trees (HBTs) were recorded within the development site. All HBTS have been avoided by the development and no HBTS would need to be removed.

Indirect impacts

Indirect impacts of the proposal include soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise. Table 6-11 below details the type, frequency, intensity, duration and consequence of the direct and indirect impacts of the proposal.

Given the current condition of the site, the following indirect impacts are unlikely to occur or be exacerbated as a result of the development:

- Inhibition of nitrogen fixation and increased soil salinity.
- Wood collection.

- Bush rock removal and disturbance.
- Increase in predatory species populations.
- Increase in pest animal populations.
- Increased risk of fire.
- Loss of breeding habitat.
- Disturbance to specialist breeding and foraging habitat.
- Reduced viability of adjacent habitat due to edge effects.
- Reduced viability of adjacent habitats due to noise, dust or light spill.
- Increased risk of starvation, exposure and loss of shade or shelter.

Table 6-11 Potential impacts to biodiversity during the construction and operation phases.

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Short-term	• Myall Woodland TEC	• Direct loss of native flora and fauna habitat • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock • Increased edge effects
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operation Long-term	• Myall Woodland TEC	• Degradation of Myall Woodland TEC • Loss of native flora and fauna habitat
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operation Short-term	• Superb Parrot	• May alter fauna activities and/or movements • Loss of foraging or breeding habitat • Inhibit the function of plant species, soils and dams
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction /operation Long-term	• Myall Woodland TEC	• Degradation of Myall Woodland TEC • Weed establishment and spread
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction /operation Long-term	• Superb Parrot	• Loss of foraging habitat
Loss of breeding habitats	None	Constant	Construction Long-term	• Superb Parrot	• Loss of potential breeding habitat • Potential decline in bioregional population
Earthworks and mobilisation of sediments	Unknown	Regular	Construction	• Myall Woodland TEC	• Erosion and sedimentation and/or pollution of soils, dams and downstream habitats
Trampling of threatened flora species	Unknown	Unknown	Construction	• Small Scurf Pea	• Loss of native flora habitat

Prescribed impacts

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts of development on the habitat of threatened species or ecological communities associated with human made structures, or 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 movement of threatened species that maintains their life cycle
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Impacts to matters of national environmental significance

One EPBC-listed species was recorded during the field surveys, Superb Parrots seen flying above the canopy in the south of the development site (transmission line route). Habitat for this species in the development site is primarily limited to isolated hollow-bearing paddock trees, which provide low-quality foraging, shelter, and nesting habitat.

Seven threatened fauna species and five migratory birds identified in the EPBC Protected Matters Search Tool report are considered to have the potential to occur in the development site.

EPBC Assessments of Significance were completed for each of these species. These concluded that a significant impact was unlikely, on the basis that the proposal would not:

- Lead to a reduction of the size or area of occupancy of a population, or fragment or disrupt the breeding cycle of a population
- Affect habitat critical to the survival of any species
- Introduce invasive species harmful to any species
- Introduce disease that would cause any species to decline
- Interfere with the recovery of these species

A referral to the federal Department of Environment and Energy is not considered necessary.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. Habitat within the study area is not considered to be critical to the survival of the Koala and an assessment of significant impact according to the EPBC Act significant impact criteria is not required.

6.2.7 Impacts Requiring Offsets

Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community; or
b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community; or
c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 6-12.

Table 6-12 PCTs and vegetation zones that require offsets.

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
1	44	Forb-rich Speargrass – Windmill Grass - White Top grassland of the Riverina Bioregion.	0.49	36.4	9
2	26	Weeping Myall Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion.	0.05	86.5	2

Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 6-13.

Table 6-13 Species credit species that require offsets.

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Small scurf Pea *Cullen parvum*	2.00	0.54 ha	11

Offsets required under the EPBC Act

No species listed in the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

6.2.8 Safeguards and mitigation measures

Table 6-14 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
BD1	The following plans are to be prepared and approved by the relevant authorities: • Biodiversity Management Plan. • Construction Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. The plans should include but not be limited to the relevant commitments below.	**Pre-construction**		
BD2	Timing works to avoid critical life cycle events such as breeding or nursing: • Dams would be removed in winter to avoid impacts on wetland birds, with Latham's Snipe and Wood Sandpiper are outside Australia, and outside the summer breeding season for Australasian Bittern	**C**		
BD3	Implement clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events, including:	**C**		

No.	Safeguards and mitigation measures	C	O	D
	• Pre-clearing checklist. • Tree clearing procedure.			
BD4	Relocation of habitat features (fallen timber, hollow logs) from within the development site. Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	**Pre - construction**		
BD5	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed: • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.	**C**		
BD6	Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise. Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works.	**C**	**O**	**D**
BD7	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill: • Avoid Night Works. • Direct lights away from vegetation.	**C**	**O**	**D**
BD8	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operation activities. • Construction would cease if dust observed being blown from site until control measures were implemented. • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	**C**		**D**
BD9	Temporary fencing to protect significant environmental features such as riparian zones.	**C**		**D**
BD10	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Pest and Weed Management Plan	**C**	**O**	
BD11	Staff training and site briefing to communicate environmental features to be protected and measures to be implemented: • Site induction. • Toolbox talks. • Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	**C**	**O**	

No.	Safeguards and mitigation measures	C	O	D
BD12	Preparation of a vegetation management plan to regulate activity in vegetation: • Protection of native vegetation to be retained. • Best practice removal and disposal of vegetation. • Staged removal of habitat features such as fallen logs with attendance by an ecologist. • Weed management. • Unexpected threatened species finds. • Rehabilitation of disturbed areas.	**C**		
BD13	Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment: • An erosion and sediment control plan would be prepared in conjunction with the final design and implemented. • Spill management procedures would be implemented.	**C**		
BD14	Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation.	**Design Stage**		

6.3 VISUAL IMPACT

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

Visual –

Including 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.

ROADS AND MARITIME SERVICES

Given the type and scale of the proposed development and its proximity to the public road network it is considered appropriate that the issues relating to potential distraction of, and for glint/glare impacts on passing motorists be addressed in the development submission. Consideration could be given to the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.

Xurban completed a Landscape & Visual Assessment (LVA) of the proposal, in compliance with the SEARs. This report assesses the visual impact implications of the proposal on viewers using the local road network and from residential properties, and the appropriateness of the proposed solar farm within the current landscape setting. The VIA also includes a Landscape Strategy to address identified impacts, including onsite vegetation screening and general design measures.

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

6.3.1 Approach

The VIA has been completed in the following stages:

Viewshed

Defining the viewshed of the solar farm and the parameters of human vision. The viewshed is the study area for this visual assessment.

Planning background

The statutory planning background looks at the areas within the viewshed to determine if there are planning restraints or highlighted areas that would be visually sensitive.

Landscape units and sensitivity

Landscape Units are based on the physical characteristics of the area within the viewshed. The characteristics that assist in defining the landscape units include geology, vegetation, topography and drainage patterns, as well as the extent of man-made modifications and urban development. The landscape sensitivity of each landscape unit is the degree to which the particular landscape can undergo further change. Generally, the greater the extent of man-made modifications, the lesser its sensitivity to change.

Seen area analysis

The existing topography of the solar farm and the surrounding landscape is one that is very flat and therefore apart from the shielding afforded by the levees containing the major irrigation canals, there is little in the way of topographical relief which would restrict views to the solar farm from the surrounding landscape. Therefore, a Seen Area Analysis has not been prepared for this project.

Viewpoint assessment

The assessment of the potential visual impact is undertaken from indicative viewpoints within the domain and from residential properties.

1. *Public domain viewpoints:*

In assessing the visual impact of a solar farm from the public domain, the assessment of visual impact is undertaken from a range of publicly accessible viewpoints and is based on four criteria:

- Visibility: the visibility of the proposed solar farm can be affected by intervening topography, vegetation and buildings.
- Distance: the distance of the viewer from the proposed nearest component of the solar farm. The level of visual impact decreases as distance increases.
- Landscape character and viewer sensitivity: the character of the surrounding landscape, both around the site and adjacent to the viewing location, must be considered. Generally, a man-modified landscape is considered to be of lower sensitivity, and a pristine landscape is considered highly sensitive. A residential townscape would be given a higher sensitivity rating than an industrial landscape.
- Number of viewers: the level of visual impact decreases where there are fewer people able to view the proposed solar farm. Conversely, the level of visual impact increases where views are from a recognised vantage point. Viewer numbers from a recognised vantage point would be rated as high.

These four criteria need to be considered in the assessment of visual impact.

2. *Private domain viewpoints:*

The assessment of visual impact from residential properties is slightly different to one undertaken from publicly assessable viewpoints. An assessment of viewer numbers is not relevant, and the landscape sensitivity is always rated as high, as it must be recognised that people feel most strongly about the view from their house and from their outdoor living spaces. Furthermore, occupants of residential properties are regularly observing from their house, whereas persons viewings the proposed solar farm from publicly accessible viewpoints are typically only at those points for comparatively short periods of time.

The visibility of the solar farm and the distance between the residential location and the solar farm are the two criteria that vary within an assessment of the visual impact from a residential property. Viewer sensitivity is always rated as high.

The same scale of effects is used for both the assessment of the visual impact from publicly accessible viewpoints and from residential locations.

The scale of effects, for rating the overall visual impact of the solar farm from publicly accessible and residential viewpoints, ranges from no impact (Nil) to a potentially positive visual impact. Negative visual impacts are graded from negligible to high.

Nil*:* there would be no perceptible visual change.

Positive*:* would be a visual change that improves the outlook or view.

Negligible*:* minute levels of effect that are barely discernible over ordinary day-to-day effects. The assessment of a negligible level of visual impact is usually based on distance. That is, the solar farm would either be at such a distance that, when visible in good weather, the solar farm would be a minute element

in the view within a man-modified landscape or it would be predominantly screened by intervening topography and vegetation.

Low: visual impacts that are noticeable but that will not cause any significant adverse impacts. The assessment of a "low" level of visual impact would be derived if the rating of any one of four criteria, that is visibility, distance, viewer numbers and landscape sensitivity, is assessed as low.
Therefore, a solar farm in a landscape which is man-modified, and which already contains many buildings or other structures, may be rated as a low level of visual impact. Similarly, if the distance from which it is viewed means that its scale is similar to other elements in the landscape it would also be assessed as a low level of visual impact.

Medium: visual impact occurs when significant effects may be able to be mitigated/remedied. The assessment of a medium visual impact will depend upon all four assessment criteria being assessed as higher than low.

High or unacceptable adverse effect: extensive adverse effects that cannot be avoided, remedied or mitigated. The assessment of a high or unacceptable adverse effect from a publicly accessible viewpoint requires the assessment of all four factors to be high. For example, a highly sensitive landscape, viewed by many people, with the solar farm in close proximity and views that were unable to be screened or filtered would lead to an assessment of an unacceptable adverse effect.

Photomontages

Photomontages can assist in the assessment of individual viewpoints by illustrating the scale of the solar farm and particularly the solar panels in the existing landscape.

The model does not take into account screening such as vegetation or infrastructure. On this basis it is considered a 'worst case' model.

The photomontages show the changes in a 60° horizontal field of view. This horizontal field of view represents the central cone of view in which symbol recognition and colour discrimination can occur. The vertical field of view is between 10° - 15°.
The photomontages appended to this report are shown with a 60° field of view. Panoramas are included to show the full extent of the solar farm and the entire wireframe image that was the basis of the photomontages.

6.3.2 Subject land

The subject land is in three sections. Two sections of the proposed solar farm are on the east and west side of Toorak Road and the third section lies between the rail line / Houghtons Road and Research Road south of Toorak Road. Figure 1-2 shows the location of the subject land and three sections of the proposal area, as well as the surrounding road network.

The subject land for the LVA is an approximately 180.7 ha allotment on multiple titles. The allotments surrounding the subject site are rural properties of differing sizes, and the north-east corner of the site is close to residential areas of Leeton.

The proposed solar module array layout on which the landscape and visual assessment is based is shown in Figure 1-3.

The solar panels are in linear banks which would generally run north-south, except those in the southern section would run north-east to south-west.

The solar panels, which formed the basis for a photomontage model, were the NX Horizon Self-Powered Tracker. The solar panels that would be used in the proposal would be a maximum of 2.2 m above the ground line. This is rounded up to a height of 2.5 m for the purposes of modelling.

6.3.3 Viewshed

The area that may potentially be visually affected by the development is called the viewshed. The viewshed is not the same as the extent of visibility, as it may be possible to see components of the solar farm from areas outside the viewshed. Rather, the viewshed is the area from which there could be a visual impact.

Yanco and the surrounding rural area in which the solar farm is proposed to be located is a landscape that includes many man-made elements. In this type of landscape, the viewshed is defined by a distance at which the largest elements of the solar farm (the solar panels) would be an insignificant or negligible element in a viewer's field of view.

The viewshed for the solar farm is based on a distance at which a 2.5 m vertical solar panel takes up just 0.5° of the vertical field of view. At a distance of 300 m, a 2.5 m solar panel would take up less than 0.5° of the vertical field of view. Therefore, a distance of 300 m is used to define the edge of the viewshed or study area for this visual assessment.

6.3.4 Zones of Visual Impact

Within a viewshed, differing zones of visual impact can be determined based on the distance of the viewer to the solar panels. For example, the visual impact of the solar farm at 300 m is less than the visual impact of the solar farm seen from a distance of 25 m, as the apparent height and scale of the solar farm changes as a person moves nearer or further away.

For the purposes of assessing the effect of distance, the zones of visual impact are defined and graphically shown in Figure 6-3.

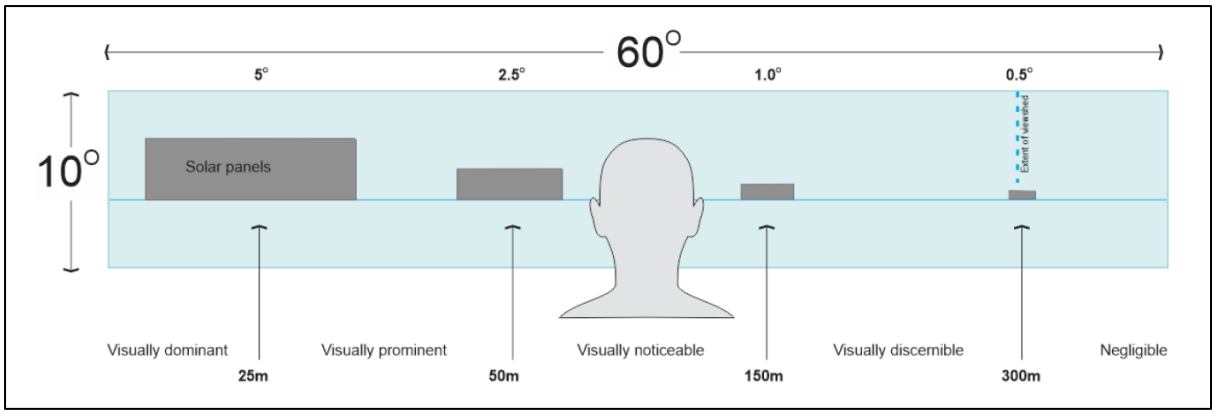


Figure 6-3 Diminution of visual impact based on distance.

Table 6-156-16 shows the zones of visual influence based on the proportion to which a 2.5 m high solar panel is apparent within the vertical field of view.

Table 6-156-16 Zone of Visual Influence

Distance from observer	Visual impact
> 300 m	The extent of the viewshed would occur when the visual impact is negligible. At a distance greater than 300 m, a 2.5 m high solar panel is no longer an easily recognisable element in a man-modified landscape. This 300m distance is adopted as the edge of the viewshed.
150 – 300 m	In the band between 150 – 300 m the solar panels would be discernible in most lighting conditions. At the outer edge of this range, in all but exceptionally clear lighting conditions, the solar panels would become increasingly imperceptible.
50 – 150 m	Visually noticeable visual impact would occur between the range of 50 - 150 m where the solar panels would be visible in the landscape in most lighting conditions. Landscape between the viewer and the solar farm can reduce visual impact.
25 – 50 m	Visually prominent visual impact occurs at distances between 25 – 50 m where the solar panels are visually prominent in the landscape.
< 25 m	Visually dominant visual impact would occur when a viewer is 25 m or less from the solar panels. The component of the solar farm visible at this distance would be dominant. Vegetation can be effective as a screen, and must be at least as high as the solar panels.

6.3.5 Existing environment

Topography

The subject site and the surrounding landscape is very flat. Google Earth gives levels of between 237 m AHD and 239 m AHD across the entire subject site. The area with the viewshed (300 m from the edge of the solar farm) is of similar elevation. Minor topographical relief is given by the levee bank which runs along the eastern side of the subject site. This levee bank is around 1 – 1.5 m above the surrounding plain.

Land use and vegetation

The subject site and surrounding area within 300 m of the solar farm (the viewshed) is rural farmland with associated residential properties, and a small area of residential land which is located within 300 m of the subject site in the north-east corner.

There is limited native vegetation on the subject site, as most of the land has been cleared for farming of grapes and oranges. Orange groves and planted grape vines are the dominant species visible around the subject site. A strip of she-oak (*Allocasuarina* sp.) has been established along the boundary of the south-western section of the subject site. There are also plantings of eucalypts and she-oaks, including hedgerows and individual trees. Such hedgerow planting is rare in areas within or surrounding the subject site.

Sensitivity

The sensitivity of the rural areas would be assessed as low as these are areas which regularly undergo change. Whether the land is tilled, or crops are altered from year to year. Grapes can be removed and replaced with oranges or pasture. These areas undergo regular change.

The residential areas are considered to have a high degree of sensitivity, as these are people's homes and they are sensitive to changes in the views that they see every day.

6.3.6 Proposed landscaping

Species were selected on the advice of a local grower of indigenous species and vetted by the NGH Environmental ecologists.

The plants that would be used in the proposed landscape buffer planting and heights that would be anticipated in five to ten years are listed below.

Botanical name	Common name	Height (m)
Acacia decora	Western Global-wattle	2 – 4
Acacia oswaldii	Umbrella Wattle	3 – 5
Allocasuarina cristata	Belah	5 – 10
Allocasuarina luehmannii	Bulloke	5 – 10
Callitris glaucophylla	White Cypress-pine	5 – 10
Eucalyptus melliodora	Yellow Box	5 – 10
Eucalyptus populnea	Brimble Box	5 – 10

It is recognised that this is a harsh environment for growing trees and these heights are much below the eventual mature heights that these species can grow to.

However, the heights that have been used in the photomontages, which are discussed later in this report, show a range of random heights of the proposed vegetation between 4 and 6 m in height with the occasional Eucalypt being modelled at 7 m in height.

This is much less than the heights obtained by She-oaks on site and provides a conservative basis for the imagery. However, it is stressed that given the flat topography and the lack of elevated viewing locations, the proposed landscaping only needs to reach a height that is slightly higher than the proposed solar panels (around 3 m in height) for the vegetation to be effective as a screen or visual buffer.

The proposed vegetation is also planted in three rows within the 10 m buffer planting zone and the plants in each row are planted at 2 m centres.

This means that there is a high degree of redundancy within the planting design which allows for plant losses. Plant losses are also minimised by the fencing around the planted areas which prevents losses from grazing. Rabbit guards are also specified as part of the initial planting.

The location of the proposed planting buffer is shown in Figure 6-4, on the northern, western, and southern sides of the proposed solar farm.

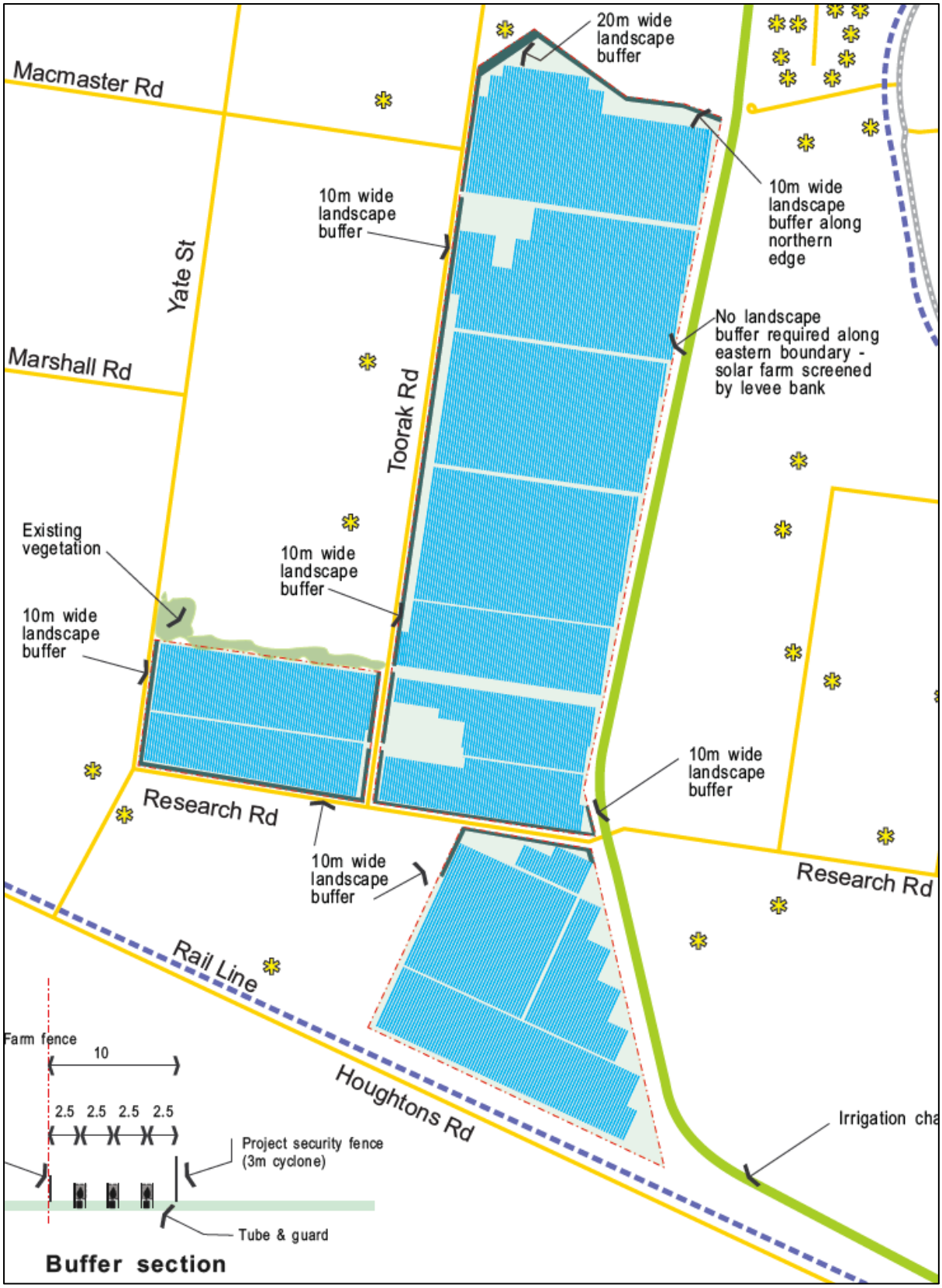


Figure 6-4 Proposed planting.

6.3.7 Results

The visual assessment is partly based on the impact and visual change at a number of selected locations. Figure 6-5 shows the location of the twenty viewpoints selected that demonstrate a range of views to the solar farm.

Figure 6-5 Location of representative viewpoints (Map source: Google Earth Pro).

These viewpoint locations were selected to show the visual impact generally from locations close to the solar farm. The viewshed of the solar farm is around 300 m as the solar panels would be 2.2 m high. Apart from needing to be in relatively close proximity, viewpoints were also selected that would indicate the level of visual impact from nearby residential properties, either on adjoining farms or within the residential areas of Leeton and Yanco.

Table 6-176-18 Visual impact at representative viewpoints with reference to the proposed solar farm at Yanco.

VIEWPOINT 1 – 50 Maxwell Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from the driveway of a residence (R13) around 420 m east of the solar farm's eastern border. The viewpoint is taken from the entry gate as there are no views from the house and yard. At this distance and given the presence of the intervening irrigation canal bund, there would be no views from this location to the solar farm. For these reasons, the visual impact from VP1 would be assessed as **Nil**. **No mitigation required.**
Proximity	420 m	
VIEWPOINT 2 – Gladman Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from around 540 m to the east of the proposed solar farm, facing west towards the proposed solar farm (R16). This location shows the existing canal and an orange grove between the roadside edge and the solar farm. The view to the solar farm would be completely screened by existing planting. For these reasons, immediately after construction the visual impact from VP2 would be assessed as **Nil**. **No mitigation required.**
Proximity	540 m	
VIEWPOINT 3 – 215 Research Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from a road easement south of Research Road which provides access to a rural property and associated residence (R19). VP3 is around 430 m east of the edge of the solar farm. The existing house adjacent to VP3 is orientated to the north, while the closest edge of the solar farm is to the east. A minor embankment which runs along the edge of an irrigation canal would screen views to the solar panels further to the east. The proposed solar farm would not be visible from VP3, although from locations further to the east, in front of the house, the solar panels may just be visible. For these reasons, the overall visual impact from VP3 would be assessed as **Negligible**. **No mitigation required.**
Proximity	430 m	
VIEWPOINT 4 – Research Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	

Proximity	60 m	Taken towards the west from where Research Road crosses a low bridge over a major irrigation canal immediately to the east of the proposed solar farm, at a distance of around 60 m. There is a slight rise at the bridge which would allow views to the solar farm. This landscape already contains visible infrastructure, including the bridge and associated canal engineering as well as power lines and a shed in the foreground. For these reasons, the overall visual impact from VP4 would be assessed as **Low**, immediately after construction. Landscaping is proposed along both sides of Research Road and returning north and south along the eastern boundaries. Once this landscaping was established, the overall visual impact would reduce to **Negligible to Nil**. **Mitigation required.**
VIEWPOINT 5 – Amato Road at end of Maxwell Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from the corner of Amato Road and Maxwell Road, which is an unmade road easement. VP5 is around 85 m from the eastern boundary of the proposed solar farm. This viewpoint looks towards the east. The existing irrigation canal and its associated bunds would be between the solar farm and this viewpoint. The upper sections of the solar panels may be just visible. However, this is a little used road with few viewers. For these reasons, the overall visual impact from VP5 would be assessed as **Negligible**. **No mitigation required.**
Proximity	85 m	
VIEWPOINT 6 – Amato Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Amato Road close to a residential area in Yanco. These residential properties lie to the east and are on the closest residentially-zoned land adjacent to the solar farm. These residential properties are on large allotments and typically have screen planting along their rear boundary which would screen views to the solar farm if it was possible for the solar farm or solar panels to be seen. The area on the opposite side of the irrigation canal is the proposed site of the solar farm. No sections of the solar panels would be visible from the location. The visual impact from VP6 would be assessed as **Nil**. **No mitigation required.**
Proximity	-	
VIEWPOINT 7 – McQuillan Road and Back Yanco Road intersection		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	

Proximity	500 m	Taken from the slight rise as McQuillan Road crosses the railway line, which runs parallel to the Back Yanco Road. This viewpoint is around 500 m east of the solar farm. McQuillan Road is an unsealed road providing access to rural properties to the west of the railway line. The solar panels would either not be visible at all in the distance, or at most be just discernible. Therefore, the visual impact from VP7 would be assessed as **Negligible to Nil**. **No mitigation required.**
VIEWPOINT 8 – 269 Toorak Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from the rear fence of a residence on Toorak Road (R07), adjacent to the northern boundary of the solar farm. The viewpoint is around 30 m north of the proposed solar farm. The house is oriented towards the north, and there are few locations from within the southern edge of the property that would have a view of the proposed solar farm. From this location, the view is across a minor irrigation canal to the existing grape vines on the subject site. The solar panels will be visible, and while they are similar in scale to the grape vines, they are a different element in the landscape, and are visible from a few locations in the residential property to the north. The proposed vegetation buffer would screen all views to the solar farm from VP8. For these reasons, the level of visual impact from VP8 is assessed as **Medium** immediately following construction, but this would reduce to **Negligible** or even **Positive** once vegetation establishes along the edge of the irrigation canal. **Mitigation required.**
Proximity	30 m	
VIEWPOINT 9 – Toorak Road, driveway to House HO5		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from the driveway entry to House R05 in Toorak Road, approximately 20 m east of the proposed solar farm. The house on the property is well set back from the road and has a well-established garden which would potentially screen views to the proposed solar farm. The solar panels would be visible from the gate, however the house is some distance from the solar farm and, although visible immediately after construction from the gate, the visual impact would be more significant if the house was at this location, closer to the solar farm. However, as the house is some distance from the solar farm, the visual impact from the gate immediately after construction would be assessed as **Low**. Once planting was established along the Toorak Road frontage, the level of visual impact from VP9 would reduce to **Negligible** or even **Positive**. **Mitigation required.**
Proximity	20 m	
VIEWPOINT 10 – Toorak Road, driveway to House R04		
Summary of Viewpoint		Viewpoint Description / Impact

Land use type	Residential	Taken from the driveway entry to House R04 in Toorak Road, approximately 20 m east of the proposed solar farm. The house on the property is well set back from the road. The solar panels would be visible from the gate, however this is some distance from the house and, although visible immediately after construction from the gate, the visual impact would be more significant if the house was at this location, closer to the solar farm. However, as the house is some distance from the solar farm, the visual impact from the gate immediately after construction would be assessed as **Low**. Once planting was established along the Toorak Road frontage, the level of visual impact from VP10 would reduce to **Negligible** or even **Positive**. **Mitigation required.**
Proximity	20 m	
VIEWPOINT 11 – 285 Toorak Road, House R08 and R09		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from adjacent to House R09 which, although accessed from Toorak Road, around 440 m east of Toorak Road. The viewpoint is around 340 m north of the proposed solar farm. The house is orientated towards the north and sits within a well-established orange grove. This orange grove screens views to the solar farm, although very narrow view lines may be possible along the access tracks between the orange rows. The solar panels may be just visible down these access laneways. Therefore the visual impact from VP11 would be assessed as **Negligible**. **No mitigation required.**
Proximity	340 m	
VIEWPOINT 12 – Houghtons Road, opposite substation		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Houghtons Road opposite an existing substation, around 1 km east of the solar farm. This substation would be connected to the proposed solar farm and would cross Houghtons Road further to the west. The solar panels would not be visible as they would be screened by vegetation and an earthworks embankment on the north side of Houghtons Road. Therefore, the visual impact from VP12 would be assessed as **Nil**. **No mitigation required.**
Proximity	1 km	
VIEWPOINT 13 – Houghtons Road, at power line crossover		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Houghtons Road at the location where the proposed power line would cross Houghtons Road to connect to the substation, around 170 m east of the proposed solar farm.

Proximity	170 m	Existing powerline infrastructure is visible, and the solar panels would not be visible as they would be screened by vegetation and an earthworks embankment on the north side of Houghtons Road. Therefore, the visual impact from VP13 would be assessed as **Negligible to Nil**. **No mitigation required.**
VIEWPOINT 14 – Houghtons Road, opposite the subject site		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Houghtons Road directly opposite the subject site, around 80 m south of the proposed solar farm. Existing powerline infrastructure is visible, but the solar panels would not be visible as they would be screened by an earthworks embankment on the north side of Houghtons Road. This embankment screens the lower section of the orange groves which are established on the north side of the rail line. Therefore, the visual impact from VP14 would be assessed as **Nil**. **No mitigation required.**
Proximity	80 m	
VIEWPOINT 15 – 649 Ronfeldt Road, House R01		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Residential	Taken from the rear yard of a residence that is accessed from Ronfeldt Road. This viewpoint is around 320 m west of the southern section of the proposed solar farm and 400 m south of the northern section's location north of Research Road. The existing house is orientated towards the east, with a pathway leading from the house to the eastern paddocks and sheds. The viewpoint is located at the end of this path looking east to the closest solar panels. The existing view is broken by many elements in the foreground including power lines and tanks. However, at a distance of 320 m, the proposed solar panels are at the edge of the viewshed and they would be difficult to discern. The colour change brought about by the solar panels is only discernible on close examination of the photomontage. The landscaping, as it is higher than the solar panels, is more evident. Overall, the visual impact from VP15 would be assessed as **Negligible**, which would reduce to **Nil** once the vegetation was established to a height greater than the solar panels. **Mitigation required.**
Proximity	320 m	
VIEWPOINT 16 – Intersection of Yate Road and Research Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from the intersection of Yate Road and Research Road, directly opposite the south-western corner of the solar farm, between R02 and R03. This viewpoint is around 60 m south-west of the nearest corner of the solar farm.

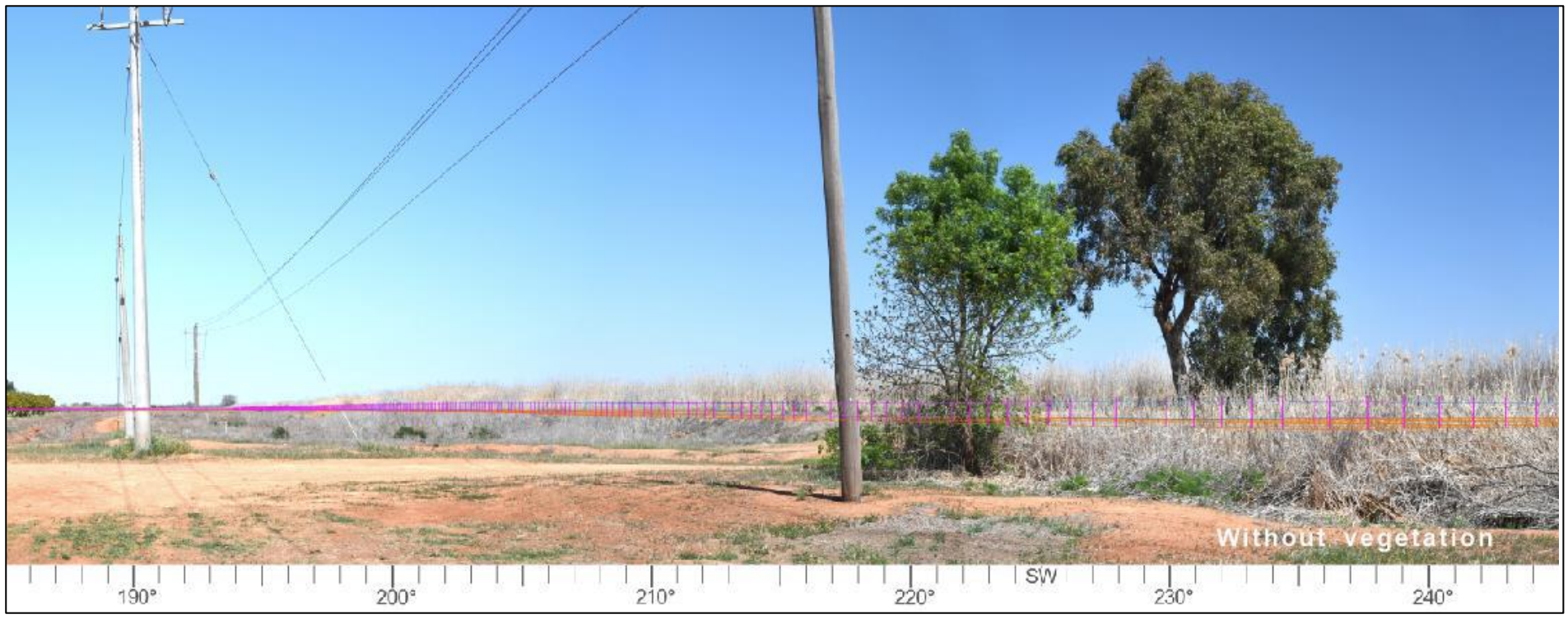
Proximity	60 m	Research Road is visible turning right, parallel to the irrigation canal. Existing powerline infrastructure is visible, and the solar panels will be visible as they will replace the orange grove at the intersection. This location has few viewers; however, buffer planting is proposed along both road frontages. Therefore, the visual impact from VP16 immediately after construction would be assessed as **Low**, and once the vegetation established, the visual impact would reduce to **Nil**. **Mitigation required.**
VIEWPOINT 17 – Yate Road		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Yate Road, north from VP16, where the road is a "Dry weather access only" road. This viewpoint is around 210 m north of the proposed solar farm. This location has few viewers, and the existing planting to the south will screen views to the proposed solar farm. Therefore, the visual impact from VP17 would be assessed as **Negligible**. **No mitigation required.**
Proximity	210 m	
VIEWPOINT 18 – Toorak Road and Macmaster Road intersection		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Toorak Road at the intersection with Macmaster Road, around 50 m west of the solar farm. This viewpoint is a similar distance to the entry driveway viewpoints discussed in VP9 and VP10, but in this case the viewpoint is from the public domain. House R06 is some further 250m further west of VP18. This location has few viewers using Macmaster Road, and the grape vine planting to the east is similar in height to the proposed solar panels. For these reasons, the visual impact from VP18 would be assessed as **Low** immediately after construction, and this would reduce to **Nil** or **Positive**, once the planting proposed along Toorak Road reached a height greater than the 2.2 m high solar panels. **Mitigation required.**
Proximity	50 m	
VIEWPOINT 19 – Rourke Road and Houghton Road intersection		
Summary of Viewpoint		Viewpoint Description / Impact
Land use type	Rural	Taken from Rourke Road south of the intersection with Houghton Road near the entry to the Yanco Agricultural Institute, Leeton Field Station. This viewpoint is around 970 m south-west of the solar farm. The orange groves to the north of the viewpoint are not visible. Therefore, the solar panels would also not be visible, and the visual impact from VP19 would be assessed as **Nil**. **No mitigation required.**
Proximity	970 m	
VIEWPOINT 20 – Toorak Road		
Summary of Viewpoint		Viewpoint Description / Impact

Land use type	Rural	Taken from Toorak Road on a slightly elevated bridge as Toorak Road crosses an irrigation canal. This viewpoint is around 30 m from the proposed solar panels to the east and the south-west. The proposed solar farm would replace the existing grape vines and orange groves in the area. A band of orange trees could be retained in lieu of the proposed landscaping. However, this assessment has been based on the provision of the 10 m landscape strip as shown on the accompanying Landscape Plan. The solar panels would be visible and the visual impact from VP20 would be assessed as **Low** immediately after construction and **Nil** to **Positive** once the landscaping was established to a height greater than the solar panels. **Mitigation required.**
Proximity	30 m	

Table 6-196-20 Photomontages of representative viewpoints

PHOTOMONTAGE 1 (VIEWPOINT 6)

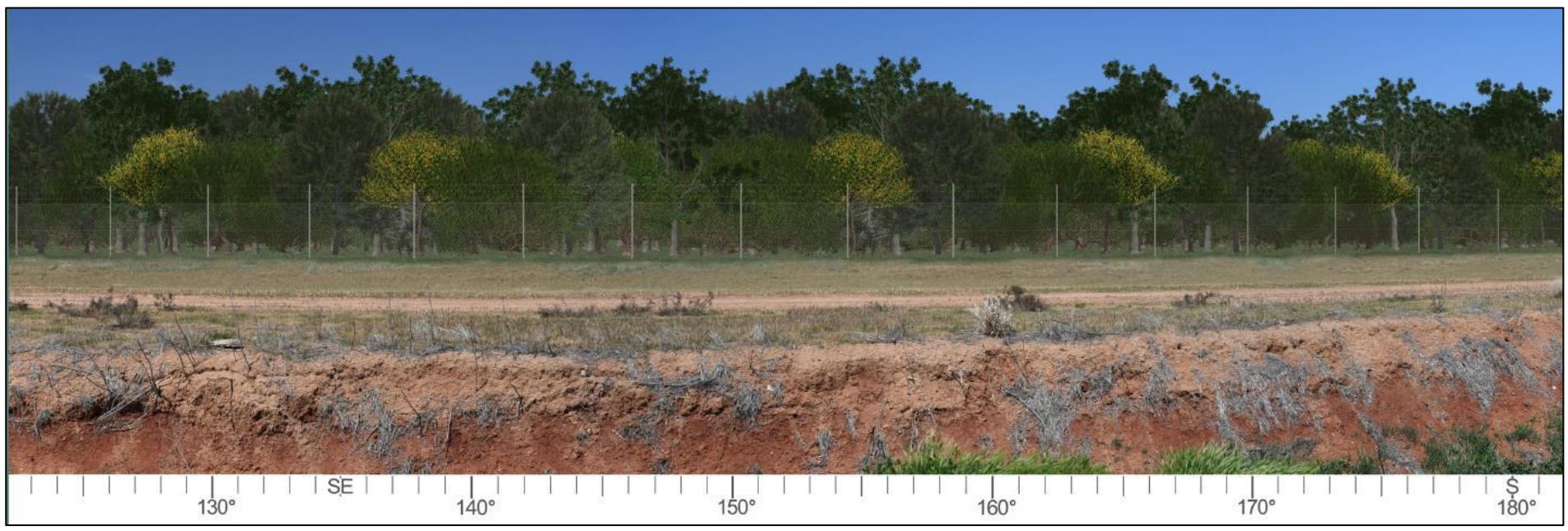
This figure is called a photomontage, but actually shows the proposed solar farm as a red outline, as the solar panels would be behind the embankment in the foreground.



PHOTOMONTAGE 2 (VIEWPOINT 8)

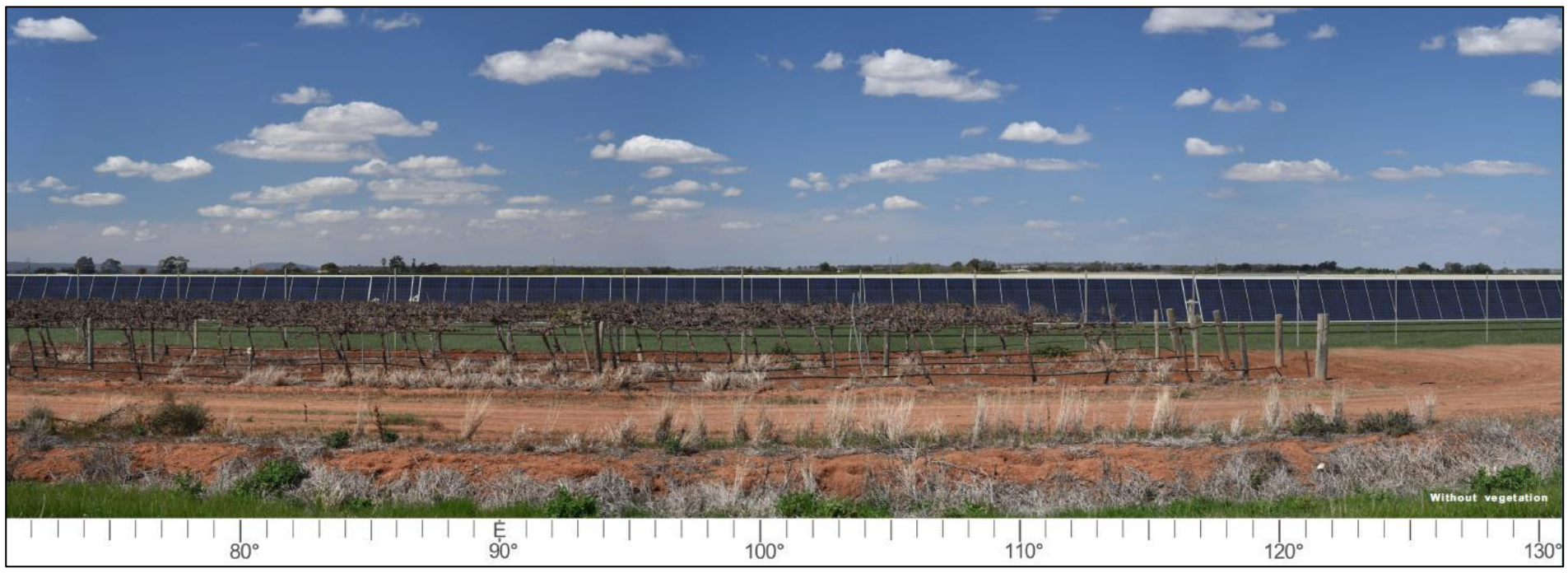
Photomontage without proposed screening vegetation.

Photomontage with proposed screening vegetation, which would screen all views to the proposed solar farm.

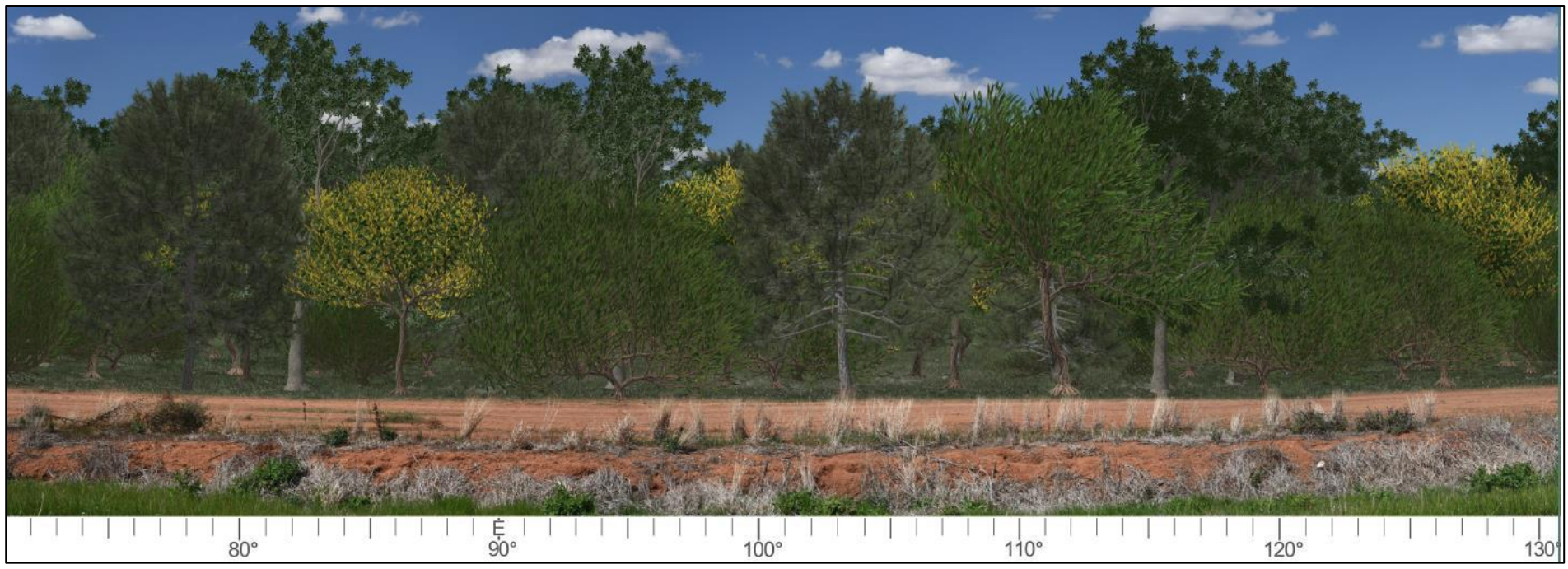


PHOTOMONTAGE 3 (VIEWPOINT 10)

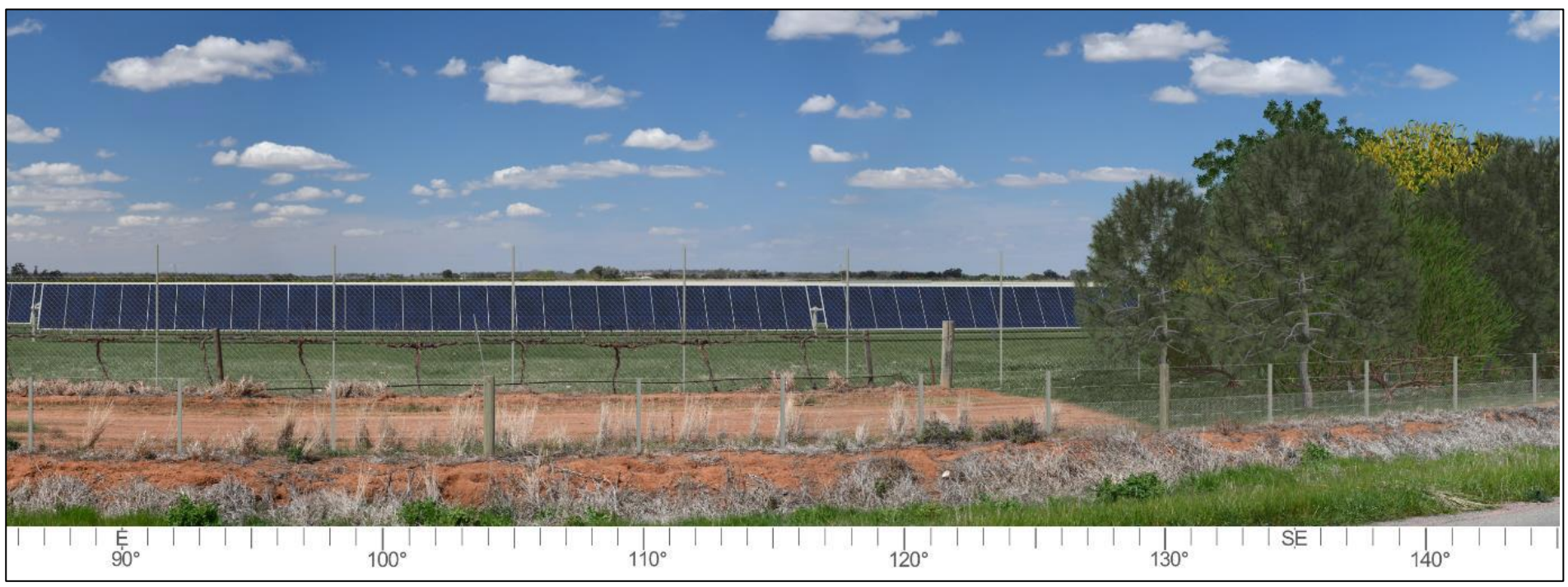
Photomontage without proposed landscaping.



Photomontage with proposed landscaping with tree planting.



Photomontage with grapevines within 10 m landscape buffer retained, in lieu of the proposed landscaping. The grapes were photographed in early spring, so they do not provide the visual screen which can be achieved by the proposed buffer landscaping shown on the right of the figure below. The vegetation proposed in the landscape plan is more effective, and unless the retention of the grapes provides a social or agricultural benefit, it would seem that the proposed replacement landscaping is the preferred option. If a situation occurred where orange groves were planted parallel to the road, the retention of these would be equally effective for screening and would have the additional advantage of being immediately effective.



PHOTOMONTAGE 4 (VIEWPOINT 15)

Photomontage without proposed landscaping.

Photomontage with proposed landscaping.

6.3.8 Glare, reflectivity and night lighting

Glare and reflectivity

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare or reflection. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat.

The panels will not generally create noticeable glare compared with an existing roof or building surface (NSW Department of Planning 2010). Seen from above (such as from an aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

Other onsite infrastructure that may cause glare or reflections, depending on the sun angle, include:

- Steel array mounting - array mounting would be steel.
- Temporary site offices, sheds, PV boxes or PV skids.
- The onsite delivery station.
- Perimeter fencing.
- Permanent staff amenities.

The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:

- Buildings will be non-reflective and in eucalypt green, beige or muted brown.
- Pole mounts will be non-reflective.
- Security fencing posts and wire will be non-reflective.
- Avoidance of unnecessary lighting, signage and logos.
- Retain and protect existing boundary landscaping.

This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to residences, motorists or aircraft.

Therefore, the impact would be assessed as Nil to Negligible.

Night lighting

Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations) and would comply with *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*, which sets out guidelines for control of the obtrusive effects of outdoor lighting and gives recommended limits for relevant lighting levels to contain these effects within tolerable levels. Lighting would be directed away from roads and residences so as not to cause light spill that may be hazardous to drivers.

Such lighting would be similar in scale and less frequent than lighting on adjacent farm properties. Therefore, the impact would be assessed as Negligible.

6.3.9 Results summary

Views from the public domain

The level of visual impact from the local road network would be **Low** to **Negligible** immediately after construction, but this would reduce to **Nil** or even **Positive**, once the proposed planting reached a height greater than the solar panels.

In part, the low level of visual impact is a result of the height of the solar panels, which at 2.2 m in height is not dissimilar to grape vines which are common in the area. This allows a visual confirmation of the potential visual impact, as these grape vine areas quickly disappear into the landscape as a viewer moves further away on the local road network. This also supports the relatively small viewshed that is based upon the height of the proposed solar panels.

However, not only does this height reduce the impact from close proximity, the height of the panels also means the landscape can quickly screen views from immediately adjacent roads.

The range of viewpoints in the public domain from which a resident or viewer can see the solar panels is also limited because of the height. Minor topographical features such as the embankment running adjacent to the irrigation canal on the eastern boundary is sufficient in height to screen views to the solar farm.

Views from the private domain

The visual impact from the private domain is limited to very few houses, most of which are on rural properties. Where these houses are surrounded by vegetation, grape vines or orange groves, the visual impact is either **Negligible** or **Nil**.

The only property which has been assessed as having an impact greater than **Low** was the house at 269 Toorak Road (VP8). Arguably, the rating of **Medium** is a conservative assessment as the house is orientated away from the solar farm, and even this conservative assessment is of short duration. Landscaping along the edge of the irrigation canal to the south of this property would quickly reduce the level of visual impact to **Nil** or **Positive**.

Cumulative impacts

Adverse cumulative impacts occur when the infrastructure or activities at the solar farm site exacerbate the negative impacts of other infrastructure or activities occurring nearby.

During construction, the additional traffic and dust generation impacts are probably the greatest potential for cumulative visual impacts. The visual impact of increased traffic movements to the site would be predominantly limited to construction. It is understood a Traffic Management Plan would be developed to minimise vehicle movements and dust as much as practical for construction.

The operational view of the solar farm may generate a cumulative impact, being in direct contrast to the previous agricultural views. The array site requires security fencing and steel dominated infrastructure.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles is all that would be required. Cumulative visual traffic impacts are considered negligible.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the existing and retained vegetative screening and earthwork embankments of the site that block out most views.

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally

around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare or reflection. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat. The panels will not generally create noticeable glare compared with an existing roof or building surface (NSW Department of Planning 2010). Seen from above (such as from an aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

Other onsite infrastructure that may cause glare or reflections, depending on the sun angle, include:

- Steel array mounting - array mounting would be steel.
- Temporary site offices, sheds, PV boxes or PV skids.
- The onsite delivery station.
- Perimeter fencing.
- Permanent staff amenities.

This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to residences, motorists or aircraft.

In conclusion, with the recommended mitigation measures the proposed solar farm would be appropriately sited with minimal visual impact. The landscape setting which is being established is consistent with landscape elements around Yanco and Leeton.

6.3.10 Safeguards and mitigation measures

Table 6-216-22 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
VA1	Screening would be required on-site, generally in accordance with the draft Landscape Plan provided in the VIA (Appendix I): • Plantings would be three rows deep and where practical, planted on specific sections of the outside of the permitter fence, to break up views of infrastructure including the fencing. • The proposed plant species to be used in the screen are native, fast growing, with spreading habitat and mixed mature heights of 2-4 m, 3-5m and 5-10 m. Proposed plants derived from the naturally occurring vegetation community in this area. • Plants were selected in consultation with affected near neighbours and a botanist or landscape architect. • The timing is recommended to be within 2 months of completion of construction so that actual views of infrastructure can be more certain. The timing of planting should also be chosen to ensure the best chance of survival. • The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.	**C**	**O**	**D**
VA2	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	**Design stage**		

No.	Safeguards and mitigation measures	C	O	D
VA3	Construction and operational night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). Lighting will comply with *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*, including: • Eliminating upward light spill, directing light downwards and directing light away from sensitive receivers. • Use of shielded light fixtures. • Using asymmetric beams. • Compile and record a complaint register.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

6.4 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

SECRETARY'S ENVIRONMENTAL ASSESSMENT 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, 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;*
- *An assessment of potential land use conflicts, including completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and*
- *Measures to remediate the land following decommissioning in accordance with State Environmental Planning Policy No 55 - Remediation of Land*

DPI REQUIREMENTS

The SEARs should require an accurate assessment of the impacts to current and surrounding agricultural uses and industries and these impacts need to be acknowledged and factored into the development of the EIS. To justify the project's location the SEARs should request:

- *A full soil survey and analysis to ground truth the true nature of the soils.*
- *An assessment of the foregone irrigation-based production over the project lifespan.*
- *Feedback from Murrumbidgee Irrigation Ltd on the implications of stranded assets likely from cumulative impacts of more such developments within the gazetted irrigation areas.*
- *If proponents are considering further proposals in gazetted irrigation areas managed by Murrumbidgee Irrigation Ltd (MI), Coleambally Irrigation Co-operative Limited (CICL) and Murray Irrigation Ltd (MIL), feedback should be sought from the appropriate company on the implications of stranded assets likely from cumulative impacts of more such developments.*

DPE (RESOURCES AND GEOSCIENCE) REQUIREMENTS

GSNSW has no resource sterilisation concerns to raise regarding the proposed Yanco Solar Farm Project at this stage and have no additional issues to be addressed. However, the proponent should ensure that the results of the above search are documented in the exhibited EIS.

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. Given the location of the site, the discussion is centred on agricultural land use but also considers residential use, and road and electricity networks.

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.

6.4.1 Existing environment

Agriculture and land capability

The rural land within the region is used primarily for agriculture including cropping and grazing. The Yanco development site comprises several large paddocks which have been deep ripped and largely cleared for the horticulture of grapes and oranges. Land and agricultural activities like the development site are widespread in the region.

The land is classed as follows under the Land and Soil Capability Assessment Scheme (Figure 6-6):

- Class 3: sloping land that is capable of sustaining cultivation on a rotational basis. This land can be readily used for a range of crops including cereals, oilseeds and pulses. Productivity will vary with soil fertility.
- Class 6: steeply sloping lands (20–33% slope) that can erode severely even without cultivation, or land that will be subject to severe wind erosion when cultivated and left exposed. Land generally is suitable only for grazing with limitations and is not suitable for cultivation (OEH 2012).

Class 3 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. Class 6 is considered **Low Capability Land**: Land that has very high limitations for high-impact land uses and is restricted to low-impact land uses such as grazing, forestry and nature conservation. 97% of the development site is classified as Class 3 land.

The NSW Government introduced a range of measures designed to deliver greater protection to agricultural land from the impacts of developments. These measures included the safeguarding of 2.8 million ha of **Biophysical Strategic Agricultural Land** (BSAL) across the state, and **Critical Industry Clusters** (CIC). BSAL is land identified with high quality soil and water resources capable of sustaining high levels of productivity, which is critical to sustaining the state's agricultural industry, while CICs are concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region, and provide significant employment opportunities. The development site is not mapped as being BSAL or CIC, therefore the proposal would not impact on land critical for agriculture (DPE 2017).

There are no current mineral titles, licences or applications relevant to the development site indicated in the Minview database (DPE 2017). An exploration licence (EL0659) owned by Esso Exploration expired in 1974 over the development site. The closest operating quarry is located approximately 20 km north-east of Leeton, Milbrae Quarry, on Colinroobie Road.

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 would be rehabilitated to restore land capability to pre-existing agricultural use.

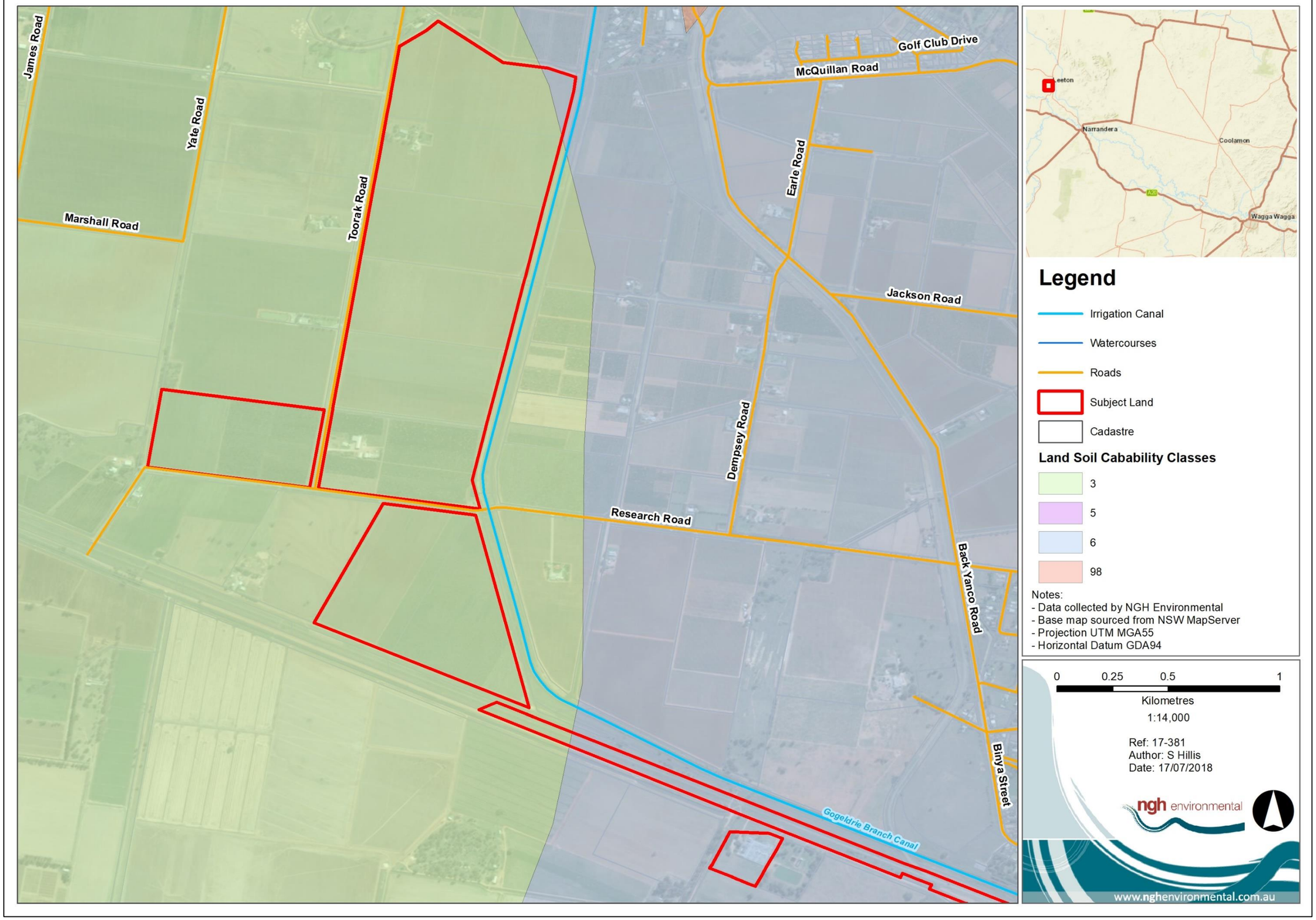


Figure 6-6 Land and soil capability mapping of the development site and surrounding area

Agricultural economy

The Leeton LGA's local economy is highly dependent on irrigation, with 65% of business entities that do not employ staff and 28% of micro-business employing 5 people or less. The agricultural sector is diverse with a range of financial institutions and professional services within the region directly linked to manufacturing and agricultural services. 36% of Leeton's economic value and 44% of employment is directly related to food and fibre production (Leeton Shire Council 2018).

Murrumbidgee Irrigation

The Main Canal (Gogeldrie Branch) bounds the eastern and southern sides of the proposal. The proposal will not interfere with the operation of the main canal and connected structures, and existing access to Murrumbidgee Irrigation infrastructure will be retained. As such, there will be no stranded assets.

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) (Figure 6-7), with low density residential (R1) within 650 m of the site. Surrounding agricultural land generally consists of cropping and grazing. Other land uses in the locality include:

- Fivebough and Tuckerbil Wetlands.
- Residential dwellings and associated dwellings.
- Public road network.
- Electricity connection and transmission infrastructure.
- Township of Yanco within 1 km of the site and Leeton within 5 km of the site, comprising retail, health, accommodation, schools and community services.

Mineral resources

Geological Survey of NSW (GSNSW) was consulted by email on 17 July 2018 in regard to biodiversity offsetting, implications for access and prospective mineralisation. A letter response was received on 27 July outlining the requirements of the SEARs.

No current mineral titles were found on-site, and biodiversity offsets/stewardship are not a requirement of the proposal.

The SEARs letter from GSNSW dated 17 August 2018 further confirmed that no current mineral, coal or petroleum titles or applications, or operating quarries of mines exist over the development site or adjacent to it. GSNSW has no sterilisation concerns or additional issues to be addressed.

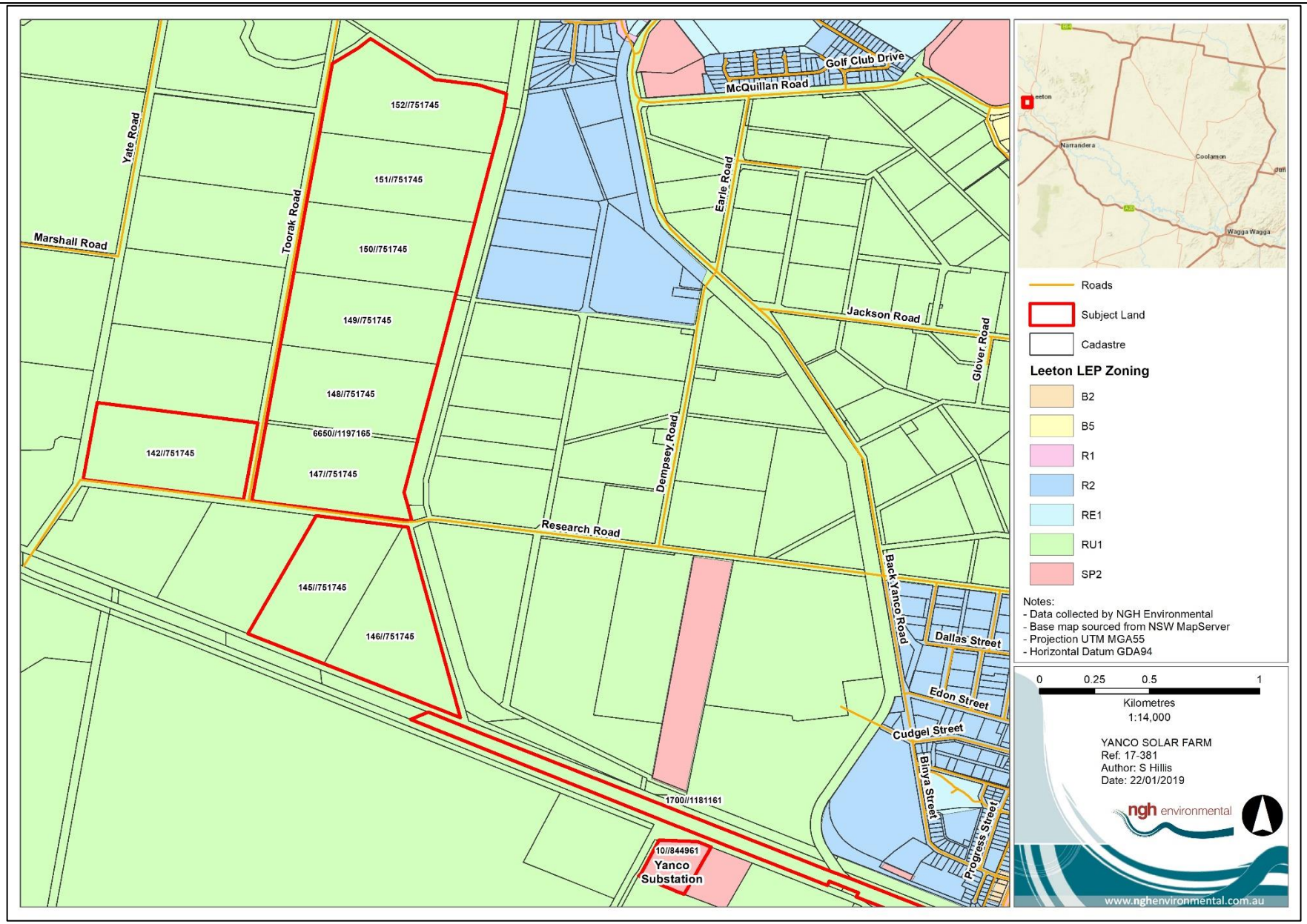


Figure 6-7 Planning zones surrounding the subject land (Leeton Shire Council LEP 2014), indicated by the red line.

6.4.2 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 6-256-26 has been determined using the risk ranking matrix shown in Table 6-236-24, and in accordance with the probability table and measure consequence table in Department of Primary Industries LUCRA 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 6-236-24 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 6-256-26 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Agricultural land use					
Agricultural spraying (aerial)	C3	13	There is likely to be a reduction in aerial spraying, therefore a reduced risk and consequence. The site will continue to be managed through agricultural spraying.	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 using water carts when required.	C5	4

			Dust is not expected to generate a significant land use conflict during operation.		
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	Screen landscaping along boundaries where identified in Section 6.3 would mitigate expected impacts on visual amenity.	D5	2
Noise	C3	13	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). 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
Mining land use					
Resource extraction/exploration	D3	9	It is unlikely there would 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 range of scores in the mitigated risk rating were all low, demonstrating that the proposed construction and operation of the solar farm will have minimal impact to the area.

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.

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.

Toorak Road is dedicated as shared Council/Crown Road, with Council being the dedicated road authority under the provisions of the *Roads Act 1993*.

Connection of transmission lines to the existing Yanco substation will 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.

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. No loss of productive potential is expected to result from the proposal in the long term.

AGRICULTURAL IMPACTS

The Socioeconomic Report (Appendix G) indicates the following impacts on agricultural land:

- Approximately 205 ha of irrigated productive farming land will be unable to be used during the lifetime of the solar farm. The land is irrigated through a mix of historical onsite bores and water purchased though licence.
- This situation will affect land used principally for fruit production (oranges and grapes), with fruit production currently estimated at 3,500 tonnes pa.
- The value of production lost is estimated at up to $1.2 million per year (good year) or an average of $850,000 over a longer-term period (expressed in $2018 dollars). All production

from the site supplies the domestic market (i.e. no exports). In comparison, it is estimated the wholesale value of clean electricity supply into the national grid from the Yanco Solar Farm could total $10.0 million per year.

- The number of jobs supported by existing onsite activities is estimated at 3 full time equivalent (FTE) jobs, which include 2 FTE onsite jobs and the equivalent of 1 FTE job for casual pickers during the harvesting (e.g. oranges). Vine picking is automated and does not require casual labour. A small amount of additional employment is supported through local transportation services and processing (oranges and grapes). In an employment context, the small loss of jobs associated with the ceasing of agricultural activities at the Subject Site is likely of be matched by the creation of new jobs to support solar farm operations at the site.
- The Murrumbidgee Irrigation Area where the solar farm is located contains approximately 1,700,000 ha of irrigated agricultural land supply. In this regional context, the temporary loss of irrigated agricultural land associated with the Yanco Solar Farm amounts to just 0.1% of all irrigated agricultural land.
- The property owner will be compensated by the proponent/operator for hosting the solar farm through purchase of approximately 50% of the site upfront and annual lease payments for the remaining 50% (approximately) of the site, with these lease payments increasing in line with CPI over the 30-year agreement period. It is understood that these purchase/lease payments would result in significantly higher income to the landowner compared with continuation of horticultural activities across the subject site.
- Some small-scale agricultural activity will continue on the site during the operational phase of the solar farm. The proponent is exploring the possibility of facilitating sheep grazing on the site, under the solar structure. Additionally, grapevines (and potentially other fruit trees) will be used to screen parts of the solar farm.
- The land can be rehabilitated to its original condition at the end of the project when all above ground infrastructure is removed, allowing for irrigated agricultural activities to recommence.

Resource loss and fragmentation

The proposal would not impact on land identified by the NSW Government as BSAL or CIC. Construction works involve only minor excavation with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to Section 7.2 and Section 7.3 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.

The proposal will not result in rural land fragmentation or alienation of resource lands as defined under the Rural SEPP. It is considered that the proposal would not generate any land use conflicts or have an impact on the nature of existing surrounding agricultural holdings given the proposal will not alter the existing environment.

Disturbance to farming operations and livestock

Adjacent farming operations are compatible with the proposal. Noise from nearby farming practices over the day would not impact on the proposed solar farm. The proposed solar farm construction and decommissioning 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. The strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.

The impacts from dust on local and regional air quality and farming operations 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.

Changes in biosecurity risks – pests, 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 weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on Leeton 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 herbicide 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 cats and foxes). 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.

Murrumbidgee Irrigation – stranded assets

The proposal will not interfere with the operation of the main canal and connected structures, and existing access to Murrumbidgee Irrigation infrastructure will be retained. As such, there will be no stranded assets.

RESOURCE IMPACTS

Approximately 5,400 m^3 of gravel would be required to surface the access road and internal service track network, inverter/battery storage areas and substation hardstand. Approximately 1,000 m^3 of sand may be required for the bedding of underground cables, depending on electrical design and ground conditions. Approximately 265 m^3 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, 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 for other land uses in the area. It is estimated that approximately 38 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 0.9 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, both in the installation of infrastructure and the commitment to maintain ground cover vegetation, where practical, during operation, the proposal is considered to be highly reversible in terms of preserving the agricultural capability of the development site.

Following decommissioning the rehabilitated site could be restored to its pre-existing condition for alternate land uses, including agriculture or mining. At the end of the project, all above-ground infrastructure would be removed and current agricultural activities could recommence or future proposed mining activities could commence.

6.4.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-276-28.

Table 6-276-28 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 Yanco substation.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above-ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reversal of any compaction by mechanical ripping. • Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the solar farm is decommissioned.			**D**
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	**C**	**O**	

	with Leeton Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.			
LU5	The proponent would consult with GSNSW in relation to biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral resources.	**C**		**D**
LU6	Construction and operational 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**
LU7	All underground cabling and infrastructure to be removed following decommissioning.	**C**		
LU8	If possible and practical, managed 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

6.5 NOISE IMPACTS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Noise –

Including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and cumulative noise impacts (considering other development in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;

Renzo Tonin & Associates Pty Ltd was engaged to complete a Noise Assessment (NA) for the proposal (Appendix F). 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, where required.

6.5.1 Regulatory requirements

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.
- NSW Department of Environment and Conservation (DECC) – Assessing Vibration: A Technical Guideline 2006.

Construction noise

It is proposed that the constriction of the proposal will take approximately 10 months. Construction will occur during the following standard hours of construction:

Table 6-29 Recommended construction hours

Recommended Construction Hours
Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays

The NSW '*Interim Construction Noise Guideline' DECC 2009* (ICNG) provides guidelines for assessing noise generated during the construction phase of developments. The key components of the guidelines that are incorporated into this assessment include:

- *Use of LAeq as the descriptor for measuring and assessing construction noise:* NSW noise policies, including the *NSW Noise Policy for Industry* (NPI), *NSW Road Noise Policy* (RNP) and *NSW Rail Infrastructure Noise Guidelines* (RING) have moved to the primary use of LAeq over any other descriptor. As an energy average, LAeq provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the LA10 descriptor.
- *Application of reasonable and feasible noise mitigation measures:* As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical

to build given the project constraints. Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

Table 6-30 sets out the noise management levels and how they are applied for residential receivers measured against the Rating Background Level (RBL).

Table 6-30 Noise management levels at residential receivers

Time of Day	Noise Levels
Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise Affected: RBL + 10 dB(A)
	Highly Noise Affected: RBL + 5 dB(A)
Outside recommended standard hours	Noise affected: RBL + 5 dB(A)

As no work outside standard working hours is proposed, only the daytime noise management levels have been assessed.

Operational Noise

Noise impact for operation is assessed against the *NSW Noise Policy for Industry* (NPI) (EPA 2017). The assessment has two components.

- Intrusive noise levels.
- Amenity noise level.

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the LAeq,15min descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined in Table 6-31.

Table 6-31 NSW Noise Policy for Industry intrusiveness goals.

Time of day	RBL dB(A) L_{A90}	Intrusive noise = RBL + allowance	NML dB(A) $L_{A90\ (15min)}$
Day	35	= RBL + 5	40
Evening	33	= RBL + 5	38
Night	31	= RBL + 5	36

The NPI describes a process for determining the project amenity noise levels. This aims to limit continuing increases in noise levels from industrial development. The recommended amenity noise levels aim to protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The project amenity noise level represents the objective for noise from a single industrial development at a receiver. The NPI calculates the project amenity noise level for industrial developments as the recommended amenity noise level minus 5 dB(A).

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI calculates the

$L_{Aeq,15min}$ level by adding 3dB(A) to the $L_{Aeq,period}$ level. The industrial noise during operation should not normally exceed the acceptable noise levels for rural residential properties as detailed in Table 6-32.

Table 6-32 NSW Noise Policy for Industry amenity goals.

Receiver type	Noise amenity area	Time of day	Recommended amenity noise level	Project amenity noise levels	
				Noise Level $L_{Aeq.period}$ dB(A)	Noise Level $L_{Aeq.15min}$ dB(A)
Residence	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38

Comparing the amenity and intrusiveness criteria indicates that the intrusiveness criteria are more stringent for day, evening and night. Compliance with the intrusiveness criteria would result in compliance with the amenity criteria.

6.5.2 Existing Environment

The existing noise sources from land use adjacent to the development site generally consist of cultivation management, irrigated horticulture, harvesting of grape and orange orchards, large lot residential activity and road traffic noise from Research Road, Back Yanco Road, Houghtons Road, Canal Street and Toorak Road. Noise generating equipment includes tractors, headers, quad bikes, light vehicles and heavy vehicles. These land uses characterise the background noise within the area. Noise levels from farm activities (sowing, spraying, harvest) are likely to be concentrated at peak times during a given season.

Sensitive receivers

Residential properties surround the development site (Figure 3-6), with 23 sensitive receivers identified adjacent to the development site. The nearest uninvolved residential dwelling, R07, is about 30m northwest of the solar farm boundary. The majority of the receivers are within 400m of the boundary, and the farthest property is 1,600m southeast of the development site.

The distance between the selected receivers and the proposed solar farm boundary are shown in Table 6-33.

Table 6-33: Sensitive receivers adjacent to the development site

Receiver Identification	Distance to Development Site
Receiver R01 – 649 Ronfeldt Road, Yanco	Residential property located approximately 300m southwest of the project area
Receiver R02 – 405 Research Road, Yanco	Residential property located approximately 110m southwest of the project area
Receiver R03 – 410 Yate Road, Leeton	Residential property located approximately 130m southwest of the project area
Receiver R04 – 328 Toorak Road, Leeton	Residential property located approximately 110m west of the project area
Receiver R05 – 284 Toorak Road, Leeton	Residential property located approximately 140m west of the project area

Receiver R06 – 22 McMaster Road, Leeton	Residential property located approximately 250m northwest of the project area
Receiver R07 – 191 Toorak Road, Leeton	Residential property located approximately 30m northwest of the project area
Receiver R08 – 165 Toorak Road, Leeton (West)	Residential property located approximately 250m north of the project area
Receiver R09 – 165 Toorak Road, Leeton (East)	Residential property located approximately 300m north of the project area
Receiver R10 – 32 Back Yanco Road, Leeton	Residential property located approximately 240m northeast of the project area
Receiver R11 – 30 Back Yanco Road, Leeton	Residential property located approximately 410m northeast of the project area
Receiver R12 – 50 Maxwell Road, Leeton (West)	Residential property located approximately 390m east of the project area
Receiver R13 – 50 Maxwell Road, Leeton (East)	Residential property located approximately 420m east of the project area
Receiver R14 – 55 Maxwell Road, Leeton	Residential property located approximately 420m east of the project area
Receiver R15 – 40 Gladman Road, Leeton	Residential property located approximately 480m east of the project area
Receiver R16 – 49 Gladman Road, Leeton	Residential property located approximately 560m east of the project area
Receiver R17 – 80 Dempsey Road, Leeton	Residential property located approximately 910m east of the project area
Receiver R18 – 186 Research Road, Leeton	Residential property located approximately 760m southeast of the project area
Receiver R19 – 215 Research Road, Yanco	Residential property located approximately 450m southeast of the project area
Receiver R20 – 235 Research Road, Yanco	Residential property located approximately 240m southeast of the project area
Receiver R21 – 13 Tecoma Street, Yanco	Residential property located approximately 130m northeast of the project area
Receiver R22 – 120 Houghtons Road, Yanco	Residential property located approximately 1,030m southeast of the project area, and approximately 430m south of the powerline easement
Receiver R23 – 26 Euroley Road, Yanco	Residential property located approximately 1,600m southeast of the project area and approximately 550m southeast of the powerline easement

Background noise levels

Background noise levels for the development site were determined in accordance with Fact Sheet A of the NPI. Background noise measurements were recorded at site L1, near residential receiver R07, located at 191 Toorak Road (Figure 3-6), on the northern boundary of the development site. The noise monitor was installed in the 'free field' (ie. away from building facades).

The noise measurement instrumentation used in the survey was designed to comply with the requirements of AS 1259.2-1990 "Acoustics - Sound Level Meters. Part 2: Integrating - Averaging" and carried appropriate and current calibration certificates. The equipment utilised for the noise surveys comprised of a RTA04 (CESVA SC310) Noise Monitor, fitted with a microphone wind shield.

Sound level measurements occurred from 2nd October to 17th October 2018. During the monitoring, the sound level meter was set to 'fast' time weighting and an 'A' frequency weighting. During that period eight days of weather met the required meteorological conditions.

Existing background and ambient noise levels are presented in

Table 6-34 below. The identified receivers surrounding the development site are all classified as rural under NPfI guidelines. The recorded background noise levels were close to levels typical for a rural area, with a day RBL less than 40dB(A), an evening RBL of 35 dB(A) and a night RBL of 30 dB(A).

Table 6-34 Measured existing Background (L90) and Ambient (Leq) noise levels, dB(A)

Location	Background (L_{90}) noise levels			Ambient (L_{eq}) noise levels		
L1	Day	Evening	Night	Day	Evening	Night
	33	35	31	50	50	45

In accordance with the NPfI, where background noise levels are less than the minimum assumed RBLs, the minimum assumed RBL's are adopted for all receivers. Furthermore, the NPfI recommends that the project intrusiveness level for evening be set at no greater than the project intrusiveness noise level for daytime. Therefore, the background noise levels for sensitive receivers have been set at the levels detailed in Table 6-35 below.

Table 6-35 Rating Background Level used for the assessment

Time of Day	RBL for assessment
Day	35
Evening	33
Night	31

6.5.3 Potential impacts

Construction

Noise management levels

Construction noise management levels (NMLs) have been calculated for the project (

Table 6-36). These NMLs will be used to manage impacts associated with noise sensitive receivers adjacent to the proposal (Figure 3-6). The NMLs for the project have been calculated based on the measured RBL and NSW ICNG (DECC 2009) criteria. In addition, during standard construction hours sensitive receivers experiencing construction noise at or above 75 dB(A) would be deemed highly noise affected.

Table 6-36 Construction Noise Management Levels at Residential Receivers.

Time of day	RBL dB(A) L_{A90}	NML = RBL + allowance	NML dB(A) $L_{A90\ (15min)}$
Day	35	= RBL + 10	45
Evening	33	= RBL + 5	38
Night	31	= RBL + 5	36

Construction noise sources

Construction activities normally result in temporary and short duration increases in the noise and vibration levels of a site. Noise would be created and emitted to the surrounding environment via a range of processes. Pertinent construction activities in relation to noise and vibration are likely to include earthworks, piling, site levelling, laying of concrete, installation of services, etc.

During construction it is envisaged that the work activities are likely to include the following:

- Site preparation - back-filling, levelling and grading. Such activities would require the use of dozers, excavators and muck-away lorries.
- Civil Works – Pilling of the steel posts and frames for the solar panels, trenching for underground cabling.
- Construction and Installation - This phase of works is assumed to involve the casting of reinforced concrete slabs 'in-situ', blockwork, steel/scaffold erection and the installation of plant etc. It is assumed that these works would require the use of concrete truck mixers, compressors, generators, heavy lifting equipment (including cranes) and hand tools.
- Drainage and access tracks levelling

Noise impact predictions on each sensitive receiver were conducted. The predictions have taken into account the typical noise levels of construction equipment likely to be used for the construction phase. Two construction activities were assessed using the sound power levels in Table 6-37. Construction noise levels have been predicted at the nearest receivers for the construction of the solar farm (scenario 1) and for the construction of the Transmission Line and road works (scenario 2).

The construction activities selected above provide a worst-case scenario for noise generated from the site, assuming that all plant would be operating simultaneously.

Table 6-37 Construction equipment sound power levels.

Scenario 1		Scenario 2	
Road work / compound construction equipment	**Sound power level (dB)**	**Panel framing and cabling equipment**	**Sound power level (dB)**
Small Pile Driver	114	**Front End Loader**	113
Fixed Crane	113	**Grader**	110
Front End Loader	113	**Vibratory Roller**	109

Backhoe	111	**Delivery Truck**	108
Grader	110	**Water Cart**	107
Vibratory Roller	109	**Light Vehicles (e.g. 4WD)**	103
Concrete Truck	109		
Delivery Truck	108		
Water Cart	107		
Concrete Pump	105		
Power Generator	103		
Concrete Vibrator	103		
Light Vehicles (e.g. 4WD)	103		

The sound power levels for the equipment presented in the above table are sourced from the Australian Standard 2436 – 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites'; the Interim Construction Noise Guidelines (ICNG), information from past projects and information held in the Renzo Tonin database.

Construction noise assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 2018) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

Table 6-38 presents construction noise levels likely to be experienced at the nearby affected receivers based on the construction activities and the three noisiest plant operating concurrently, associated with the works conducted within the development envelope. Table 6-39 refers to the noise levels likely to be experienced at the nearby affected receivers due to the construction of the transmission easement. The noise level ranges represent the noise source being located at the furthest to the closest proximity to each receiver location.

Table 6-38 Predicted LAeq,15min Solar Farm Construction Noise Levels at Receiver Locations, dB(A)

	Noise Management Level1	Up to 3 (noisiest) plant operating concurrently
R01	*45*	23-**48**
R02	*45*	24-**59**
R03	*45*	24-**57**
R04	*45*	28-**59**
R05	*45*	25-**56**
R06	*45*	21-**50**
R07	*45*	20-**68**
R08	*45*	<20-**50**
R09	*45*	<20-**48**

R10	*45*	22-**50**
R11	*45*	22-45
R12	*45*	28-42
R13	*45*	27-42
R14	*45*	28-42
R15	*45*	29-40
R16	*45*	28-40
R17	*45*	26-36
R18	*45*	25-39
R19	*45*	24-44
R20	*45*	24-**51**
R21	*45*	21-**56**
R22	*45*	<20-36
R23	*45*	<20-30

Table 6-39 Predicted LAeq,15min Easement Construction Noise Levels at Receiver Locations, dB(A)

	Noise Management Level1	**Up to 3 (noisiest) plant operating concurrently**
R01	*45*	23-33
R02	*45*	<20-28
R03	*45*	<20-26
R04	*45*	<20-26
R05	*45*	<20-23
R06	*45*	<20
R07	*45*	<20
R08	*45*	<20
R09	*45*	<20
R10	*45*	<20-20
R11	*45*	<20
R12	*45*	21-26
R13	*45*	21-26
R14	*45*	22-26
R15	*45*	25-30
R16	*45*	25-30
R17	*45*	26-29
R18	*45*	29-33
R19	*45*	30-37
R20	*45*	29-39
R21	*45*	<20

R22	*45*	32-42
R23	*45*	27-40

The construction works would occur in a rural environment with a low level of background noise. Based on the construction noise levels presented in Table 6-38 for the construction of the solar farm, the noise management levels at Receivers R01 to R10 and R20 to R21 may be exceeded when construction works are conducted within close proximity to the receivers. These exceedances would occur over a short-term, during normal working hours. The maximum duration that affected residents would be likely to experience worst case construction noise is 8 hours in a day. Such activities would move progressively across the site, meaning that at any one receiver, worst case construction noise would typically last for 3-4 weeks only.

For the construction of the easement, Table 6-39 indicates that construction noise levels will comply with the noise management levels at all the identified receivers. It is noted that construction noise levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A) for all construction stages of the solar farm project.

General construction noise mitigation measures include:

- Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 “Guide to Noise Control on Construction, Demolition and Maintenance Sites”, are expected to reduce predicted construction noise levels.
- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of ‘noise control’ or ‘silencing’ kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Overall, construction noise impacts are unlikely to significantly affect nearby sensitive receivers.

Operation

Solar Farm Operation

In accordance with the NPI, noise impact should be assessed in terms of both intrusiveness and amenity. As discussed in Section 6.6.1, the intrusiveness criteria are more stringent for day, evening and night than the amenity criteria, therefore the intrusiveness criteria will be used in the assessment of operational impact, refer to Table 6-31.

Noise from the operation of the solar farm would be generated by:

1. The onsite switching station.
2. Inverter / Transformer units.
3. Batteries.
4. Synchronous condenser.
5. Maintenance activities.
6. Tracking motors and movement of the solar panels.

The proposed solar farm will operate solar panels installed on single-axis trackers that are driven by motors. As such, the tracking motors are a potential source of mechanical noise and up to 4,300 tracking motors (NexTracker or equivalent) would be evenly distributed across the PV footprint area depicted in Figure 1-3. The tracking motors would turn no more than five (5) degrees every 15 minutes and would operate no more than one (1) minute out of every 15-minute period.

Additionally, the site will require the operation of 17 containerised inverter / transformer units (SMA MV PS 5500SC or equivalent) and 18 containerised Energy Storage Systems (ESS) with associated converters which are distributed across the PV footprint. The ESS will also utilise air conditioning units to maintain stable temperatures for the batteries, which have also been identified as a potential noise source.

During operations, up to three staff would be required on-site to maintain the solar farm. Noise from maintenance vehicles on site will be infrequent. At times several vehicles may access the development site per day. Maintenance would mostly be activities conducted inside a maintenance/control building located in the south-eastern corner of the development site. Noise from other maintenance works (panel cleaning or replacement) would be intermittent and low.

Table 6-40 lists the predicted sound levels from the plant and equipment used for the operation of the Proposal.

Table 6-40 Typical Operational Plant and Equipment & Sound Power Levels

Plant Item	Plant Description	LAeq Sound Power Levels, dB(A) re. 1pW
1	Tracker Motor (up to 4,300 in total; model NexTracker or equivalent)	50 (each)
2	Inverter / Transformer (17 in total; model SMA MVPS 5500SC)	88 (each)
3	Energy Storage Facility Converter (18 in total; model Freemaq DC/DC TD0500)	74 (each)
4	Energy Storage Facility Air Conditioning Units (18 in total)	75 (each)

5	Synchronous Condenser (1)	93 (each)
5	Light vehicle (3 in total)	103 (each)

In accordance with the NPfI, where the character of the noise in question is assessed as particularly annoying (ie. if it has an inherently tonal, low frequency, impulsive or intermittent characteristic), then an adjustment of 5dB(A) for each annoyance aspect, up to a total of 10dB(A), is to be added to the predicted value to penalise the noise for its potential increase in annoyance. Therefore, a 5dB(A) penalty has been applied individually to the predicted noise contributions from the inverters and transformers.

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 2018) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site. Table 6-41 below presents the predicted noise levels for the worst-case scenario based on concurrent operation of all the plant and equipment. The tracker motors were time corrected based on their operation of one (1) minute out of a 15-minute period.

Table 6-41 Predicted LAeq,15min Operational Noise Levels at Residential Receiver Locations, dB(A)

Receiver Location	Project Noise Trigger Levels			Predicted Operational Noise Levels, LAeq, 15min			Comply? (Yes/No)
	Day	Evening	Night	Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion[1]	
R1	*40*	*38*	*36*	25	29	29	Yes
R2	*40*	*38*	*36*	26	30	30	Yes
R3	*40*	*38*	*36*	25	29	29	Yes
R4	*40*	*38*	*36*	30	33	34	Yes
R5	*40*	*38*	*36*	29	33	33	Yes
R6	*40*	*38*	*36*	24	29	29	Yes
R7	*40*	*38*	*36*	24	29	29	Yes
R8	*40*	*38*	*36*	22	27	27	Yes
R9	*40*	*38*	*36*	22	27	27	Yes
R10	*40*	*38*	*36*	25	29	29	Yes
R11	*40*	*38*	*36*	22	27	27	Yes
R12	*40*	*38*	*36*	24	29	29	Yes
R13	*40*	*38*	*36*	24	28	28	Yes
R14	*40*	*38*	*36*	24	28	28	Yes
R15	*40*	*38*	*36*	23	28	28	Yes
R16	*40*	*38*	*36*	23	28	28	Yes
R17	*40*	*38*	*36*	<20	25	25	Yes
R18	*40*	*38*	*36*	21	26	26	Yes
R19	*40*	*38*	*36*	24	29	29	Yes
R20	*40*	*38*	*36*	27	31	31	Yes
R21	*40*	*38*	*36*	24	29	29	Yes

R22	*40*	*38*	*36*	<20	<20	<20	Yes
R23	*40*	*38*	*36*	<20	<20	<20	Yes

Based on the predicted operational noise levels presented in the table above, predicted noise levels at the nearest receivers comply with the nominated criteria under all meteorological conditions. Therefore, no further reasonable and feasible noise mitigation measures are required to reduce operational noise impacts.

Sleep disturbance

The NPI states:

> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
>
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - *LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater; and/or*
> - *LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.*
>
> *a detailed maximum noise level event assessment should be undertaken.*

During the night time period (before 7am during summer months) only mechanical plant will be operating, including the tracking motors, inverters, and air conditioning units for the EES. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the L_{Amax} noise levels experienced at the identified receivers will be similar to the predicted $L_{Aeq,15min}$ noise levels shown in Table 6-41. Hence, it is expected that both the $L_{Aeq,15min}$ and L_{AFmax} will be well below the nominated sleep disturbance criteria of 40dB(A) and 52dB(A), respectively.

Vibration

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's '*Assessing Vibration; a technical guideline'* (DECC, 2006). The guideline provides criteria which are based on British Standard BS 6472-1992 '*Evaluation of human exposure to vibration in buildings (1-80Hz)'.*

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at the nearest residential dwellings. Potential vibration impacts from operation are therefore not assessed any further.

Road traffic

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities has been assessed against the NSW '*Road Noise Policy'* (RNP). Vehicle access to the subject site will be via three access points on Toorak Road and one access point on Research Road. Vehicles will access Toorak Road from the north via Canal Street. The peak vehicle movements during the construction stage of the project are presented in the following table. Note, vehicle movements will only occur during the day time during the construction period.

Table 6-42 Summary of the Estimated Construction Traffic Volumes During Peak Construction

Vehicle Type	Movements Per Day	Average Hourly
Cars/ light vehicles	20 (10 in / 10 out)	2

Trucks/ heavy vehicles	72 (36 in / 36 out)	7

During the operational stage, vehicle access to the site will be maintenance vans and delivery trucks (3 x site staff light vehicle and 5 x miscellaneous courier deliveries per week) which would occur on an irregular basis. Therefore, traffic noise impacts during the operational stage of the project would be minimal and insignificant and have not been assessed further.

Based on functionality, Toorak Road and Research Road are categorised as local roads. For existing residences affected by additional traffic on existing local roads generated by land use developments, the following RNP road traffic noise criteria apply.

Table 6-43 RNP road traffic noise criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria	
		Day 7am – 10pm	**Night 10pm – 7am**
Local road	Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq,(1 hour) 55 (external)	LAeq,(1 hour) 50 (external)

Results of the road traffic noise predictions are presented in Table 6-44. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels as existing traffic volumes along Toorak Road and Research Road are unknown.

Table 6-44 Predicted Road Traffic Noise Contribution Levels Along Public Roads, dB(A) LAeq(1 Hour)

Receiver	Criteria	Traffic Movements	Speed (km/h)	Approx. Distance to Road	Predicted Noise Level	Comply?
Nearest receivers	*LAeq, (1 hour) 55*	As per Table HH	60	13m[1]	54	Yes
Notes: 1. Assumed distance to closest receiver to Toorak Road.						

From the above table, traffic noise levels from the additional traffic during the construction stage of the project is predicted to comply with the applicable noise criterion at the nearest affected receivers along Toorak Road and Research Road.

As the construction traffic noise levels are temporary and comply with the RNP criteria set above, it indicates that the traffic noise levels due to the construction works for the solar farm would not adversely affect the existing residences along Toorak Road and Research Road.

6.5.4 Safeguards and mitigation measures

Table 6-45 Safeguards and mitigation measures for noise and vibration impacts

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 7am to 6pm.	**C**		**D**

No.	Mitigation strategies	C	O	D
	• Saturday 8am to 1pm. • No work on Sundays or public holidays.			
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	**C**	**O**	**D**
NS3	A letter box drop would be prepared and provided to residences within 2km of the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	**C**	**O**	**D**
NS4	Implement noise control measures that are suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", to reduce predicted construction noise levels.	**C**		**D**
NS5	In addition to physical noise controls, the following general noise management measures should be followed: • Plant and equipment should be properly maintained. • Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. • Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel. • Avoid any unnecessary noise when carrying out manual operations and when operating plant. • Any equipment not in use for extended periods during construction work should be switched off.	**C**		**D**
NS6	Establish a noise management procedure to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.	**C**	**O**	**D**
NS7	Establish good relations with people living and working in the vicinity of the construction site at the beginning of a Proposal and maintain good relations throughout the project. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.	**C**		**D**
NS8	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	**C**		**D**
NS9	Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

6.6 SOCIOECONOMIC AND COMMUNITY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Socio-Economic –

Including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.

The Leeton 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 the natural environment.

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 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 potential impacts of the proposal on the socioeconomics and the local community.

6.6.1 Background

Socio-economic profile

The Leeton LGA has a population of 11,168 people (ABS 2016). In the 2011 Census, the population was 11,037 people, which represents less than a 3% increase in population over a period of five years. Over a wider area, including Griffith, Narrandera and Wagga Wagga, population growth is expected to average at 0.6% per year. Population growth in the Leeton LGA is however expected to remain static (Essential Economics 2019 - Appendix G).

The local economy is based primarily on manufacturing and mixed farming enterprises – agriculture having the largest number of businesses. Despite this, agriculture also has one of the lowest employment rates, only employing 10% of the overall workforce (Leeton Shire Council 2018).

The unemployment rate in Leeton LGA is relatively high (6.2%), with the neighbouring Narrandera LGA even higher at 8.6%. This is well above the NSW state average of 4.8% (Essential Economics 2019 - Appendix G). The proposal is likely to require 120 direct and 190 indirect workers over the construction period with the majority of staff to be employed locally. Specialist roles (like management or specialists) may be sourced outside of the local area. As such the proposal will provide new short-term opportunities for labour force participants (including existing unemployed persons – subject to appropriate skill match) (Essential Economics 2019 - Appendix G) and some long-term maintenance contracts.

The skill base in the area is reflected in its occupational structure, with 35% of workers occupied in activities associated with the types of skills required for the construction of a solar farm (i.e. technicians and trade workers, machinery operators and labourers). At a local level the Leeton LGA has approximately 42% of its residents employed on construction-based activities, well above the NSW state average of 28%.

Commercial and private accommodation

Leeton LGA and the surrounding area has a reasonable supply of commercial accommodation as measured by the ABS Tourism Accommodation series for year-ending June 2016. The data which identifies supply for

hotels, motels and apartment with 15 rooms or more shows the area contains 49 establishments and 1,450 rooms. Room occupancy rate of 61% is lower than the NSW State average of 68%, indicating the proposal will boost the commercial accommodation sector (Essential Economics 2019 - Appendix G).

Room occupancy rates for Leeton and Narrandera LGA's in particular are low, with 45% and 52% occupancy rates respectively (Essential Economics 2019 - Appendix G).

In addition to commercial accommodation, the area provides a range of additional options such as caravan and holiday parks, boutique serviced apartments, bed and breakfast facilities, pubs/hotels and guest houses (Essential Economics 2019 - Appendix G).

Private accommodation is often used to support construction worker's needs, especially long term. ABS Census data for 2016 indicates an above-average level of vacant dwellings of 10.6%. Leeton and Narrandera LGAs were relatively high, with 11.7% and 15.0% vacancy respectively, indicating potential for private accommodation opportunities.

Township services

Workers locating temporarily to the project area will require a wide range of other convenience services, and the project will also need to source trade and other services from businesses located in the immediate region. Services located in Narrandera, Leeton, Wagga Wagga and Griffith will be the bulk supply of services, with other smaller settlements likely to support the proposal.

The township of Leeton, given its proximity, will service the majority of the project needs such as trade supply, transport services, machinery hire and repair, and retail services. Narrandera will also provide a supporting project role.

6.6.2 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 of the similarities between highly supported domestic scale installations and large-scale facilities.
- Understanding of 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 6.3 and Appendix I of this EIS assess the visual impacts of the proposal 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. Engagement has occurred via two community open days and direct engagement through letters, emails, phone calls and face to face meetings. The proponent also created a dedicated

website and email address for the proposal to provide information about the proposal and enable communication and feedback to be received (section 5.3).

DIRECT ENGAGEMENT

Direct engagement was offered to the nearest neighbours of the boundary of the development site. This occurred through letter drops, emails, phone calls and face to face meetings. Concerns raised during the engagement include:

- Community impacts.
- Visual impact.
- Effects on land use.
- Heating of surrounding land.
- Clearing of orchards and vineyards.
- Loss of agricultural jobs.
- Dust.
- Health.

Visual impacts were addressed with the concerned individuals through direct correspondence. In some instances, visual montages were provided of the concerned residence to show the before and after impacts of proposed vegetative screening, which was also developed with input from concerned residents.

OPEN DAYS

Two open days were held in Leeton, 9 March and 8 and 9 August 2018. Fourteen feedback forms were completed at these sessions. Respondents were generally in support of the proposal with concerns raised with specific reference to the proposal being:

- Drying effect on land and soil by the solar panels (1 respondent).
- Removal of good topsoil (1 respondent).
- Land value (6 respondents).

For respondents that provided details, concerns were addressed through direct correspondence. All other issues raised were addressed via the dedicated website, project update mail-outs and public notices.

WEBSITE

The proponent has established a dedicated project website (https://yancosolarfarm.com.au), which provides information on the proposal. The website includes an online community feedback form that can be filled in by any members of the community. A dedicated email address info@yancosolarfarm.com.au and phone number also allows anyone interested to reach the proponent with general and project related enquiries.

6.6.3 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. About 120 direct and 190 indirect full-time staff would be employed during peak construction, 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.
- A range of employment and contracts including landscaping, fencing, security, catering, trenching, maintenance, piling, roads and electrical work.
- It is estimated that $560,000 in wage spending would be directed at local and regional businesses and service providers during the construction period. Spending would include housing expenditure, retail, recreational spending, and personal, medical and other services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to section 7.4).
- Change in the rural landscape character and visual amenity of the area (refer to Section 6.3).
- Influx of workers may put pressure on local accommodation, health and broader 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.

Leeton and surrounding areas provide many visitor accommodations. It is possible that, in conjunction with other major projects, shortages of accommodation may occur at times during the construction stage. It is, however, important to note that the majority of construction staff would be local and would not require commercial accommodation. The project would engage with local accommodation providers and Leeton Shire Council, if necessary, to provide additional short term and temporary accommodation at these businesses. The proponent would also consult with Leeton and Narrandera Shire Councils 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 and cities to coincide with where workers are staying.

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

Approximately 5 full-time jobs will be supported on an ongoing basis through the operation and maintenance of the proposal. Three ongoing local full-time equivalent jobs are likely to be supported, associated with landscaping and ground care, panel cleaning, electrical and technical services and security.

The development of rural land uses compatible with agricultural activities, such as solar power generation, have 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 involve little soil disturbance and provide an alternative income stream for large agricultural properties can be seen as an important local economic benefit.

Revenues payable to Leeton Shire Council associated with the operation of the proposal would also be applicable, negotiated between council and the proponent. This presents an increase in the rates base for the area.

The proponent will also engage with Leeton Shire Council to investigate a developer contribution payment if the proposal is approved, which may fund the delivery of community infrastructure and programs.

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.

The American National Renewable Energy Laboratory (NREL 2018) notes that the impact of solar farms on neighbouring property values has not been studied in-depth; however, numerous studies found the impact of wind energy generation on neighbouring properties to be negligible. As solar farms do not have the same impacts as wind farms (i.e. landscape views, shadowing, light flicker etc.), the impact on property values is anticipated to be less.

Mitigation measures in the form of vegetative screening are an effective method to obscure views of the proposal.

6.6.4 Safeguards and mitigation measures

Table 6-46 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: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	**C**	**O**	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**	**O**	
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

7 ASSESSMENT OF ADDITIONAL ISSUES

7.1 ABORIGINAL HERITAGE

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues.

Heritage –

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents;

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

There are large parts of NSW that have not been subject to archaeological survey and as such there may be unrecorded Aboriginal sites within or near the project area. Desktop assessment and site survey should investigate the landscape for any evidence of prior streams, which may indicate areas of archaeological potential. All Aboriginal objects identified must be reported to the OEH through registration on AHIMS in accordance with the mandatory notification requirements of section 89A of the National Parks and Wildlife Act 1974.

Aboriginal cultural heritage –

1. *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 these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010), and be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with OEH regional branch officers.*
2. *Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.*
3. *Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.*
4. *The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR.*
5. *The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts.*
6. *The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.*

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The full report is provided in Appendix H 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 Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010,* following the consultation steps outlined in the (ACHCRP) guide provided by OEH.

7.1.1 Background

The Yanco and Leeton area is within an area identified as part of the Wiradjuri language group (Howitt 1904, Tindale 1974, MacDonald 1983, Horton 1994).

The Wiradjuri language group was the largest in NSW prior to European settlement. Wiradjuri people believe that "*Wiradjuri was created and come from the Wiradjuri creator. The origins of Wiradjuri…came from Wiradjuri country…from the beginning. We were always here*" (Yalmambirra 2013).

The Wiradjuri borders, however, were not static; they were most likely fluid, expanding and contracting over time to the movements of smaller family or clan groups. These boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought and abundance.

It was the small family group that was at the core of Aboriginal society and the basis for their hunting and gathering life. The immediate family camped, sourced food, made shelter and performed daily rituals together. The archaeological manifestations of these activities are likely to be small campsites, characterised by small artefact scatters and hearths across the landscape. Places that were visited more frequently would develop into larger site complexes with higher numbers of artefacts and possibly more diverse archaeological evidence.

These small family units were part of a larger band which comprised several families. They moved within an area defined by their particular religious sites (MacDonald 1983). Such groups might come together on special occasions such as pre-ordained times for ceremonies, rituals or simply if their paths happened to cross. They may also have joined together at particular times of the year and at certain places where resources were known to be abundant. The archaeological legacy of these gatherings would be larger sites rather than small family camps. They may include large hearth or oven complexes, contain several grinding implements and a larger range of stone tools and raw materials.

There are several ethnographic recordings of Aboriginal life in the Murrumbidgee region from the 1800s. Most notably, the observations of Beveridge (1883) focused on the prevalence of Aboriginal people around waterways in the region.

The Fivebough and Tuckerbil Wetlands, which are located approximately 5km north east of the proposal area, have always been an integral food resource for the Wiradjuri people (Creamer 1985). The abundance of natural edible plant and animal species present year-round meant that it became a gathering, hunting and fishing place that contributed greatly to the diet of the local tribes. Sustainable practices were employed to ensure that only enough food for the next meal was collected and breeding stocks were left untouched.

The extent of the Wiradjuri group means that there were many different environments that were exploited for natural resources and food. Like everywhere in Australia, Aboriginal people were adept at identifying and utilising resources either on a seasonal basis or all year round.

Database searches and consultation

A search of the AHIMS database was conducted over an area approximately 5 km x 5 km centred on the proposal area extent, on 2nd August 2018. An additional search of the AHIMS database was undertaken on 13th December 2018 to provide a better understanding of the site type modelling in the area. The search was conducted over an area approximately 30 km x 30 km centred on the proposal area. There were an additional 106 Aboriginal sites and one declared Aboriginal Place recorded in the search area. Figure 7-1 shows the locations of the AHIMS sites in relation to the proposal area and Table 7-1shows a breakdown the of the site types.

Table 7-1 Breakdown of previously recorded sites with 30km of the proposal area.

Site Type	Number
Artefact (1 or more)	49
Modified Tree (Carved or Scarred)	49
Massacre	1
Stone Quarry	2
Aboriginal Resource and Gathering	2
Earth Mound/PAD	1
Earth Mound, Hearth (oven)	2
Artefact Scatter, Stone Quarry	1
Shell Midden	1
Restricted Site	1
TOTAL	**109**

None of the registered AHIMS sites are located within the proposal area. The closest sites are three scarred trees located approximately 1 km to the north. There is a dominance of scarred trees in the wider area, especially where remnant stands of native trees exist.

One of these scarred tree sites (AHIMS# 49-6-001) is listed as destroyed. Email correspondence with OEH confirmed that the Restricted Site (AHIMS# 49-6-0036) does not fall within the proposed Yanco Solar Farm area, but is closer to Narrandera (*per email* OEH, Eva Day 14/12/18).

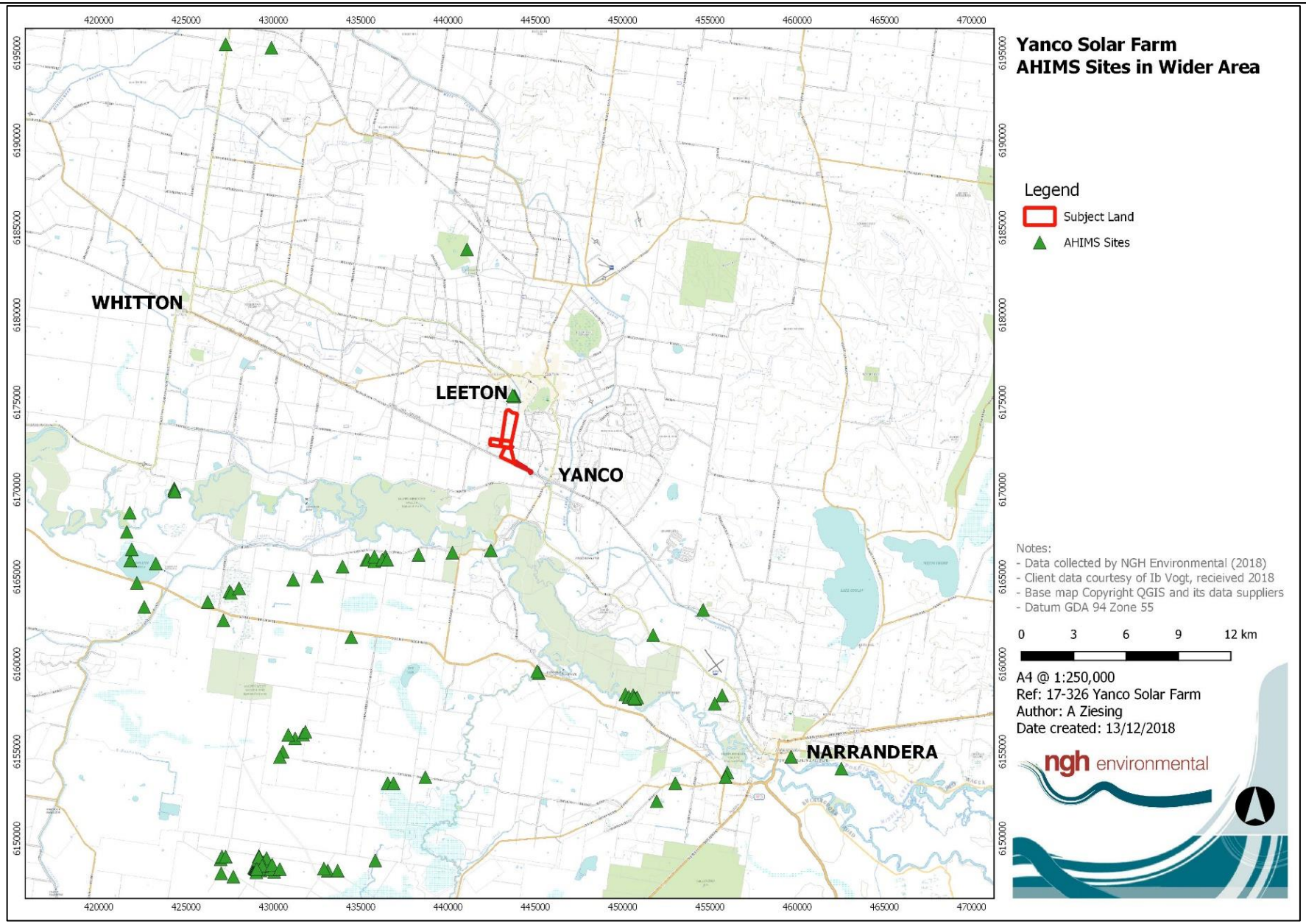


Figure 7-1 Location of AHIMS sites

7.1.2 Site survey

Methodology

The survey strategy was to cover as much of the ground surface as possible within the proposal area. Although the actual ground impact from the construction method for the proposed solar farm is likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites.

The strategy therefore was to walk a series of transects across the proposed solar farm landscape to achieve maximum coverage. Because the proposed solar farm area was arranged in plantings of north-south and/or east-west orange trees and vineyards in evenly spaced rows, transects were spaced evenly between the rows of plantings with the survey team spread apart at 15 to 25 m intervals, walking in parallel lines. The evenly spaced nature of the orange trees and vineyards made this an ideal survey strategy. The team was able to walk in parallel lines, at a similar pace, allowing for maximum survey coverage and maximum opportunity to identify any heritage features.

The survey team consisted of between three and five people, which allowed for approximately 45-125 m wide tracts of the proposal area to be surveyed with each transect depending on the number of survey participants and the spacing of individuals. At the end of each transect, the team would reposition along a new transect line at the same spacing and walk back on the same compass bearing between the orange trees and vineyards. Two people surveyed the proposed transmission line, the widening access routes along Research Road and Toorak Road and intersection upgrades at Toorak Road and Canal Street, Irrigation Way and Canal Street, Toorak Road and Research Road and all associated access points and channel crossings into the proposed solar farm.

While no mature trees remained within the proposed solar panel area the remaining trees along the transmission line route and the Gogeldrie Branch Canal south of Research Road were inspected for Aboriginal modification (cf. Long 2005).

We believe that the survey strategy was comprehensive and the most effective way to identify the presence of Aboriginal heritage sites. Discussions were held in the field between the archaeologists and Aboriginal community representatives to ensure all were satisfied and agreed with the spacing, coverage and methodology.

The initial survey was undertaken on 22nd and 23rd October 2018 by three archaeologists from NGH Environmental with two representatives from the Aboriginal community.

After the initial survey the area for the proposed transmission line was altered to the southern side of Houghtons Road, making it necessary to undertake subsequent fieldwork on 11th December 2018. The same survey method was continued from the initial survey.

Notes were made about visibility, photos were taken, and any possible Aboriginal features identified were inspected.

Survey coverage

The survey was impeded by poor visibility in the orange orchard, however the visibility in the vineyard was quite high, particularly in the field which had recently had the vineyard crop cleared and the paddock ploughed.

The visibility in the orange orchard ranged from less than 5% to 25% with an averaged visibility of 5%. The visibility in the vineyard ranged from 10% to 100% in the recently cleared and ploughed field, with an

average of 40%. Bare ground along vehicle tracks were inspected and all contributed to the effectiveness of the visibility and the survey coverage. The visibility of the disturbed areas along proposed transmission line, road widening, and intersection upgrade areas ranged from less than 5% to 40% with an average visibility of 15%.

Over the course of the field survey, approximately 25 km of transects were walked across the proposal area by each participant. Allowing for an effective view width of 5m each person, this equates to a total surface area examined of 52 ha. However, allowing for the visibility restrictions, the effective survey coverage for the orange orchards is reduced to 1.2 ha, or 1.8% and the effective survey coverage for the vineyard reduced to 9.6 ha, or 8%.

Overall, it is considered that the surface survey of the Yanco Solar Farm proposal area had sufficient and effective survey coverage. The results identified are considered a true reflection of the nature of the Aboriginal archaeological record present within the proposal area.

Results and conclusions

Despite the variable visibility encountered during the survey, no Aboriginal cultural material or objects were found in the initial ACHA survey.

During the subsequent survey for the southern transmission line route, one new isolated artefact (YSF_IF_001) was identified between the south side of Houghtons Road and the channel bank. This site consists of a single fine-grained red silcrete core located in a red cracking clay exposure south of Houghtons Road and 2 m north of the channel bank. The core has three negative flake scars from two platforms with a secondary reduction stage and 15% pebble cortex. The site is heavily disturbed from channel silt dumping and the ground surface visibility is low (30%) due to the low-lying vegetation and surrounding road base gravels (Figure 7-2).

Discussion

The predictions based on the modelling for the proposal area were that stone artefacts were the most likely manifestation of Aboriginal occupation of the area, despite the high level of disturbance. However, the survey identified only one Aboriginal object within the proposal area, suggesting that the level of disturbance was even higher than originally assumed.

Given that most of the proposal area has been levelled and subject to extensive modification, the lack of Aboriginal sites was not unexpected.

The absence of Aboriginal scarred trees in the proposal area was expected and corresponds directly with the lack of remnant old growth trees within and adjacent to the immediate proposal area.

It is also possible that the Aboriginal occupation of the area focused on larger permanent sources of water and resources, such as the Murrumbidgee River and Yarangery Creek to the south of the proposal area. Unfortunately, due to the extensive modifications seen across the proposal area, the construction of channels and prolonged cultivation the pre-European landscape of the area is unable to be established and has been almost entirely disturbed.

In terms of the current proposal therefore, extrapolating from the results of this survey, it is unlikely that *in situ* stone artefacts could occur within the proposed development footprint. Based on the land use history of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the Yanco Solar Farm project area.

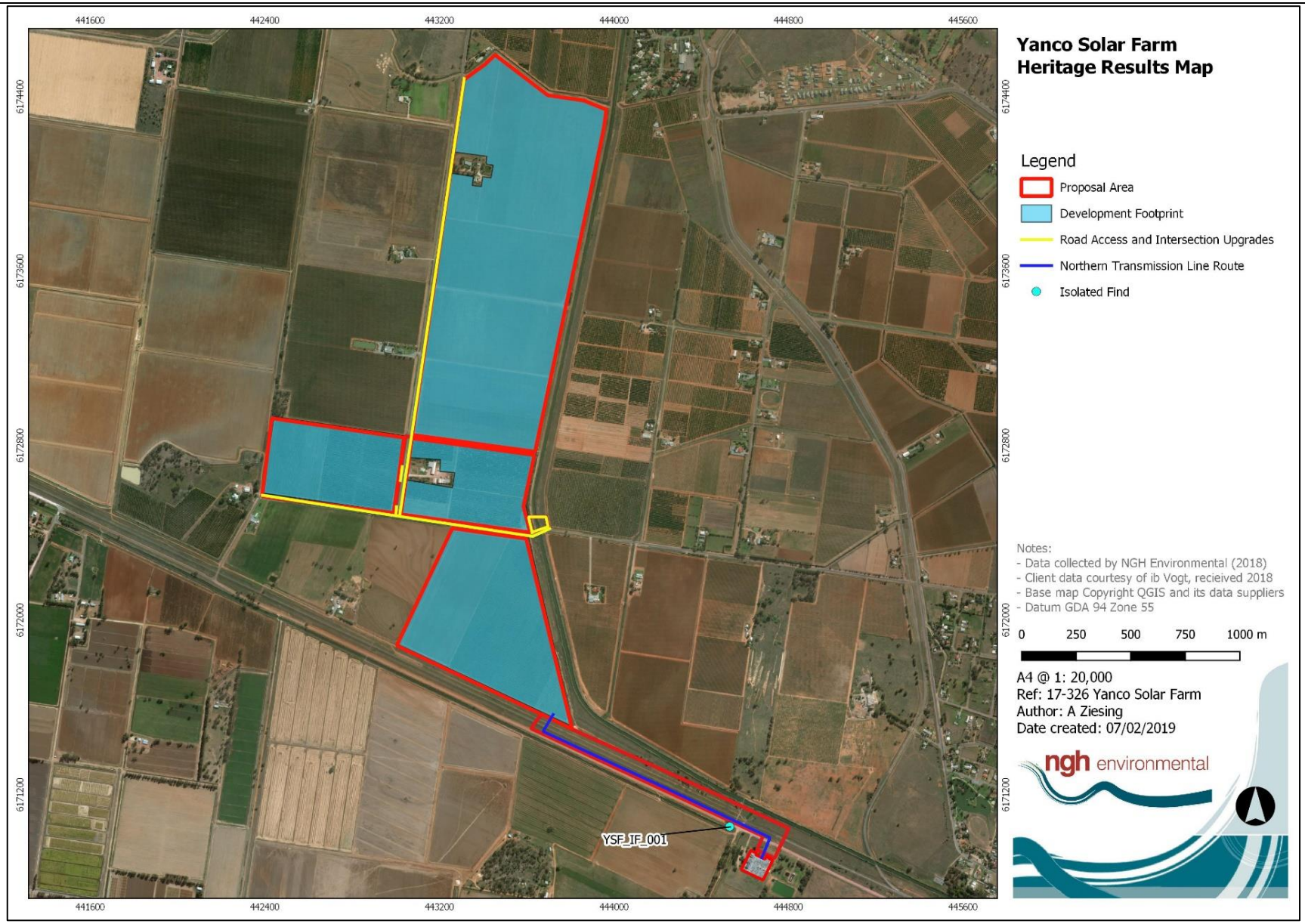


Figure 7-2 Location of recorded site

7.1.3 Potential impacts

Construction

Only one isolated find (YSF_IF_001) was identified within the development area. ib vogt can avoid this site by utilising the proposed northern transmission line route. Therefore, the assessment of harm for the project is nil.

The values potentially impacted by the development are any social and cultural values attributed to the project area by the local Aboriginal community. As described, only one isolated find (YSF_IF_001) was identified within the development area, which will be avoided by utilising the northern proposed transmission line route. Therefore, the impact to values for the project is nil.

Operation

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

7.1.4 Safeguards and mitigation measures

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

Table 7-2 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	The proponent should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	**C**		
AH2	Should any Aboriginal objects be uncovered by the work which is not covered by a valid Aboriginal Heritage Impact Permit (AHIP), excavation or disturbance of the area is to stop immediately and the Office of Environment and Heritage (OEH) is to be informed in accordance with the *National Parks and Wildlife Act 1974* (as amended). Works affecting Aboriginal objects on the site must not continue until OEH has been informed and the appropriate approvals are in place. Aboriginal objects must be managed in accordance with the *National Parks and Wildlife Act 1974.*	**C**		
AH3	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**		
AH4	Avoidance of isolated artefact (YSF_IF_001) be achieved by utilising the proposed northern transmission line route. If the route is altered to the southern transmission line option in the future, then this site should be	**C**		

No.	Safeguards and mitigation measures	C	O	D
	salvaged and reburied outside of the impact corridor in consultation with the Leeton & District LALC.			
AH5	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. The salvage of Aboriginal objects can only occur following development consent that is issued for State Significant Developments and must occur prior to works commencing. A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database. An Aboriginal Site Impact Recording Form must be completed and submitted to AHIMS following harm for each site collected or destroyed from salvage and/or construction works.	**C**		
AH6	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	**C**		

C: Construction; O: Operation; D: Decommissioning

7.2 SOIL

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Land –

Including:

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, 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;

Water –

Including:

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);

DEPARTMENT OF PRIMARY INDUSTRIES

The SEARs should require an accurate assessment of the impacts to current and surrounding agricultural uses and industries and these impacts need to be acknowledged and factored into the development of the EIS. To justify the project's location the SEARs should request:

- *A full soil survey and analysis to ground truth the true nature of the soils.*

7.2.1 Approach

A desktop survey was undertaken of the development site by NGH Environmental, and a field survey was undertaken of 17 representative survey sites by DM McMahon Pty Ltd. Five representative topsoil samples were obtained and analysed at a NATA accredited laboratory for pH and electrical conductivity, cation exchange capacity, exchangeable sodium percentage and dispersion, Colwell phosphorus and phosphorous buffering index, calcium:magnesium ratio and dispersion. The soil sampling sites are shown in Figure 7-3, with those in green sent to the NATA laboratory. The resultant Soil Assessment 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 onsite.

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.

The Soil Assessment is summarised below and provided in full in Appendix I.

Figure 7-3 Soil survey investigation pit locations

7.2.2 Existing environment – Riverina Bioregion

Topography

The Riverina Bioregion includes the alluvial fans of the Lachlan, Murrumbidgee and Murray Rivers west of the Great Dividing Range and extends into central-north Victoria. The landscape of the upper catchment of the bioregion is a series of overlapping, low gradient alluvial fans. The lower reaches of theses rivers are unconfined and transect wide continuous floodplains with overflowing lakes. Discharge from past and present streams control patterns of sediment deposition, soils, landscapes and vegetation (OEH 2018).

The site is situated over the Topographic map sheet Leeton 1:25,000 8128-1N. The site is located at an elevation of approximately 138m AHD. The landform is flat with a slope class of level.

Geology and geomorphology

The site lies within the mapping units Oc3 from the Digital Atlas of Australian Soils (CSIRO, 1991):

Oc3 - Plains with domes, lunettes, and swampy depressions, and divided by continuous or discontinuous low river ridges associated with prior stream systems--the whole traversed by present stream valleys; layered soil or sedimentary materials common at fairly shallow depths: chief soils are hard alkaline red soils

(Dr2.33), grey and brown cracking clays, commonly (Ug5.24) and (Ug5.35), and other (D) soils in a complex soil pattern with the following general features:

(i) well-drained to moderately drained plains of (Dr2.33) with (Db1.33 and Db1.43), often with thin A horizons (<4 in. thick);
(ii) moderately to poorly drained gilgai plains subject to some seasonal flooding of (Ug5.3), (Dr2.33), (Db1.43), (Dy2.33 and Dy2.43), and (Ug5.2) soils;
(iii) poorly drained gilgai plains subject to frequent seasonal flooding of (Ug5.2), (Ug5.3), (Db1.43), (Dy2.43), (Dd1.33 and Dd1.43), and (Ug5.4) soils;
(iv) swampy depressions of (Dd1.33 and Dd1.43), (Db1.43), (Dy2.43), (Dy3.43), and (Ug5) soils;
(v) domes and/or lu. Occurs on sheet(s): 3.

The site geology and lithology are distributed over one unit: Cainozoic alluvium.

Potential contamination

A search of the NSW Environment Protection Authority (EPA) contaminated land public record (NSW EPA 2018) was undertaken for contaminated sites within the Leeton LGA on 13th September 2018. One result was returned, which was a former service (petrol) station in Yanco – 14 Main Ave. At its closest point, the former service station is over 900 m from the development site.

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

One soil characteristic exists at the site, classified using the Australian Soil Classification (ASC) System (Isbell 1996).

Table 7-3 Australian Soil Classification

Australian Soil Classification	
Chromosols	These soils are most 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). 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 7-4.

Table 7-4 Soil analysis results (McMahon 2018)

Description	pH	Salinity rating (EC)	Cation exchange capacity	Exchangeable sodium (Dispersion)	Plant available phosphorus	Phosphorus buffering index	Calcium: magnesium ratio
Topsoil	Slightly acidic to moderately alkaline (6.2 to 7.9)	Very low	Low to moderate	Low	12 to 110 mg/kg (low to high)	64 to 90 (very low to low)	1.5 to 3.1 (low potential for dispersion upon wetting)

Description	pH	Salinity rating (EC)	Cation exchange capacity	Exchangeable sodium (Dispersion)	Plant available phosphorus	Phosphorus buffering index	Calcium: magnesium ratio
Subsoil	Slightly acidic to moderately alkaline (6.3 to 8.8)	Very low	-	Low to nil	-	-	-

Limitations

Management practices can be grouped into management classes of ASC units with Chromosols being represented across the majority of the property in the Oc3 soil landscape. The potential landscape limitations are summarised below in Table 7-5.

Table 7-5 Landscape limitations (McMahon 2018)

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulfate soils	Infrastructure
Chromosol	Predominant across the site	Low	Low	No	Low	No	Low

Results summary

The risk of erosion on-site as a result of construction activities is considered to be low due to low relief and generally low salinity and sodicity of topsoils and subsoils. Excavation of soils should be limited where possible, and excavated subsoil stockpiled and contained to avoid potential dispersion. Ground cover around the structures should be maintained where possible. Maintenance of ground cover will also aid in the prevention of topsoil losses from wind erosion.

Acid sulfate soils were not present on-site and are unlikely to occur due to lack of appropriate landscape characters, such as the dominance of mangroves, reeds, rushes and other marine/estuarine or swamp-tolerant vegetation, low lying areas, back swamps or scalded areas of coastal estuaries or floodplains etc.

Given the majority of soils on site are classified as 'non-sodic' and are of low salinity, the risk of salt build-up in discharge areas is low. However, changing direction of surface waters and any run-on should be avoided as local changes in the water regime are likely to mobilise any salts stores, however low, in the soil. Deep rooted vegetation should be maintained where present and established where absent, and ground clearing should be minimised.

There are two registered groundwater bores within 500 metres of the site boundary. The groundwater bores near the site are for stock and/or domestic use. The groundwater is likely to be in alluvial layers and be responsive to rainfall and recharge events in terms of standing water level and salinity. From a review of the current and proposed site operations the potential impacts on salinity, groundwater and hydrology are thought to be low.

7.2.3 Potential impacts

Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, and cause soil erosion and subsequent sedimentation. Earthworks are required during the construction phase

including for the construction of access roads, compound, laydown and parking areas, pile erection, trenching and boring and fencing:

- Based on a worst-case scenario using the NexTracker system, 36,000 piles at approximately 20 cm x 20 cm will be pile driven into the ground = 0.144 ha of disturbance (0.078 % of the 183.13 ha development footprint).
- 5.7 km of track at 5 m wide = 2.8 ha of disturbance (1.53 % of the 183.13 ha development footprint).
- Substation pad of 80 m x 80 m = 0.64 ha of disturbance (0.35 % of the 183.13 ha development footprint).
- 17 inverter transformer stations of 13 m x 3 m = 0.29 ha of disturbance (0.16 % of the 183.13 ha development footprint).
- 17 battery units of 16 m x 3 m = 0.08 ha disturbance (0.04 % of the 183.13 ha development footprint).

Regarding assumed impacts for the establishment of electricity transmission, it is noted that:

- Where overhead transmission options are utilised, actual soil impacts will be minor, restricted to pole footings and minor compaction due to access.
- Where underground options are utilised, actual impact areas will be greatly reduced; a 3m wide trench will be excavated within a 15m easement.

Excavation of trenches for cabling will also be required up to 1200 mm deep and up to 3000 mm wide.

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. As mentioned above, excavation of subsoils will be limited where possible, and excavated subsoils will be stockpiled and contained to avoid potential dispersion and sediment transfer.

Ground disturbance resulting from the proposal would also be limited, given no major earthworks are required due to low relief of the landscape. Groundcover would be retained as far as practicable prior to and during construction. A Ground Cover Management Plan would be prepared to ensure stability post construction for the operation of the proposal.

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 an inadequate top soil layer. Overall, these impacts would occur in small, discrete parts of the development site and are not considered substantial.

The majority of soils on site are classified as ‘non-sodic’ and are of low salinity. The risk of salt build-up in discharge areas is low. However, changing direction of surface waters and any run-on should be avoided as local changes in the water regime are likely to mobilise any salt stores in the soil. Deep rooted vegetation will be maintained where present and established where absent, with ground clearing minimised.

Pile driving/screwing of steel posts supporting the arrays and the 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. Concrete spill risk is unlikely due to no overland flow paths or waterways present within the development footprint for solar panels and infrastructure.

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 Leeton LGA is not classed as an area identified by NSW EPA mapping as containing naturally occurring asbestos (NOA). Therefore, it is unlikely that the minor earthworks required during construction would impact on any NOA.

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 low erosion risk and retaining vegetation underneath the panels would 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 where possible (wind prevailing).

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 would require traversing 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.

Vegetation and ground habitats are also likely to be affected by reduced insolation and temperature and increased humidity underneath the solar modules. Wind speeds may also be reduced.

Impacts to soils during operation of the Proposal are expected to be minimal and would be limited to the following:

- Localised soil erosion under the panels from rainfall and cleaning water runoff, if ground cover is not maintained beneath the array infrastructure. This is a risk if panels are fixed, but a low risk if panels are tracking. The risk is also influenced by rainfall and groundcover management.
- Ongoing erosion from disturbed areas such as unsealed tracks and drainage structures.

Pasture grasses at the proposed solar array site comprise two physiological groups; cool season C3 grasses and warm season C4 grasses. C4 grasses require more sunlight to drive photosynthesis than C3 grasses and are likely to decline or disappear from under the array.

In the grazed paddocks, existing native and exotic pasture across the site is likely to decline initially due to shading following PV array installation. A reduction in cover may lead to bare ground and susceptibility of the soil to erosion. The selection of a more suitable shade tolerant pasture species for planting would address this issue if bare areas develop.

Soil underneath the PV modules would likely receive less rainfall than surrounding soil. Evapotranspiration losses would also be lower due to shading and reduced air movement. Lateral movement of surface and subsurface water from adjacent rain-exposed areas would be likely to occur. As such, the net amount of moisture available to vegetation under the PV modules should not be substantially altered.

As a function of the work environment and grading activities, relatively long distances (or reaches) of solar developments may be smoothed out to permit the piles/panels to be installed and to promote effective transportation networks. The combination of long reaches and the smooth surfaces may result in an increased runoff velocity. Under pre-development conditions the areas may have had generally similar characteristics. However, without the grading activities, small pockets and depressions may have existed that would capture runoff, reduce flow velocities, provide opportunity for infiltration and/or ensure that not all runoff left the site. Once smoothed out, runoff may not have had these same opportunities, resulting in greater run-off volumes, collecting and then eroding the soils. The maximum distance of runoff as overland sheet flow is around 80 m, at which point it will form concentrated flow. This shallow concentrated flow could extend for several hundred metres and give rise to a number of issues. It is at this point where runoff could form rills and gullies leading to erosion concerns and sediment transport.

Ground cover would be established and maintained in line with the Ground Cover Management Plan.

Through a reduction in cultivation activities, soil disturbance would be decreased, as the site would no longer be tilled or harvested for pasture. On completion of the proposal, further soil disturbance or vegetation removal (exotic pastures or re-established native grasses) would not occur until decommissioning, thus improving overall quality of the soil structure and reducing erosion potential.

7.2.4 Safeguards and mitigation measures

Activities with potential for adverse soil impacts would be managed through the development and implementation of site-specific sediment control plans and spill controls, as detailed below (

Table 7-6).

Table 7-6 Safeguards and mitigation measures for soil impacts

No.	Safeguards and mitigation measures	C	O	D
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plan 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: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation.	**Prior to and during construction**		**D**

	• During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction.			

SO2	A Groundcover Management Plan would be developed in consultation with a soil scientist and/or an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover:
	• Soil restoration and preparation requirements.
	• Species selection.
	• Soil preparation.
	• Establishment techniques.
	• Maintenance requirements.
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements:
	  • Live grass cover would always be maintained at or above 70% to protect soils, landscape function and water quality.
	  • Any grazing stock would be removed from the site when cover falls below this level.
	  • Grass cover would be monitored on a fortnightly basis using an accepted methodology.
	• Contingency measures to respond to declining soil or groundcover condition.
	• Identification of baseline conditions for rehabilitation following decommissioning.
		Pre-construction		

SO3	The array would be designed to allow sufficient space between panels to establish and maintain ground cover beneath the panels and facilitate weed control.	**Design stage**		
SO4	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 soil, and health and safety of firefighters and first responders in the case of a hazardous spill.	**C**	**O**	**D**
SO5	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: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation).	**C**	**O**	**D**

	• 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.			
SO6	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.	**C**	**O**	**D**
SO7	Sodic soil should be treated with gypsum where required.	**C**		
SO8	Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation control: • Preserve and stabilise disturbed areas, drainageways and steep slopes. • Minimise the extent and duration of disturbance. • Install perimeter controls. • Employ the use of sediment control measures to prevent off- and on-site damage. Inspect and maintain sediment and erosion control measures regularly. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. • Provide access and general construction controls.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.3 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER) AND HYDROLOGY

SECRETARY'S ENVIRONMENTAL ASSESSMENT 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, 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;*

Water –

- *An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including the Murrumbidgee River, Guises Creek, irrigation canals, drainage channels, wetlands, riparian land, farm dams, 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);

DEPARTMENT OF INDUSTRY

DOI Water –

- *The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.*
- *A detailed and consolidated site water balance.*
- *Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.*
- *Proposed surface and groundwater monitoring activities and methodologies.*

7.3.1 Existing environment

Surface water

The development site is in the Riverina Local Land Services area, situated in the Murrumbidgee River Catchment. The development site is located approximately 3.5 km north of the Murrumbidgee River and approximately 300 m north of Guises Creek, with manmade irrigation channels surrounding the development site (Figure 7-4). No natural watercourses or prescribed streams run through the development site.

The proposal site is located in the Murrumbidgee Irrigation Area and several irrigation channels run through the development site. These irrigation channels are involved in existing agricultural activities on the subject land. Irrigators in the MIA have licences which allow them to use a prescribed amount of water each year. The natural hydrology of the site has been largely replaced by irrigation and drainage channels, and storage dams. There would be no removal of irrigation channels throughout the proposal site.

In addition to irrigation channels, four farm dams are located within the development footprint (Figure 7-5).

Figure 7-4 Irrigation canal

Figure 7-5 Typical farm dam

Murrumbidgee Catchment Area

The Murrumbidgee catchment covers 84,000 square kilometres, around 8% of the Murray-Darling Basin (DoI 2018). It is bordered by the Great Dividing Range, the Lachlan catchment and the Murray catchment. The river itself spans almost 1,600 km and meets the Murray River near Balranald. A series of regulated creeks that comprise the Yanco Creek system receive water from the Yanco Creek off-take at the confluence of the Murrumbidgee River and Yanco Creek. The off-take is located in the middle reaches of

the Murrumbidgee River. Flow of the Yanco Creek system is in a south-westerly direction where it eventually joins the Murray River (OoW 2011).

The catchment supports approximately 520,000 people and includes the Australian Capital Territory and Canberra, Wagga Wagga, Cooma, Tumut, Narrandera, Griffith, Leeton (Yanco), Hay and Balranald. Major irrigation districts have been developed in the middle of the catchment surrounding Griffith and Leeton. The irrigation area provides 25% of NSW fruit and vegetable production, 42% of NSW grapes and half of Australia's rice production (OoW 2011).

Murrumbidgee Irrigation Area

The MIA covers an area of 660,000 ha of which about 170,000 ha is irrigated. Water is supplied by Burrinjuck and Blowering Dams in the upper Murrumbidgee Catchment. Water released from Burrinjuck and Blowering Dams flows down the Murrumbidgee and Tumut Rivers to their confluence near Gundagai, then continues to flow down the Murrumbidgee River to Berembed Weir. Water is diverted from the weir to Bundidgerry Storage, which is the start of the irrigation canal system owned by Murrumbidgee Irrigation. The main canal feeds supply channels that take irrigation water to farms (Murrumbidgee Irrigation 2017).

The next significant point is the Yanco Regulator. The Gogeldrie Branch Canal diverts water off the Main Canal through the back of Yanco to Leeton, directly adjacent to the proposal.

Flooding

The development site is located within the Murrumbidgee River Catchment. The site is situated on flat terrain at an elevation of 140 m ASL. The development site is not mapped as flood prone, or within a wetland, riparian land or watercourse in the Leeton LEP (NSW Government 2014).

Flood depth mapping across the proposal (Figure 7-6) was provided by Leeton Shire Council. Since 5th October 2017 when the map was produced, the boundaries of the proposed solar farm have changed. The current proposal is for site 1 and the four land parcels in site 2, west of Gogeldrie Branch Canal. Site 3 is no longer part of the proposed development site.

Hydraulic results from the Leeton Shire Flood Study Volume 1 - Report (LSC 2015) indicate that the majority of flooded areas in Yanco are assigned to the low hazard category. Flood mapping (Figure 7-6) shows that some areas of the proposal would be impacted by flood water for a 1% AEP to a depth of less than 0.25 m.

Groundwater

The proposal is situated above the Lower Murrumbidgee Alluvium and is comprised of:

- A shallow alluvial layer of yellow and brown poorly sorted sand and clay sediments (Shepparton Formation) to a depth of around 50 – 70 m below the ground surface. The shallow alluvium contains the shallow aquifer, which extends to a depth of 40 m below the ground surface or to the base of the Shepparton Formation (DoI 2018). Recharge to shallow aquifer occurs through vertical downward movement of water from the river system and its tributaries, infiltration of rainfall and irrigation water and through-flow from the Mid Murrumbidgee Aquifer (DoI 2018).
- A deep alluvial layer of pale grey to white sand layers with grey and white clay lenses lies beneath the Shepparton Formation and is comprised of the Calivil Formation and the Renmark Group. The depth of this layer is from approximately 40 m to 400 m below ground level (DoI 2018). Recharge of the deep aquifer is via through-flow from the Mid Murrumbidgee Deep Alluvium and vertical leakage from the shallow aquifer (DoI 2018).

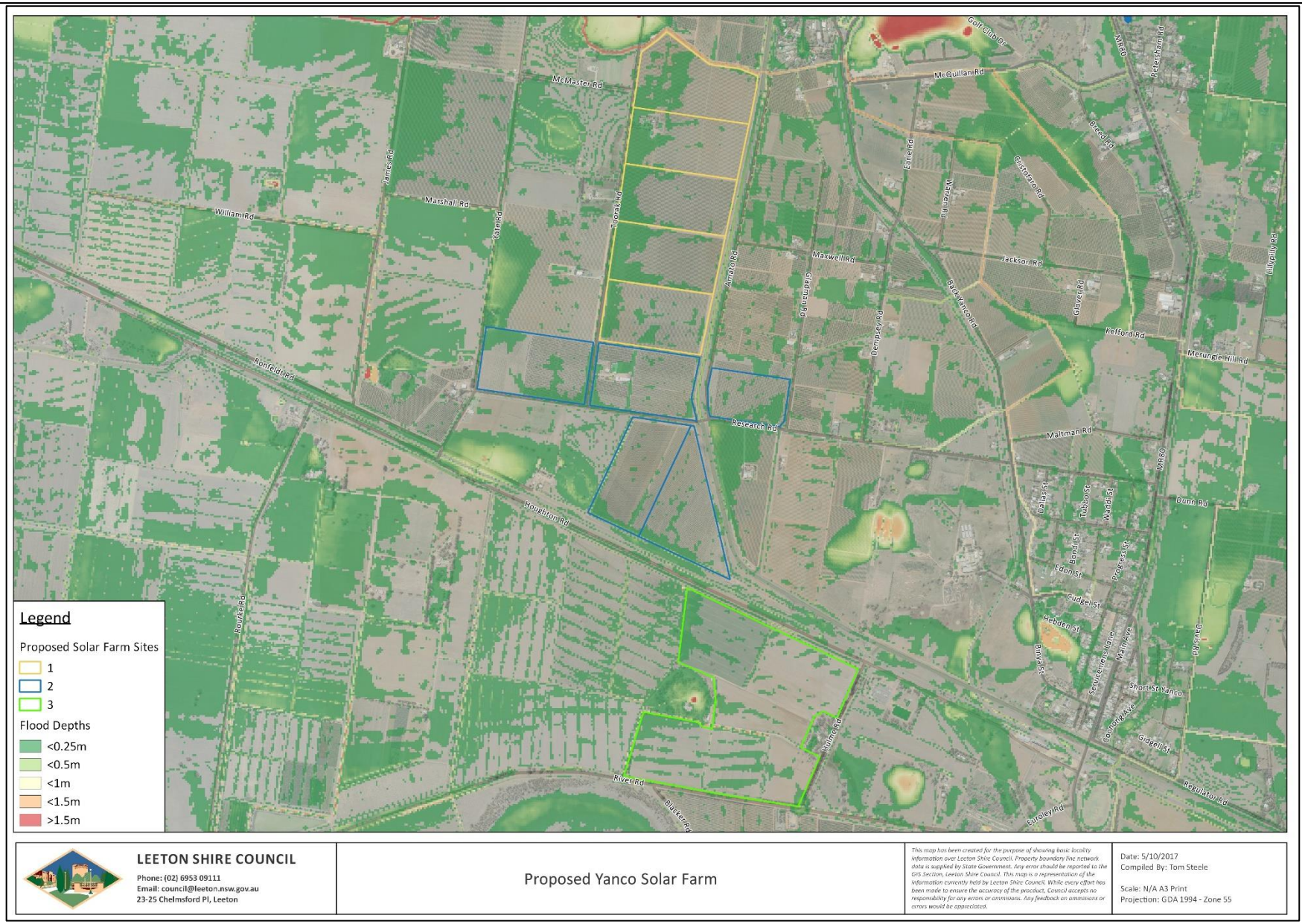


Figure 7-6 Flood depths for a 1% Annual Exceedance Probability flood event (Leeton Shire Council)

Groundwater of the Lower Murrumbidgee Alluvium generally flows westward or downstream through the shallow and deep aquifers. It is under a losing condition over a considerable length, particularly due to the redistribution of Murrumbidgee River flow through the off-take for the Yanco Creek system and Colombo Creek (DoI 2018).

The Lower Murrumbidgee Alluvium was identified as a high-risk groundwater system in 1998. Over-allocation, localised drawdown, interference between bores and saline leakage into aquifers were identified as major risks (DoI 2018). Total groundwater entitlements have been reduced from 514.6 GL to 270.0 GL (DoI 2018).

There are two bores within 500 m of the development site with Bore IDs GW058303 and GW0405004. Both are used for Stock and Domestic water supply. Data is available for GW058303 and indicates that the drill depth is 10.40 m with a standing water level of 2.10 m and a good rating against salinity.

No free groundwater or seepage was observed during pit excavations for the soil survey (refer to section 7.2). The maximum depth of excavations at the site was 1.4 m.

Bores

The NSW DPI database of groundwater lists multiple bores within and adjacent to the development site (Figure 7-7). The majority of these are listed as private domestic bores and/or irrigation bores.

Groundwater Dependent Ecosystems (GDEs)

Potential GDEs within the vicinity of the development site are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM 2018a). There is no listed aquatic or terrestrial GDE sites within the development site (Figure 7-8). The closest aquatic GDE is located approximately 1.5 km south of the development site and comprises the Murrumbidgee River and associated riparian zone. Small patches of terrestrial GDE of low potential surround the development site.

The development site is, however, mapped as Groundwater Vulnerable in the Leeton LEP.

Aquatic Biodiversity

Species that could potentially be impacted under the *Fisheries Management Act 1994* were assessed in Table 7-7 (with all marine and coastal species excluded). It was determined that there would be no impact to aquatic biodiversity as a result of the proposed works as the irrigation channels would be retained on-site.

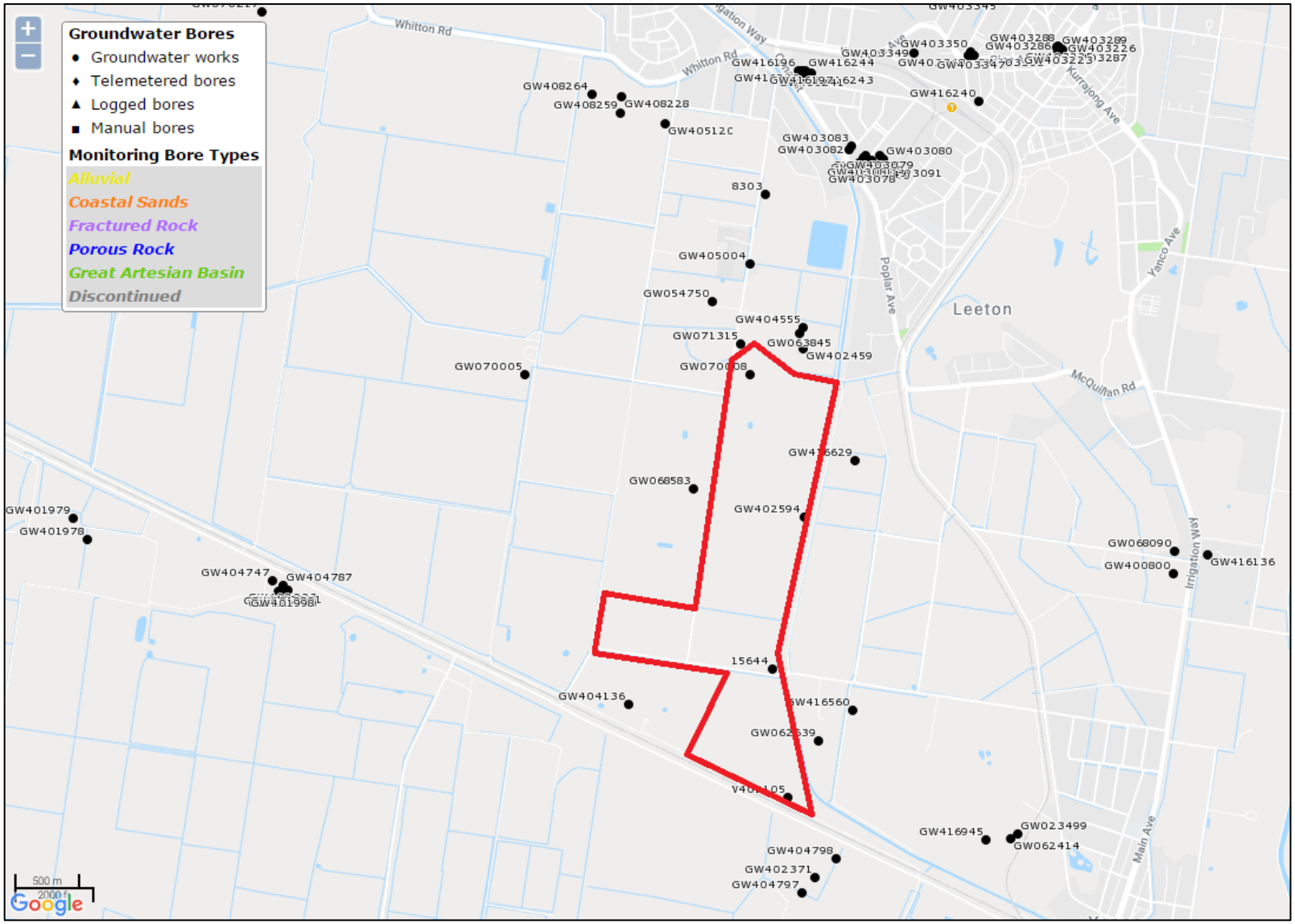


Figure 7-7 Groundwater works in the area (NSW DPI 2018). *The solar subject land boundary is indicated by the red line.*

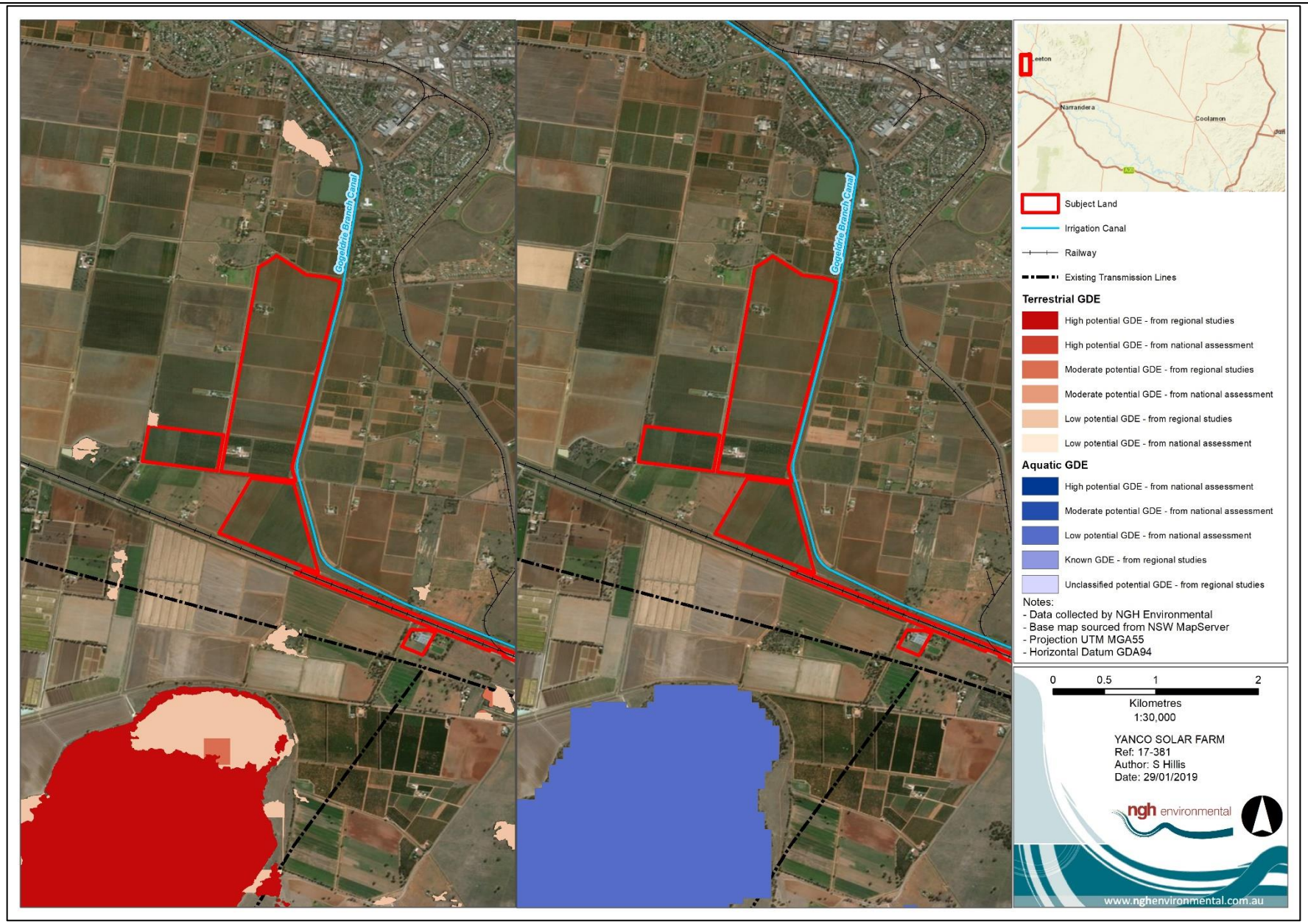


Figure 7-8 Terrestrial and aquatic GDEs in proximity to the development site

Table 7-7 Habitat assessment for threatened species listed under the *Fisheries Management Act 1994.*

Species and Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Fish				
Flathead Galaxias *Galaxius rostratus* CE EPBC CE FM	Below 150 m in altitude. Billabongs, lakes, swamps, and rivers, with preference for still or slow-flowing waters.	**Yes** Permanent irrigation channels below 150 m AHD.	**Unlikely** Within species distribution, however assumed extinct within the Murrumbidgee catchment.	**No** Irrigation channels will not be impacted by development.
Murray Hardyhead *Craterocephalus fluviatilis* 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.	**No** No lakes, backwaters, billabongs with deep water.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Stocky Galaxias *Galaxias tantangara* CE FM	Small, cold, clear and fast-flowing alpine creek, flowing through open forest of eucalypts, low shrubs and tussock grass.	**No** No alpine creeks.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Australian Grayling *Prototrocetes marena* 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.	**No** No coastal habitat.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.

[1] 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[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Eastern Freshwater Cod *Maccullochella ikei* E FM	Clear flowing rivers with rocky substrate and large amounts of in-stream cover.	**No** No flowing rivers with rocky substrate or cover.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Oxleyan Pygmy Perch *Nannoperca oxleyana* E FM	Coastal lowlands, mostly coastal floodplains in swamps, creeks and lakes of coastal Banksia heath.	**No** No coastal habitat.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Southern Pygmy Perch *Nannoperca australis* E FM	Slow-flowing waters and still, well vegetated habitats in small streams, lakes, billabongs and wetlands.	**No** No suitable slow-flowing or still permanent water with abundant in-stream vegetation.	**Unlikely** Outside species known distribution.	**No** No suitable habitat in study area.
Southern Purple Spotted Gudgeon *Mogurnda adspersa* 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.	**No** No suitable slow-flowing or still permanent water with permanent aquatic or overhanging vegetation.	**Unlikely** Outside current known species distribution.	**No** No suitable habitat in study area.
Trout Cod *Maccullochella macquariensis* E FM	Areas with large in-stream woody debris.	**No** No suitable permanent water with large woody debris.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Murray Cod *Maccullochella peelii* V EPBC	Slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs.	**No** No deep, slow-flowing streams or rivers or suitable habitat.	**Likely** Within species distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Macquarie Perch *Macquaria australasica* 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.	**No** No deep water with plenty of cover.	**Likely** Within species distribution.	**No** No suitable habitat in study area.
Silver Perch *Bidyanus bidyanus* V FM	Faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin.	**No** No fast-flowing water.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Darling River Hardyhead population in the Hunter River catchment *Craterocephalus amniculus* 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.	**No** Outside Hunter River catchment.	**No** Outside population distribution.	**No** Population not in study area.
Murray-Darling Basin population of Eel-tailed Catfish *Tandanus tandanus* 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.	**Possible** Small freshwater dams with sand/mud substrate.	**Unlikely** Not recorded in locality.	**No** Species not recorded in locality.
Snowy River population of River Blackfish *Gadopsis marmoratus* EP FM	Clear flowing streams with good instream cover such as woody debris, aquatic vegetation and undercut banks.	**No** Outside Snowy River catchment.	**No** Outside population distribution.	**No** Population not in study area.

Species and Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Western population of Olive Perchlet *Ambassis agassizii* EP FM	Western (Murray-Darling) population is limited to a few localities in Darling drainage upstream from Bourke.	**No** Outside Darling drainage system upstream from Bourke.	**No** Outside population distribution.	**No** Population not in study area.
Invertebrates				
Darling River Snail *Notopala sublineata* CE FM	Darling River and its tributaries. Artificially introduced hard surfaces including irrigation pipelines.	**Yes** Artificial surfaces in waterways (irrigation pipelines).	**Unlikely** Outside species distribution.	**No** Outside species distribution.
Hanley's River Snail *Notopala hanleyi* CE FM	Artificially introduced hard surfaces including irrigation pipelines. Well oxygenated waters throughout the Murry River catchment.	**Yes** Artificial surfaces in waterways (irrigation pipelines).	**Unlikely** Outside species distribution.	**No** Outside species distribution.
Fitzroy Falls Spiny Crayfish *Euastacus dharawalus* CE FM	Creates burrows in soft stream bed below waterline.	**No** No suitable permanent streams.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Murray Crayfish *Euastacus armatus* 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.	**No** No permanent lotic habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Adams Emerald Dragonfly *Archaeophya adamsi* E FM	Narrow, shaded riffle zones with moss and abundant riparian vegetation in small to moderate sized creeks with gravel or sandy bottoms.	**No** No suitable narrow, shaded riffle zones.	**No** Outside species distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Sydney Hawk Dragonfly *Austrocordulia leonardi* E FM	Deep river pools with cooler water and permanent flow.	**No** No deep water or permanent flow.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Alpine Redspot Dragonfly *Austropetalia tonyana* V FM	Amongst rocks, logs and moss within the splash zone of waterfalls or in the nearby stream edge.	**No** No waterfalls or rocky streams.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Buchanans Fairy Shrimp *Branchinella buchananensis* V FM	Lake Buchanan in southwest Queensland, and Gidgee and Burkanoko Lakes in northwest NSW.	**No** No lake habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Endangered Ecological Community				
Lowland Darling River aquatic ecological community 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.	**No** Not in Darling River catchment.	**No** Outside community distribution.	**No** No suitable habitat in study area.
Lowland Lachlan River aquatic ecological community 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.	**No** Not in Lachlan River catchment.	**No** Outside community distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[1]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Lowland Murray River aquatic ecological community 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.	**Yes** Ephemeral stream is tributary of Murrumbidgee River.	**Unlikely** Within community distribution.	**No** No riparian vegetation impacted.
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.	**No** Not in Snowy River catchment.	**No** Outside community distribution.	**No** 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.*

7.3.2 Potential impacts

Construction and decommissioning

WATER USE

Water use during construction would be minimal and largely used for dust suppression on unsealed roads and for the construction of new roads. The water requirement would vary, dependent on weather conditions, and is estimated to be up to 38 ML in total. About 54 kL of potable water would be required for employees and contractors (refer to Table 7-8).

Table 7-8 Water requirements during construction

Water quality	Annual construction water requirement (ML)	Potential sources	Availability
Potable (drinking)	0.54 (for ~10 months)	Bottled water	Available as required – commercial supply
Non-potable	38 (for ~10 months)	Direct pump from groundwater bore.	Purchase from landowner

All non-potable water required during construction would be sourced from an existing groundwater bore, to be purchased from the landowner (licencee of WAL 11905).

SURFACE WATER QUALITY

Construction of the proposal would not directly affect surface water quality due to the physical barriers lining both sides of the irrigation canals that are adjacent to and within the subject land. The banks of the irrigation channels are around 1.5 to 2 m in height and will divert stormwater runoff away from the canals. During construction, the dams within the development footprint will be filled in, thereby reducing the impact to surface water quality.

Construction of the proposed overhead transmission line would occur away from the banks of the irrigation channel, with under-boring required for cabling. Any works within the canals would be completely avoided.

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 7.2.3 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.

Retention ponds, if required, to manage surface water during construction and operation, would 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 7.2.4.

GROUNDWATER

It is unlikely that ground water would be extracted or intercepted during construction. If required, a licence will be obtained for water extraction. The proposal is mapped as having groundwater vulnerability under the Leeton LEP (NSW Government 2014). 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

Water use volumes during operation would be minimal, at approximately 54 kL per year. Water would be required for staff amenities at the control and maintenance building and for panel cleaning. Requirements would be extremely minor except for cleaning, which is fully dependant on weather. Some solar plants are never cleaned, others require more than two cleanings per year. Water would be sourced from an existing domestic bore located on the site (currently used for stock and domestic purposes).

The toilet facilities would be connected to a septic tank installed in line with Leeton Shire Council requirements. Approval under Section 68 of the *Local Government Act* is required to operate an onsite sewage management system.

Additional water infrastructure may be required if the proponent makes the decision to use livestock to control vegetation beneath the solar panels and around the subject land. Additional infrastructure could include pipes and troughs. Water would be accessed from the current water licence for the property, from Murrumbidgee Irrigation.

SURFACE 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.

SITE WATER BALANCE

The size of the subject land is 187 ha and contains four farm dams and irrigation channels. The farm dams are currently a constraint for the solar farm and would be filled in. A site water balance has been calculated for the proposal once in operation with the existing irrigation channel and no farm dams. The subject land would remain vegetated except for internal access tracks and the hardstands and building footprints. The subject land for the substation would remain vegetated except for the existing concrete hardstand and the existing internal gravel roads. The substation has been included separately in these calculations as the infrastructure already exists, however the lot will be leased as part of the development. The runoff coefficient was used from the Wagga Wagga City Council Engineering Guidelines (WWCC 2017) as this information was not available for Leeton. The engineering guidelines were developed from work involving Wagga Wagga, Griffith, Albury and other Councils. The conservative runoff coefficients that have been used are presented in Table 7-9.

Table 7-9 Runoff coefficients

Feature	Fraction impervious	Runoff coefficient
Subject land	0.0	0.18
Concrete hardstands	1.0	0.86
Building rooftops	1.0	0.86

Feature	Fraction impervious	Runoff coefficient
Compacted gravel hardstands and roads	0.8	0.72

Water balance calculations used decile 5 rainfall statistics sourced from the Yanco Agricultural Institute site (station number 074037, 34.62°S, 146.43°E) (www.bom.gov.au), which has a continuous record for 62 years. Table 7-10 presents the land size, annual average precipitation volume and runoff for each feature.

Table 7-10 Site water balance for the operational phase of the proposed Yanco Solar Farm

Feature		Fraction impervious	Size (m^2)	Annual decile 5 precipitation (m^3)	Annual runoff (m^3)	Comment
Subject land		0.0	1800870	7113436	1280418	Vegetated component of subject land, including beneath panels.
Canal		-	8647	34155	34155	100% of the precipitation on to the channel will leave the site.
Internal gravel roads		0.8	39490	140185	100933	
Gravel compound areas		0.8	27800	10981	79063	
Inverter and battery concrete hardstands		1.0	2202	8697	7480	
Permanent building footprint		1.0	4650	18367	15796	20 m^3 would be stored in a rainwater tank for firefighting purposes.
Substation	Subject Land	0.0	28979	114467	20604	Vegetated component of subject land less the roads and the hardstand.
	Concrete hardstand	1.0	10431	41202	35434	Existing
	Gravel roads	0.8	1537	6071	4371	Existing
Total (m^3)			1,914,281	7,561,406	**1,560,306**	

A total of 7561.4 ML of rainfall is within the boundary of the subject land for the development and the existing substation. Of this volume of rainfall, 20% or 1560.3 ML is runoff due to the impervious nature of the materials or compaction of the gravel roads, hardstands and buildings. The only water storage onsite would be a 20 ML rainwater tank that will be used for fire-fighting purposes. The majority of the site would remain vegetated and uncompacted and therefore, remain pervious.

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 7-11 below.

Table 7-11 Impacts of the proposal on flooding.

Potential impact	Assessed by this EIS
Interactions of project elements (such as security fencing, hard stand areas, solar panel piles, footprints of switching room and permanent buildings) and impact upon flood waters.	• The framing used to hold the solar arrays has a very small footprint. It is unlikely they will have an impact on flood behaviour. Flood height would need to exceed 1 m before anything other than the pile is affected by floodwater. The 17 inverter/transformer units and 17 customised battery storage units attached will be installed on footings, 0.3 m above the ground. • The site office, switch room and storage shed will be built on concrete footings 0.3 m above ground level on the gravel switching station hardstand. • Hard stand areas (e.g. gravel roadways, gravel compound areas and concrete hardstands) are minimal and are unlikely to impact flood behaviour. Stormwater flooding will increase by around 20% due to the additional of the beforementioned impervious surfaces. • The permanent buildings already exist on site. The only additional building infrastructure would be the switching room. The footprint of the switching room is 75 m^2. The footprint of the switching room is small and unlikely to impact flood behaviour. A tank will be attached to the permanent buildings for fire-fighting with a capture potential of 20 m^3. • Security fencing would be around 2 m high and surround the perimeter of the proposal. It is unlikely that this infrastructure would have an impact on floodwater, with potential flood heights for a 1% AEP to 0.25 m. On-site floodways will assist in the removal of floodwater.
Location of critical infrastructure in relation to flood storage areas.	• The irrigation channels throughout the site will act as floodways. Infrastructure will be limited in these areas; refer to the constraints map in Appendix B. • Removal of on-site flood storage areas will result from the filling of the four dams within the development footprint. Infrastructure would replace the flood storage locations.

GROUNDWATER

No operational activities would affect groundwater. There would be no impacts to GDEs during operation.

7.3.3 Safeguards and mitigation measures

Table 7-12 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 would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	**C**	**O**	**D**

No.	Safeguards and mitigation measures	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 through toolbox talks for the minimisation and management of accidental spills.	**C**		**D**
WA6	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	**C**	**O**	**D**
WA7	Ensure appropriate drainage controls are incorporated into the design.	**Design stage**		
WA8	If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.4 TRAFFIC, TRANSPORT AND ROAD SAFETY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Transport –

Including an assessment of the site access route (including Sturt Highway, Newell Highway, Irrigation Way, Research Road, Main Avenue, Audley Street and Toorak Road), site access point, 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 SERVICES REQUIREMENTS

Given the scale and operational characteristics of the proposed development RMS considers that 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.

RMS 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. For such a development an assessment of the potential traffic impacts on the surrounding road network due to the development, particularly during the construction phase, should be submitted with the Development Application. The required contents and detail of the Traffic Impact Assessment (TIA) will depend on the scale of the proposed development, the characteristics of the potential traffic generation and the traffic volumes and other traffic generating influences on the surrounding public road network.

Given the potential volume of traffic and the need for deliveries of the components to the development site during the construction period, a Transport Management Plan for the construction activity should also be prepared for the proposed development. Details for deliveries of ancillary materials such as gravel and concrete should also be considered as part of the submitted documentation.

The TIA 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. Where road safety concerns are identified at a specific location along the haulage route/s, the TIA may be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.

For guidance in the preparation of the TIA the applicant 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 Austroads Guide to Traffic Management Part 3 – 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 motorist be addressed in the development submission. Consideration could be given to the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.

LEETON SHIRE COUNCIL REQUIREMENTS

The Transport Assessment report is to also include a review on the possible use and impact on the following additional local roads: Houghtons Road and Binyah Street. The proposed inclusion of Audley Street is considered to not be warranted at this stage.

7.4.1 Existing environment

Regional road network

Irrigation Way (Main Avenue) is classified as a state arterial road under the care and management of RMS, which generally runs in a north-south alignment in the vicinity of Yanco. It has a varying carriageway width along its length, accommodating one traffic lane in each direction. Near the intersection of Irrigation Way / McQuillan Road, Irrigation Way has a posted speed limit of 60km/h.

Local road network

McQuillan Road is a collector road under the care and management of Leeton Shire Council (Council) that runs in an east-west alignment between Irrigation Way and Racecourse Road. It has a road width of approximately nine metres, accommodating one traffic lane of approximately 3.5 metres width in each direction. McQuillan Road has a posted speed of 60km/h.

Canal Street (Poplar Avenue / Racecourse Road) extends on from McQuillan Road and has a general north-south alignment. Canal Street also has a road width of approximately nine metres, with one traffic lane of approximately 3.5 metres wide in each direction. Canal Street has a posted speed of 60km/h, with a school zone of 40km/h during school days from 8:00-9:30am and 2:30-4:00pm located adjacent to the MET private school.

Toorak Road is a local road under the care and management of Council that generally runs in a north-south alignment. It has a road width of approximately seven metres, accommodating one lane of traffic in each direction. Toorak Road has a posted speed limit of 80km/h. There are two canal crossings located along Toorak Road, each with a road width of approximately seven metres.

Research Road is a local road under the care and management of Council that runs in an east-west direction within the vicinity of the site. Near the site, it has a sealed road width of approximately 7.5 metres, accommodating one traffic lane in each direction. Research Road has a posted speed limit of 100km/h.

There is a bridge crossing which connects Canal Street and Toorak Road, controlled via unsignalised intersections on each end of the bridge. The crossing has a road width of approximately 7.2 metres, with one traffic lane in each direction.

7.4.2 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.
- 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 local pick up of materials.
- Trucks – would be used to transport equipment and materials around the site and for local pick up of materials. Larger sized deliveries would be undertaken by trucks as opposed to utility vehicles.
- Standard articulated trucks – would be used to transport approximately 12 metre 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 would be required to access the following locations:

- Around the perimeter of the solar farm.
- Site office/compound.
- Construction equipment laydown area.
- Transmission line route.
- Switching station.

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 receivers.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by 'platooning' of construction traffic.

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 most direct route would likely include the South Western Motorway (M5), the Hume Highway (M31), the Olympic Highway (A41), Goldfields Way (B85), Canola Way, Newell Highway (A39), and Irrigation Way (Main Street). From Melbourne, the route would likely include the Hume Highway (M31), Goulburn Valley Way (M39/A39) and Irrigation Way.

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

It is anticipated that the delivery of PV panels will occur over an approximate 40 week construction period, generating up to 36 trucks daily during the peak construction period. The largest design vehicle expected to access the site is a 19m AVs (Articulated Vehicles as defined in AS2890.2:2002) and 50 tonne capacity. It is noted that majority of construction vehicles are expected to be 19m AVs or smaller. Any oversize or overmass vehicles will require a permit with the NHVR.

The total expected peak construction traffic generation resulting from the proposed development is 96 vpd, comprising 20 light vehicle movements per day and 72 heavy vehicle movements per day. It is understood that the heavy vehicle movements will be scheduled throughout the day, resulting in a steady distribution of construction traffic to/from the site, and minimising simultaneous heavy vehicle

movements. Assuming an eight-hour delivery window, this results in approximately nine heavy vehicle movements to/from the site during peak construction periods, or 9 vph.

The majority of light vehicle movements are expected to occur prior to and following the delivery window, with a tidal flow of arrivals during the morning and departures during the afternoon / evening.

INCREASED COLLISION RISK

The increased collision risk relates primarily to traffic entering and exiting the site from Toorak Road and Research Road, in particular the entrance on Research Road due to poor line of sight.

Based on a 100 km/hr speed limit and a reaction time of 2 seconds, a safe intersection sight distance of 248 m is required in accordance with the Austroads 2010 *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*. At the Research Road access intersection, there is not sufficient sight distance for existing turning vehicles. Accordingly, the sight distance at the access is not considered acceptable without signalised traffic management.

DAMAGE TO ROAD INFRASTRUCTURE

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. The impact is expected to be negligible due to the existing capacity of the road network. However, the impact of turning traffic at the Toorak Road and Research Road intersections would likely require monitoring after the upgrade, to ensure that the road is maintained in an adequate condition.

All road upgrade works would meet the requirements of Leeton 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

Dust on the haulage route is unlikely to impact surrounding residences and motorists due to the access route being entirely sealed.

DISRUPTION TO EXISTING SERVICES

Increased traffic along Irrigation Way (Main Street) during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along the road. These disruptions would be short term only to provide traffic control during road work.

SUMMARY OF CONSTRUCTION AND DECOMMISSIONING IMPACTS

Overall, the additional traffic associated with the construction and decommissioning of the proposal would be a small component of the existing traffic loads on local and state roads. 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 the operational phase of the project, there is expected to be in the order of two light vehicles accessing each of the Toorak Road sites (the same two vehicles) per day, reducing to an expected average of one vehicle per day after the first year following completion of construction. 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 proposal area.

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.

It is important to note that traffic numbers will decrease during the operational phase of the proposal, due to the cessation of agricultural activities in the immediate area.

Additional risks to road safety from operational traffic would be minimal.

7.4.3 Safeguards and mitigation measures

Table 7-13 Safeguards and mitigation measures for traffic, transport and safety impacts

No.	Safeguards and mitigation measures	C	O	D
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Direction of traffic flow (both heavy and light). • Loads, weights and length of haulage and construction related vehicles and the number of movements of such vehicles. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).	**C**	**O**	**D**
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan will be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan would include, but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network to be undertaken in consultation with Council. • Assessment of road condition prior to construction on all local roads that would be utilised. • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the project especially at the access site along Research Road. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. • A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the Code. • Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads to minimise dust generation through increased traffic use. • 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.			
TT3	Obtain a Section 138 Consent from the relevant council/agency to perform works within the road reserve.	**C**		
TT4	The proponent would continue consultation with Leeton Shire Council regarding the proposed access sites on Toorak Road and Research Road. The intersection upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT5	The proponent would consult with RMS, Crown Lands, Murrumbidgee Irrigation and Leeton Shire Council regarding any road upgrades. Upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT6	The proponent must engage an appropriately qualified person to prepare a Road Dilapidation Report for all road routes to be used during the construction (and decommissioning) activities, in consultation with the relevant road authority. This report is to address all road related infrastructure. Reports must be prepared prior to commencement and after completion of construction (and decommissioning). Any damage resulting from the construction (or decommissioning) traffic, except that resulting from normal wear and tear, must be repaired at the Proponent's cost. Such work shall be undertaken at a time agreed upon between the Proponent and relevant road authorities.	**Pre-construction**		**D**
TT7	Prior to the commencement of construction on-site, the Proponent must undertake all works to upgrade relevant state roads, their associated road reserve and any public infrastructure in that road reserve to a standard suitable for use by heavy vehicles to meet any reasonable requirements that may be specified by RMS. The design, specifications and construction of these works must be completed and certified by an appropriately qualified person to a standard to accommodate the traffic generating requirements of the project. On Classified Roads the geometric road design and pavement design must be to the satisfaction of the RMS.	**Pre-construction**		**D**
TT8	For works on the State road network the developer is required to enter a Works Authorisation Deed (WAD) with RMS before finalising the design or undertaking any construction work within or connecting to the road reserve. The WAD documentation is to be submitted for each specific change to the state road network for assessment and approval by RMS prior to commencement of any works within the road reserve.	**Pre-construction**		

C: Construction; O: Operation; D: Decommissioning

7.5 CLIMATE AND AIR QUALITY

7.5.1 Existing environment

Climate

The Leeton LGA is part of the Riverina Bioregion of NSW, which generally experiences a dry semi-arid climate with hot summers and cool winters (OEH 2016). Seasonal temperatures vary little across the bioregion. Highest rainfall occurs in May and September (OEH 2016).

The closest Bureau of Meteorology Weather Station is Yanco Research Station, located approximately 4km south-east of the development site. Mean annual maximum temperature is 24.2°C and mean annual minimum temperature is 11.4°C. Mean annual rainfall is 398 mm (BOM 2018b). A summary of monthly climatic statistics from 1999 to 2018 is detailed in Figure 7-9.

Current drought conditions have shown an increase in temperature and a decrease in rainfall in the region. Drought has a compounding effect on environmental aspects, including biodiversity, soil and water.

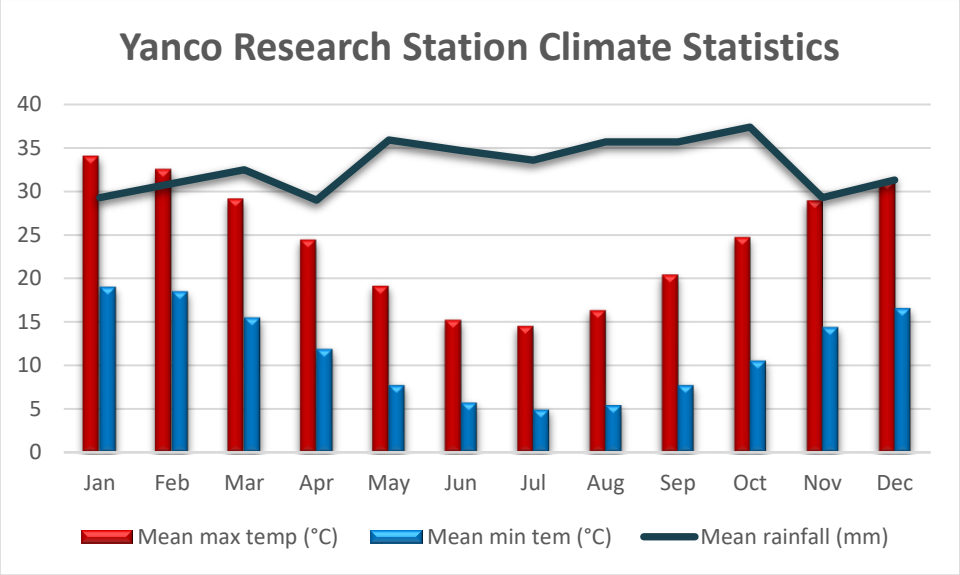


Figure 7-9 Climate statistics for Yanco Research Station (BOM 2018b)

Drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use. Current drought conditions display an increase in temperature and a decrease in rainfall in the region. Figure 7-10 shows the region has received “very much below average” rainfall over the last 6 months (BOM 2018c). Drought has a compounding effect on environmental aspects, including biodiversity, soil and water.

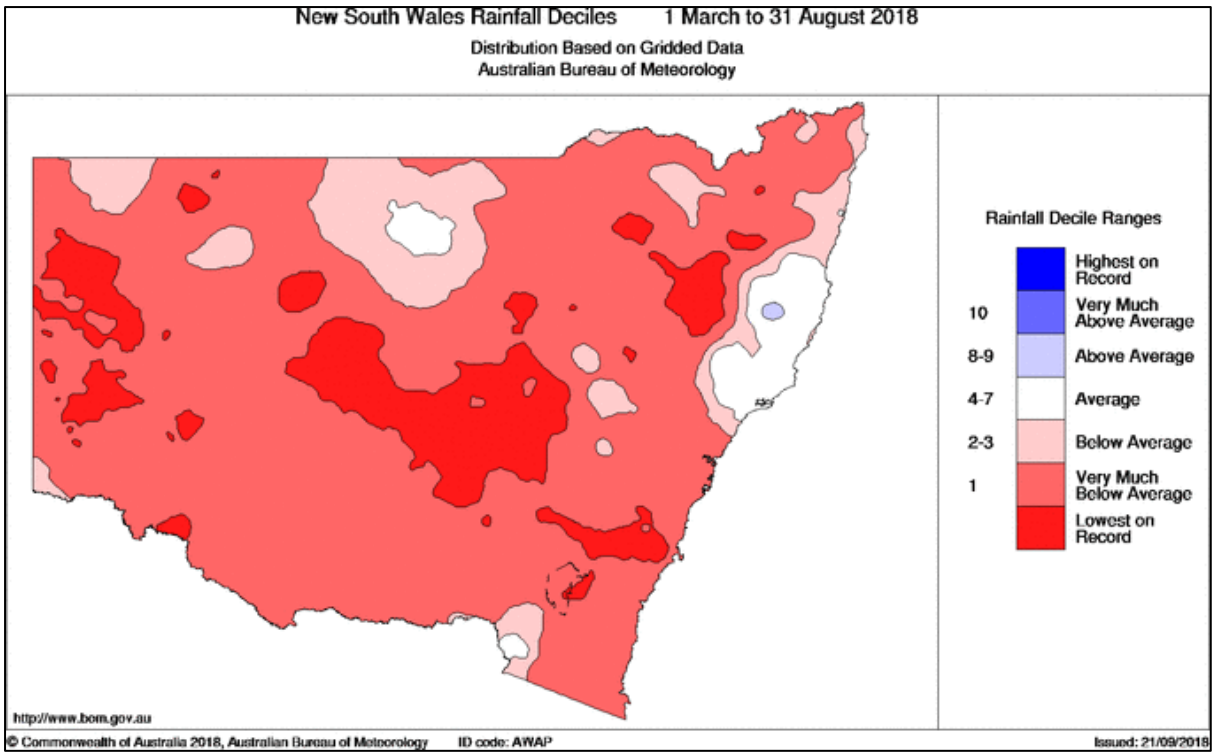


Figure 7-10 NSW Rainfall Deciles 1 March to 31 August 2018

Local air quality

The air quality around 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, application of herbicides, burning of paddocks or earth moving.

A search of the National Pollutant Inventory (DoEE 2018) identified 8 substance emissions facilities located within 30 km of the development site, which include:

- Morella Farm – Poultry farming.
- Berri Ltd Leeton – Beverage manufacturing.
- Tasco Leeton Petroleum Depot – Mineral, metal and chemical wholesaling.
- Riverina Abattoir – Meat and mead product manufacturing.
- Riverina Feedlot – Sheep, beef cattle and grain farming.
- Aero Refuellers Narrandera – Mineral, metal and chemical wholesaling.
- Kapanga Pastoral Company – Other livestock farming.
- Downer EDI Narrandera – Petroleum and coal product manufacturing.

There are no inhabited residences or buildings within the development site, with adjoining land uses including grazing, fruit production, and cropping for agriculture (namely grapes and oranges). 22 non-associated landowners are identified directly adjacent to the development site, with upwards of 200 receivers located within 1 km. Topography of the development site is relatively flat with planted vegetation screening the majority of 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^2/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 reductions in southern Australia and more extreme weather events including intense rainfall, more severe drought and harsher fires (CSIRO 2015). The region is currently in a drought.

7.5.2 Potential impacts

Construction and decommissioning

Climate can act to influence the impacts of construction and decommissioning on the environment. For example, hot, dry or windy conditions can exacerbate adverse air quality impacts; prolonged rainfall can increase soil compaction impacts. For these reasons, the specific climatic conditions of the site are considered in the assessment of impacts.

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along any unsealed road during construction and decommissioning of the proposal. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving and 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 10 months with a peak period lasting approximately 4 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 7.4).

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 0.1% of the development site based on a pile area of 20 cm x 20 cm and the NexTracker system.

Additional disturbance and earthworks will be associated with trenching for cables, the construction of concrete footings for infrastructure and internal access tracks.

23 dwellings are located adjacent to the subject land boundary and are the key receivers for adverse air quality impacts. Existing mature vegetation and earthen banks around irrigation channels occurs between the majority of receivers and the development site.

In accordance with good international practice, the assessment of sensitive receivers should consider up to 500m from the site boundary for both human and ecological receptors (Holman *et al*., 2014), due to the typical distance of dust dispersion. The assessment of other pollutants (e.g. gaseous exhaust fumes) would require a smaller area of assessment (~ 200m) as suggested by Bignal, K. *et al*. (2004) before emissions are indistinguishable from background concentrations. Dust impacts would be mitigated using dust suppression methods; refer to section 7.5.3.

23 landowners are located directly adjacent to the site, with a number of additional homes located within 1 km of the proposal. Dust and emissions would be expected to dissipate readily over this distance, with substantive air quality impacts not anticipated for these dwellings. With the minor earthworks involved and implementation of mitigation measures, air quality issues are considered manageable.

The number of substance emissions facilities in the area may have cumulative air quality effects; however, the construction and decommissioning of the proposal are not expected to noticeably increase air pollution or add to the cumulative impacts of other industries.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. However, construction will be responsive to local conditions to ensure impacts are managed. Haulage traffic, 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_2 emissions when compared to conventional coal and gas fired powered stations (Table 7-14). As discussed in Section 2.2, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 154,000 MWh per annum, the proposal would offset the brown coal equivalent of more than 51,00 tonnes per annum of CO_2 emissions and power the equivalent of about 26,000 NSW homes.

Table 7-14 Comparison of CO_2 equivalent emissions produced per kilowatt hour for the lifecycle of the asset

Generation method	Emissions produced (grams CO2 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 *et al*. (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 in comparison to the regular agricultural activities currently undertaken on the subject land (i.e. herbicide application, harvesting, ripping of soils etc.). 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 very limited period.

There is also a risk that unsealed access tracks may create dust during windy conditions. However, the access tracks will be regularly maintained. Dust creation is expected to be no more than the existing unsealed access roads that surround the site. As such, a noticeable increase in dust creation is unlikely.

Reduction of dust causing agricultural activities will also temporarily cease over the development area, with groundcover maintained to reduce erosion and dust. As such, overall dust creation on the subject land will decrease.

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 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 not expected to be significant. Cumulative impacts are discussed further in Section 7.9.

Heat Island Effect

NGH has reviewed literature available in relation to the phenomenon referred to as the Photovoltaic Heat Island (PVHI) effect. The following is a synopsis of this information. In summary:

- Several studies have been completed for utility scale solar farms
- Results are sometimes conflicting and may reflect site specific differences
- Temperature change may be linked to other changes noted in vegetation and moisture level
- The degree of temperature change appears to be marginal as well as spatially and temporally limited
- A 30m set back from neighbouring properties has been adopted in response to this issue for sites at Shepparton in Victoria.

A number of studies have shown that Photovoltaic (PV) panels convert incident solar radiation into heat and this can alter the air-flow and temperature profiles within and adjacent to the panels. This is referred to as the PVHI effect. Whether such changes may affect the thermal environment of near-by populations of humans and other species to any substantive degree has been questioned (Fthenakis & Yu, 2013). To date, there have been a number of empirical studies completed on the potential for a heat island effect in utility scale solar plants.

Published papers relevant to this issue include;

- *Barron-Gafford, G.A., Minor, R.L., Allen, N.A., Cronin, A.D., Brooks, A.E. & Pavao-Zuckerman, MA 2016, 'The photovoltaic heat island effect: Larger solar power plants increase local temperatures' Scientific Reports, vol 6, 35070. DOI: 10.1038/srep35070.*
- *Fthenakis, V.,& Yu, Y., 2013, Analysis of the potential for a heat island effect in large solar farms, Photovoltaic Specialists Conference (PVSC), 2013 IEEE 39th.*
- *Gao X., Yang L., Lv F., Hui X., Ma L., and Hou X., Study on the local climatic effects of large photovoltaic solar farms in desert areas Solar Energy 144, 244–253, 2017.*
- *Armstrong A., Ostle N. and Whitaker J., 2016. Solar park microclimate and vegetation management effects on grassland carbon cycling.*

The issue has also been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton area that are proposed by Neoen and X-Elio. The results of this are detailed in the *Panel Report for the Greater Shepparton Solar Energy Facility Planning Permit Application 2017-162, 2017-274, 2017-301 and 2017-344* (Panel Report 2018). Neoen, in preparation of a response to key issues raised in objecting submissions, submitted a *Statement of Evidence by Greg Barron-Gafford* from the Research Group Biography, Ecosystem Science (University of Arizona) (Barron-Gafford 2018).

The conclusions of these studies differ and it is noted that the studies are site specific. Some studies suggest that PV systems can actually cause a cooling effect on the local environment, depending on the efficiency and placement of the PV panels while others demonstrate a warming effect (Barron-Gafford, Minor, Allen, Cronin, Brooks, & Pavao-Zuckerman, 2016). Other studies conclude that while air temperatures may increase within the solar plant itself, they rapidly decrease to the ambient temperature beyond the perimeter of the solar plant (Fthenakis & Yu, 2013).

Armstrong et al (2016) focussed on microclimate and ecosystem processes directly under the panels on their project site. They found:

- PV arrays caused seasonal and diurnal variation in air and soil microclimate. These varied between summer (cooling of up to 5.2^{0}c) and winter (cooling up to 1.7^{0}c).
- Drying occurred under the PV arrays compared with gap and control areas.
- There were differences in the above ground plant biomass and species diversity, with both being lower under the PV array.
- Photosynthesis and net ecosystem exchange in spring and winter were also lower under the PV array.

Gao X. et al (2017) compared air and soil temperature within a solar farm to a control site (with no PV panels). This found that at a height of 2m above ground the daytime temperature at the two sites was essentially the same during winter. During the other seasons, the daytime air temperature in the PV array was higher than the control site, with the maximum difference appearing in summer. At a height of 2m above ground, the night-time air temperatures during the four seasons in the solar farm were higher than the control site, with differences in values between the sites with and without PV of 0.1, 0.3, 0.2 and 0.1 ^{0}C for summer, autumn, winter and spring respectively. It also found that the annual range of soil temperatures at depths of 5–20 cm in the solar farm was higher than the control site but with no apparent effect on soil temperature at depths of 40-180cm.

Fthenakis and Yu (2013) undertook an analysis of the potential for large solar plants to generate a PVHI effect and increase air temperature within the solar plant area. The study found that at the centre of the solar plant the annual average air temperature at a height of 2.5m above ground increased by up to 1.9^{0}C. However, this increase in temperature dissipated at a height of 5m above ground. Additionally, the solar plant completely cooled overnight, so the effect was limited in duration.

Barron-Gafford (2018) in his Statement of Evidence (SoE) to the Victorian Planning Panel (http://greatershepparton.com.au/assets/files/documents/planning/solar/Barron-Gafford_Research_Group_Report.pdf) included results on the radius of the measured heat effects. This identified that the PVHI effect was indistinguishable from air temperatures over native vegetation when measured at a distance of 30 metres from the edge of the PV array (Figure 7-11). In the SoE, Barron-Gafford states that *'this pattern held true for both daytime and night-time conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstorey" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the PVHI quickly dissipates'*.

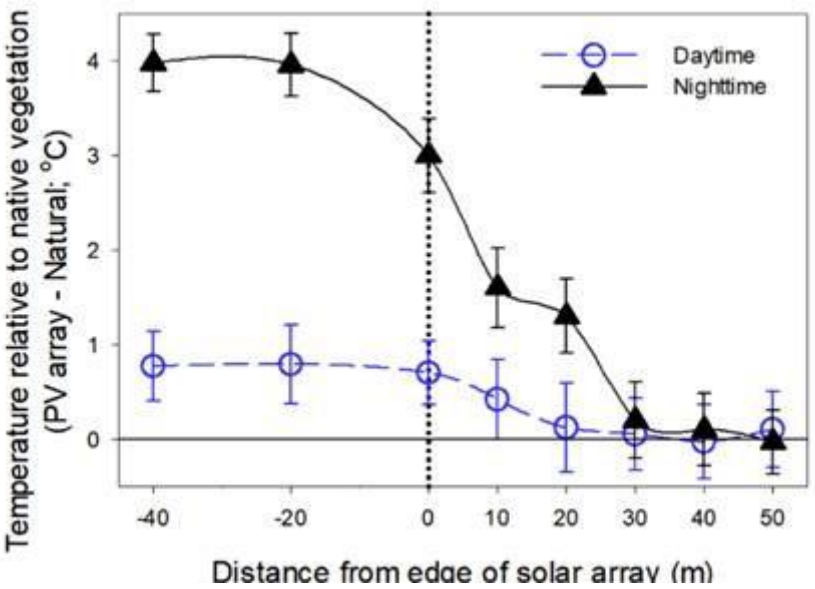


Figure 7-11 Measures of air temperature within and outside of the PV array (source:- Barron-Gafford 2018)

In conclusion of the Victorian Planning Panel Report (Panel Report 2018), the panel accepted that solar arrays will affect air and soil temperatures within the solar array perimeter, and that in relation to outside of the solar array perimeter a heat island effect is unlikely to occur. It identified that any temperature increase within the solar array will be marginal and recommended a 30 m setback from any neighbouring property boundary.

7.5.3 Safeguards and mitigation measures

Air quality impacts would be addressed via the mitigation strategies in Table 7-15.

Table 7-15 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**
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.	**C**	**O**	**D**
AQ3	Dust will be monitored and managed to prevent dust leaving the development site. This includes covering loads and watering of unsealed roads and stockpiles.	**C**	**O**	**D**
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		**D**
AQ5	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**
AQ6	Maintain a 30 m buffer from solar infrastructure to nearby and adjacent agricultural activities.	**Design Stage**		

C: Construction; O: Operation; D: Decommissioning

7.6 HAZARDS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Hazards and Risks –

Including:

- *A preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (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 Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011); and*
- *An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure;*

FIRE AND RESCUE NSW

Should a fire or hazardous material incident occur, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matters are recommended to be addressed:

- *That a comprehensive ERP is developed for the site.*
- *That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents.*
- *That the ERP detail the 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 (including electrical hazards). 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 a safe method for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment).*
- *Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP.*
- *That two copies of the ERP (detailed in recommendation above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.*
- *Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council.*

NSW RURAL FIRE SERVICE

- *The preparation of the EIS should 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 (APZs);*
  - *Measures to prevent a 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 local NSW RFS District Fire Control Centre; and*
  - *Vehicular access and defendable space around the solar array.*
- *Protection for the facilities from bush fires can be achieved through a combination of strategies which will:*
  - *Minimise the impact of radiant heat and direct flame contact by separating development from bush fire hazards;*
  - *Minimise the vulnerability of buildings to ignition and fire spread from flames, radiation and embers;*
  - *Enable appropriate access and egress for the public and firefighters;*
  - *Provide adequate water supplies for bush fire suppression operations;*

- *Focus on facility preparedness, including emergency planning and property maintenance requirements; and*
- *Facilitate the maintenance of APZs, fire trails, access for firefighting and on-site equipment for fire suppression and prevention of fire spreading from the site.*

An environmental hazard is a thing or situation which can threaten the environment or human health. Hazards may be natural or created 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.

7.6.1 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 does not include 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 Guideline is, however, a guide only and final determination is made based on considerations if the development would fall under the definition of potentially hazardous in the actual SEPP 33.

RISK SCREENING

SEPP 33 screening procedure considers 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 the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. For quantities that fall below the stated thresholds, 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 for the proposal are detailed in Table 7-16, with the location of the proposed storage sites shown on Figure 3-7. It can be seen the closest battery storage location to the subject land boundary is 30 m and that transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, therefore would not be considered potentially hazardous. The proposal does 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?
Class 2.2 Non-flammable, Non-toxic Gases					
Inert fire suppression gas	NA	NA	400 litres	Compressed in steel cylinders at each battery unit	N/A
Class 3 - Flammable Liquids (PG II)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	1 tonne	Stored in a bunded area, 20 m from boundary	No
Class 6.1 Toxic Substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1 tonne	Secure operations storage building	No

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
Class 9 Miscellaneous Dangerous Substances and Articles					
Li-ion batteries	N/A	>1000 cumulative >60/week	17 x 21.99 m^3 containers (total 374 m^3)	Housed across the site in up to 17 customised containers	No

Class 2.2 Non-flammable, non-toxic gases

Inert gas would be stored in compressed form at each storage unit 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 the use of an 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 but may pose an environmental hazard. Lithium-ion batteries (LIB) are under Class 9 Hazardous Goods, which are also not included 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).

The closest battery storage unit to the subject land boundary is approximately 30 m, with all battery storage units being located more than 250 m from any residence.

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.

POTENTIALLY OFFENSIVE INDUSTRY

The proposal would result in relatively minor 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 be largely confined to standard working hours during the construction phase (section 6.5); noise emissions would not be hazardous to neighbouring residents. Water pollution risks have been assessed as low (section 7.2 and 7.3), subject to identified mitigation measures, with longer term benefits following cessation of cultivation and maintenance of groundcover across the site. Based on these factors, the proposal is not considered a potentially offensive industry.

7.6.2 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, battery storage and other electrical components).

Existing environment

The development site is flat and laser levelled for horticulture. Little native vegetation remains in and around the development site, with remnant roadside native vegetation minimal along Toorak Road, Research Road and Houghtons Road. A planted row of vegetation exists on the western portion of the subject land. The majority of the development site has been cleared in the past. The site is not identified as bush fire prone land (NSW RFS 2018). Ground cover has largely been removed or maintained due to horticulture practices.

The local bush fire danger period occurs between October and March, where conditions are most conducive to bushfire ignition: hot and dry. The harvest period of November to mid-December on adjacent land is considered a prime risk period due to the use of machinery (ignition source) in crops (fuel) and the 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 farm dams in the development site being retained near the buildings. The main Murrumbidgee Irrigation canal also runs adjacent to the site. The Leeton Rural Fire Service is also located approximately 4 km from the proposal. A 20,000 L water storage tank would be maintained on-site as a fire-fighting resource.

Internal access tracks would be 5 m wide to ensure safe operational access and egress for emergency service personnel.

In terms of receivers and assets at risk from bush fire near the proposal, 23 dwellings are located directly adjacent to the development site with high density residential areas also located within 1 km of the site. 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 involved 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 2018

The draft *Planning for Bush Fire Protection (RFS 2018)* 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.*
- *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 10m 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.

7.6.3 Potential fire impacts

Construction and decommissioning

Specific activities that would be associated with the construction of the proposal 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.
- 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 as a fuel source over the development site and other factors discussed above, it is considered unlikely that construction of the solar farm would pose a significant uncontainable 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.

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 7.6.6.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction, any bush fire risk associated with decommissioning of the project would be highly manageable.

Operation

MAINTENANCE ACTIVITIES

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 Asset Protection Zone (APZ) would be maintained around individual buildings and the entire development site including inverters, delivery station and solar switching station. Internal access tracks are 5 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

The proposal would include approximately 81.09 MWh /57.12 MW rated capacity units of battery storage. All energy storage systems carry risks associated with the uncontrolled release of energy. While LIBs 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 battery units would 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 metalised 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.

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 reduce any risk.

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). LIBs 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 LIBs 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:

- Adherence to Building Codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations.
- Adherence to 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.

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 proposal would manage the fire risks associated with the battery units by:

- Spreading the battery units over the site in smaller, discrete storage areas rather than in one large facility. Maintaining an APZ around each battery unit.
- Locating the battery units 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, and in reference to relevant standards and guidelines.
- Facilitation (including funding) of first responder training in the management of LIB fires at the site for local brigades.

Though the specific battery manufacturer and model has not yet been determined, it is anticipated that each battery module within the implemented solution would have its temperature and voltage monitored.

The fire suppression system within the battery units 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 air conditioning 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 air conditioning units fail, the auto shutdown of the batteries would prevent overheating.

Standards and guidelines

The installation of LIBs 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).

BUSHFIRE AND 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 defendable space and to manage heat intensities at the infrastructure interface.

The PBP guidelines indicate 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, switching station and battery units, 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 battery units and switching station 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.

7.6.4 Electric and magnetic fields

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs). While a low risk to the public, in terms of the levels produced by the proposal, it is an issue that is often of concern to the public, as evidenced by solar farm feedback collected by NGH Environmental over the last several years.

About EMFs

EMFs consist of electrical 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).

Electrical 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). Electrical and magnetic field strengths reduce rapidly with distance from the source and, while electrical 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 switching stations and 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.

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 would 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 would 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 electrical and magnetic fields. Values are for 50Hz

Exposure characteristics	Electrical fields	Magnetic fields
Occupational		
	ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
	field actually required: 24.2 kV/m	field actually required: 3.03 mT
General public		
	ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 µT
	field actually required: 9.9 kV/m	field actually required: 606 µT

The proposal includes five main types of infrastructure that could create EMFs:

1. Solar Panels and invertors.
2. Underground cables.
3. Overhead 33 kV transmission line.
4. Solar switching station.
5. Battery storage.

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 electrical fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal.

7.6.5 Potential EMF 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 200µT and 1000µT limits respectively recommended for public and occupational exposure.

Exposure to EMFs during the construction of the powerline and its connection to the existing Yanco Substation would 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.

Electrical 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 also minimised.

The site is surrounded by agricultural land. Public access would be restricted by fencing around the site including the switching station 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.

7.6.6 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 would 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	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids,* and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and bunded.	**C**	**O**	**D**
HA2	The design, storage, maintenance and 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.	**C**	**O**	**D**
HA3	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA4	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA5	Design of electrical infrastructure to minimise EMFs through the solar array (underground).	**C**		
HA6	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the local RFS centre, and include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D

	• 24-hour emergency contact details including alternative telephone contact.
	• Site infrastructure plan.
	• Firefighting water supply plan.
	• Site access and internal road plan.
	• Construction of asset protection zones, fire trails, access for firefighting and on-site suppression equipment and their continued maintenance.
	• Location of hazards (physical, chemical and electrical) that will impact on the firefighting operations and procedures to manage identified hazards during the firefighting operations.
	• Such additional matters as required by the NSW RFS District Office.
	• The below requirements of Planning for Bush Fire Protection 2006:
	  ○ Identifying asset protection zones.
	  ○ Providing adequate egress/access to the site.
	  ○ Emergency evacuation measures.
	• Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.			

HA7	A comprehensive Emergency Response Plan (ERP) would be developed and implemented during construction, operation and decommissioning, and include but not be limited to: • Addressing foreseeable on-site and off-site fire events or other emergency incidents. • Detailing 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 will include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures to be instigated, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • 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 will be stored in a prominent location in a position directly adjacent to the main entry point.	**C**	**O**	**D**
HA8	To allow for emergency service personnel to undertake property protection activities, a 10 m defendable space managed as an APZ shall be provided around the buildings, switching station, battery storage units, outside perimeter of the solar array, and all areas of unmanaged vegetation being retained within the site.	**C**	**O**	**D**
HA9	A 20,000-litre water supply (tank) fitted with a 65mm Stortz fitting shall be located adjoining the internal property access road within the required APZ.	**C**	**O**	**D**
HA10	Once constructed and prior to operation, the operator of the facility will contact the relevant local emergency management committee (LEMC).	**C**	**O**	

7.7 RESOURCE USE AND WASTE GENERATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

The EIS is to include a detailed assessment of the management of the waste generated by the development, in particular, but not limited to, the treatment of the waste generated from the removal of orange trees, grape vines and associated vine structures and waste from packaging materials associated with the solar equipment.

LEETON SHIRE COUNCIL

The EIS is to include a detailed assessment of the management of the waste generated by the development, in particular, but not limited to, the treatment of the waste generated from the removal of orange trees, grape vines and associated vine structures and waste from packaging materials associated with the solar equipment.

7.7.1 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 3.5.3.

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 54 kL / 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.

Leeton Resource Recovery Centre accepts mixed commercial and industrial waste, including recyclables, mixed waste, scrap metal, green waste and batteries etc.

Tree removal waste

The waste from orange trees, grapevines and any other vegetation to be removed would be taken to the Leeton Landfill & Recycling Depot (managed by Leeton Shire Council). The waste materials would be mulched for composting at the depot.

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 appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

7.7.2 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 7.3.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved local 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 28 g 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 include 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_2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the proposal.
- 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.

7.7.3 Safeguards and mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Impacts are proposed to be addressed via the mitigation measures in Table 7-19.

Table 7-19 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: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.8 HISTORIC HERITAGE

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents;

Historic heritage –

The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:

- *Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996),*
- *Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),*
- *Include a statement of heritage impact for all heritage items (including significance assessment),*
- *Consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and*

Where potential archaeological impacts have been identified, develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) 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 (Leeton LGA) (2 October 2018). 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 Leeton 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 Leeton LEP for locally listed heritage items that are within or adjacent to the development site.

A general site inspection was also undertaken, with no items of historical heritage identified.

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 7-20. Details of listed items are provided below.

Table 7-20 Summary of heritage listings in the Leeton LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	0

NSW State Heritage Register	1
State Agency Heritage Register	9
Leeton Local Environment Plan (LEP) 2014	119 items 3 conservation areas

State Heritage Register

A search of the NSW State Heritage Register of the Leeton LGA indicated the following listings:

- Gogeldrie Weir – Narrandera (near).
- Hydro Hotel - Leeton.
- Leeton District Lands Office - Leeton.
- Leeton District Office – Artefacts in reception lobby Showcase 1 - Leeton.
- Leeton Railway Station and yard group - Leeton.
- Roxy Community Theatre - Leeton.

These items are listed under the *NSW Heritage Act 1977* and are not located in or adjacent to the development site, with the closest site being located in Leeton approximately 2 km north-east.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register for the Leeton LGA indicated 15 listings. These included:

- Driveway Palm Trees – Trunk Road, Yanco.
- Gaol and solitary confinement cell – Trunk Road, Yanco.
- Gogeldrie Weir – Murrumbidgee River, Yanco.
- Leeton Ambulance Station – Grevillia Street, Leeton.
- Leeton Courthouse – Church Street, Leeton.
- Leeton District Hospital – Palm Avenue, Leeton.
- Leeton Fire Station – Wade Avenue, Leeton.
- Leeton Police Station and site – Oak Street, Leeton.
- Leeton Railway Precinct – Railway Avenue, Leeton.
- Olive Trees – Trunk Road, Yanco.
- Rice seed germplasm collection – Trunk Road, Yanco.
- Takasuka Monument – Trunk Road, Yanco.
- Yanco Agricultural Institute – Trunk Road, Yanco.
- Yanco Creek Bridge – Sturt Highway, Narrandera (near).
- Yanco Police Station and official residence – Main Street, Yanco.

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 Leeton LEP indicated 119 local heritage items listed in the LGA. No items are located in the development site. However, there are 98 heritage items within 5 km of the proposal. These are listed below and shown in Figure 7-12:

- House - 65 Acacia Ave (I8).
- Hydro Hotel - 58-66 Chelmsford Place (I85).
- Leeton Fire Station - 19 Chelmsford Place (I9).
- House - 40 Currawang Avenue (I10).
- Shop (former Sykes and Watson Grocers) - 42-44 Kurrajong Avenue (I11).
- Girl Guides Hall (former Nissen hut) - Athel Crescent (I12).
- Rice Board Office (former) - 17 Kurrajong Avenue (I13).
- Shop - 45-47 Kurrajong Avenue (I14).
- House - 71 Kurrajong Avenue (I15).
- House - 75 Kurrajong Avenue (I16).
- State Bank (former) - 18-22 Kurrajong Avenue (I17).
- Shop - 36 Kurrajong Avenue (I18).
- Hairmaster's Building - 46-50 Kurrajong Avenue (I19).
- Shop (former butchery) - 62 Kurrajong Avenue (I20).
- House - 102 Kurrajong Avenue (I21).
- House - 104 Kurrajong Avenue (I22).
- Yanco Police Station and Lockup (former) - 37 Main Avenue (I112).
- Shop (former Butchery) - 74 Pine Avenue (I72).
- Leeton High School - 1-19 Mallee Street (I23).
- House - 5 Maple Street (I24).
- Shop (former Sharps Building & Movie Cafe) - 104-112 Pine Avenue (I25).
- Shop (former Butchery) - 80A Pine Avenue (I26).
- Shop (former Monterey Cafe) - 64 Pine Avenue (I27).
- Shop (former Percy Steven's Menswear) - 54 Pine Avenue (I28).
- Wade Hotel - 42 Pine Avenue (I29).
- Shop (former Fruitgrower's Cooperative) - 32 Pine Avenue (I30).
- Shop - 29-35 Pine Avenue (I31).
- Shop (former Bakery) - 61 Pine Avenue (I32).
- Yanco Powerhouse Museum - 13 Binyah Street (I95).
- St Mary's Anglican Church (former) - 30 Main Avenue (I97).
- Catholic Convent - Short Street (I98).
- Takasuka Monument - Irrigation Way (East (I103).
- "Yanco Agricultural Institute, Main Buildings" - 2198 Irrigation Way (East) (I106).
- St Mary's Catholic Convent - Ash Street (I55).
- House (Medical Centre) - 81 Kurrajong Avenue (I56).
- Shop (former Producer's Cooperative) - 15-17 Pine Avenue (I57).
- St Peter's Anglican Hall - 24 Church Street (I59).
- Yanco Agricultural High School (former Sir Samuel McCaughey's Homestead) - 259 Euroley Road (I108).
- Band Rotunda - Chelmsford Place, Road Reserve of Chelmsford (I62).
- Leeton Railway Station and Yard Group - Railway Avenue, Leeton Railway Reserve (I82).
- Leeton Court House - Church Street (I5).
- Wade Club (former) - 31 Church Street (I58).
- Leeton Water Filtration Plant - Acacia Ave (I63).
- Water Trough - Main Avenue (I109).
- Italian Workers Cottage - 161 Cassia Road (I64).
- St Joseph's Catholic School - 18-20 Ash Street (I65).
- Leeton Shire Council Chambers - 23-25 Chelmsford Place (I66).
- Leeton Ambulance Station - 35 Chelmsford Place (I67).
- Leeton Police Station - Oak Street (I6).
- Principal's House - 20 Church Street (I68).
- House (Commission Officer's Residence) - 5 Palm Avenue (I69).
- House - 33 Palm Avenue (I70).
- Hotel Leeton - 71-79 Pine Avenue (I71).

- Murrumbidgee Irrigator - 103-107 Pine Avenue (I33).
- Bank of NSW (former) - 115-117 Pine Avenue (I34).
- Shop (former Cafe Grande) - 119-121 Pine Avenue (I35).
- Commonwealth Bank - 123 Pine Avenue (I36).
- Shop (former Cabaret Cafe and Hall) - 127-129 Pine Avenue (I37).
- House 'Waratah' - 25 Sycamore Street (I38).
- Haven (former Hospital) - 7 Sycamore Street (I39).
- St Andrew's Presbyterian Church - 27-29 Sycamore Street (I40).
- House - 68 Wade Avenue (I41).
- Leeton Hospital & Nursing Home - 114-124 Wade Avenue (I42).
- House (former Ashton's Funeral Parlour) - 12 Wade Avenue (I44).
- Morris Chambers - 38 Wade Avenue (I45).
- House - 7 Wade Avenue (I46).
- CWA Hall (former) - 5 Wade Avenue (I47).
- Yanco Public School (Original Building) - 2-8 Cudgel Street (I99).
- Yanco Post Office (former) - 9 Main Avenue (I100).
- Yanco School of Arts (former) - 5-7 Main Avenue (I101).
- Shops - 86-90 Pine Avenue (I73).
- Mountford Park - Wade Avenue (I48).
- Cannery Office and Gardens (former) - 1 Wamoon Avenue (I49).
- St Margaret's Hospital (former) - 20 Wilga Street (I50).
- Visitors Information Centre (former MIA Manager's Residence) - 8-10 Yanco Avenue (I51).
- Showground Buildings - Acacia Avenue (I53).
- Racecourse (former airfield) - Racecourse Road (I54).
- Shops - 34-36 Pine Avenue (I75).
- Shops (former Richard's & Co Department Store) - 87-91 Pine Avenue (I76).
- St Joseph's Catholic Church - 2-8 Wade Avenue (I78).
- St Patrick's Catholic Church - Short Street (I111).
- Leeton District Lands Office - 29 Chelmsford Place (I84).
- Merungle Hill School (former) - Canal Road (I86).
- House (former Henry Lawson Cottage) - 37 Daalbata Road (I79).
- Motor Registry - Church Street (I7).
- Madonna Place - 2-8 Wade Avenue (I77).
- Hotel Yanco - 1 Main Avenue (I110).
- Leeton Public Primary School - 21-35 Mallee Street (I60).
- Wade Chambers - 44-52 Pine Avenue (I61).
- “Yanco Agricultural Institute, Rice Seed Germplasm Collection" - 2198 Irrigation Way (East) (I104).
- "Yanco Agricultural Institute, Gaol and Solitary Confinement Cell" - 2198 Irrigation Way (East) (I105).
- Roxy Community Theatre (I81).
- Catholic Presbytery - 2-8 Wade Avenue (I43).
- Yanco Water Tower - Coonong Avenue (I96).
- "Yanco Agricultural Institute, Olive Trees" - 2198 Irrigation Way (East (I107).
- Palm Tree Row - Irrigation Way (East) (I102).
- “Leeton Disctrict Office, artefacts in foyer showcase" - 29 Chelmsford Place (I83).
- Shop - 99-101 Pine Avenue (I74).

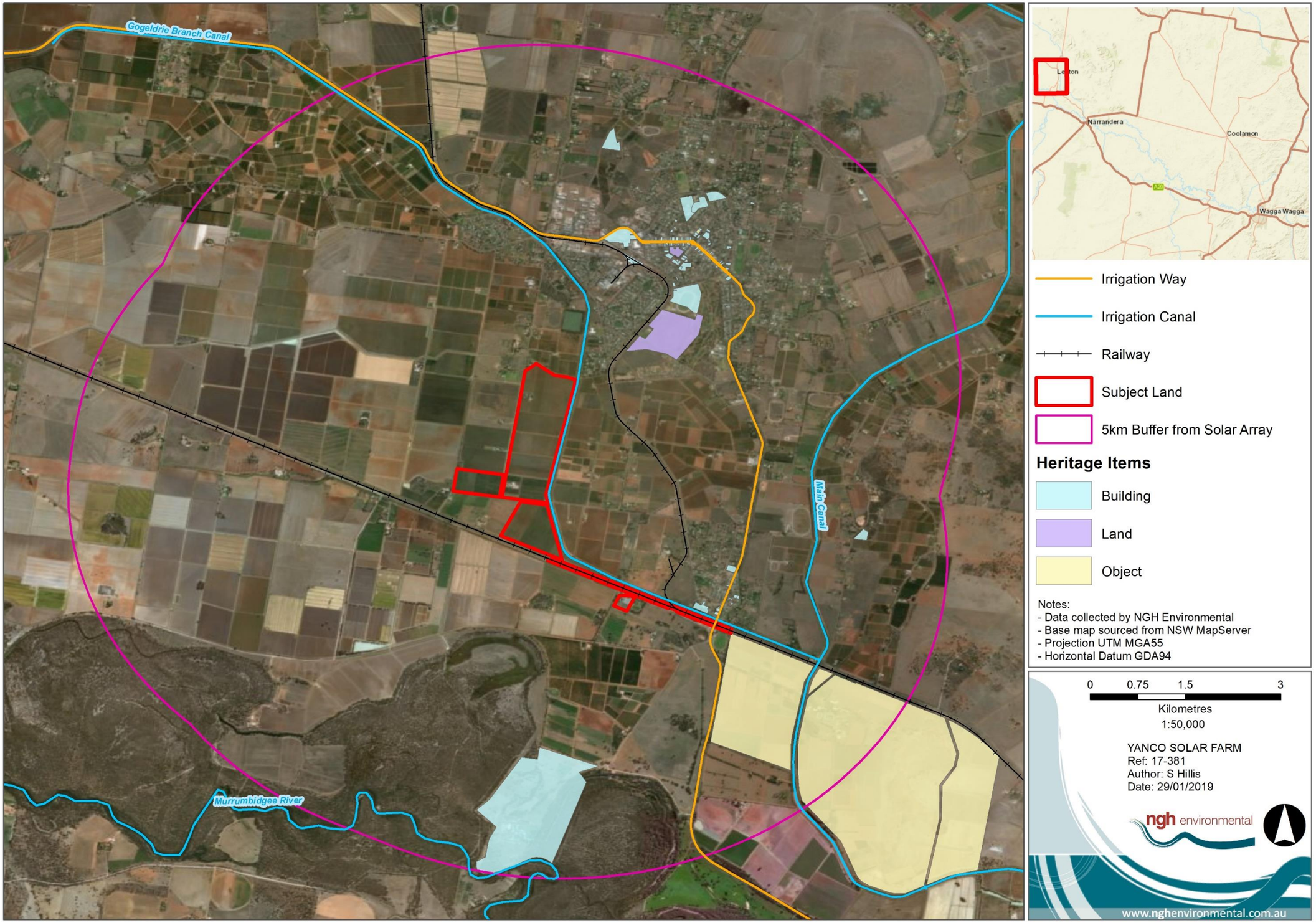


Figure 7-12 Leeton LEP Heritage items

7.8.3 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. Most of these items are found within Leeton and Yanco townships, with none adjacent to 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.

7.8.4 Safeguards and mitigation measures

Table 7-21 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**
HH2	Should any skeletal remains be found, works will cease immediately, the area cordoned off and the Police contacted.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.9 CUMULATIVE IMPACTS

7.9.1 Existing Environment

Cumulative impacts relate to the combined effect of similar or different impacts on a particular value or receiver and may occur concurrently or sequentially. For these purposes, cumulative impacts are associated with other known or foreseeable developments occurring in proximity to the proposal. The incremental effects of the proposal on existing background conditions in the study area have been taken into account in the preceding assessment sections.

One major project is listed on the Development Application tracking page on the Leeton Shire Council webpage: Leeton Solar Farm – 29 MW capacity.

The Leeton LGA is surrounded by the Griffith, Narrandera and Murrumbidgee LGA's. There are five additional active major projects listed on the Major Projects Register within the four LGA's that are either in the Development Application stage, being constructed or due to commence construction in 2019:

Table 7-22 Major projects in surrounding LGAs

Local Government Area	Major Project Detail
Griffith	**Griffith Solar Farm** 60 MW capacity, 7km south-east of Griffith over 125ha Construction commenced
Narrandera	**Yarrabee Solar Farm** 900 MW capacity, 23km south-west of Narrandera over 2,600ha Development approved – construction 2019
	Avonlie Solar Farm 200 MW capacity, 20km south-east of Narrandera over 534ha Development Application/submissions, construction late 2019
	Sandigo Solar Farm 100 MW capacity, 23 km south-east of Narrandera over 231 ha Development approved, construction mid 2019
Murrumbidgee	**Darlington Point Solar Farm** 275 MW capacity, 10 km south of Darlington Point over 710 ha Development approved, construction early to mid-2019

Cumulative impacts may have a minor impact to SSD proposals occurring within the LGAs. Mechanisms to consult with local industry are, however, included in Section 5 and Appendix C.2 and would assist to manage cumulative impacts should additional developments become relevant to the proposal.

7.9.2 Potential Impacts

Potential cumulative impacts are primarily associated with the following:

- Biodiversity impacts.
- Visual and landscape character impacts.
- Noise impacts.
- Traffic impacts.
- Pressure on local facilities, goods and services.
- Local agricultural impacts.

Biodiversity impacts

The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 % of native vegetation in NSW has been removed since European settlement (NSW Scientific Committee 2011) and the removal of vegetation at the proposal is contributing to this process. The cumulative impact of similar renewable energy projects, particularly where EEC is involved, can be considerable given that many poorly-conserved vegetation communities have a substantial portion of their extent represented on private land where most renewable energy projects are proposed. Small losses of vegetative communities may be insignificant at a local level but may accumulate over time to cause a significant reduction in the extent of remnant patches.

Cumulative impacts are considered best addressed by avoiding and minimising. Where avoidance is not possible the impact of each contributing project is assessed on a case by case basis. Long term mechanisms like offsetting through the BAM are structured to address the ongoing impacts of multiple projects in a cohesive manner. For the proposal, credits were generated by the BCC and offsetting of biodiversity impacts considered. However, the overall proposal has been designed to avoid and minimise impacts to biodiversity, and the site is already devoid of native vegetation.

Visual and landscape character impacts

The visibility of the proposal (the operational view) may generate a cumulative impact with the existing Yanco substation and existing transmission lines. The proposal requires security fencing and steel dominated infrastructure. The mitigation measures recommended in this report and the VIA (Appendix E and Appendix I) will act to reduce the cumulative impacts. Screen planting would be undertaken in key locations on-site, outside the perimeter fence, to minimise views of infrastructure.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure within the low relief landscape.

Noise impacts

Noise impacts through the use of plant, machinery and vehicles would be heightened if the construction of other developments is undertaken concurrently. Mitigation measures to address and reduce any impact have been proposed as part of this report. Cumulative impacts are therefore unlikely to increase construction noise impacts and are expected to be minor and manageable.

Traffic impacts

Cumulative traffic impacts may occur on common construction access and freight transport routes. Irrigation Way is a high capacity road designed for heavy vehicle traffic and is likely to absorb any cumulative impacts. Any impact to Toorak and Research Road is expected to be marginally noticeable due to high use of large trucks delivering fruit from the site; however, any impact from increased traffic would be predominately limited to the 10-month construction period. It is also important to note that traffic numbers will decrease for the duration of the operational stage of the proposal due to cessation of agricultural activities. Cumulative traffic impacts are considered unlikely or would be for a short period of time.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles will be required.

Pressure on local facilities, goods and services

There is potential that the possible concurrent construction of the proposal with other SSD or local development would increase pressures on local community services including accommodation. However, there is also a potential for positive cumulative economic effects from the construction of multiple developments in the area. Socio-economic benefits in relation to developments in the region will be continuous and ongoing for the community with increased jobs and economic input into local business.

The proposal would not result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. Due to the number of local communities in the area, any cumulative impact on local services are likely to be spread between communities. There is sufficient residual capacity within the existing communities. It is unlikely that there would be negative cumulative impacts to local facilities, goods and services.

Local agriculture impacts

Approximately 210 ha of productive farming land through cropping will be lost to the solar farm development. 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.

These impacts have been assessed in detail in Section 6.4 and found to be highly manageable. It is also important to note that the proposal will not limit all agricultural activities, and it is proposed to graze the development site.

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 are expected.

7.9.3 Safeguards and mitigation measures

The cumulative impacts identified for the proposal are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

8 ENVIRONMENTAL MANAGEMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS.*

8.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposal would be managed by implementing a project-specific suite of mitigation measures detailed in Sections 6 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 Operational Environmental Management Plan and a Decommissioning Environmental Management Plan. 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

Construction (C), Operation, (O), Decommissioning (D)

No.	Safeguards and mitigation measures	C	O	D
BD1	The following plans are to be prepared and approved by the relevant authorities: • Biodiversity Management Plan. • Construction Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. • The plans should include but not be limited to the relevant commitments below.	**Pre-construction**		
BD2	Timing works to avoid critical life cycle events such as breeding or nursing: • Hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts to fauna that would occur • Dams would be removed in winter to avoid impacts on wetland birds, when Latham's Snipe and Wood Sandpiper are outside Australia, and outside the summer breeding season for Australasian Bittern	**C**		
BD3	Implement clearing protocols including pre-clearing surveys, daily surveys and staged clearing, with a trained ecological or licensed wildlife handler present during clearing events, including: • Pre-clearing checklist. Tree clearing procedure.	**C**		

No.	Safeguards and mitigation measures	C	O	D
BD4	Relocation of habitat features (fallen timber, hollow logs) from within the development site. Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	**Pre - constructio**		
BD5	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed: • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.	**C**		
BD6	Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise. Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	**C**	**O**	**D**
BD7	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill: • Avoid Night Works. • Direct lights away from vegetation.	**C**	**O**	**D**
BD8	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operational activities. • Construction would cease if dust observed being blown from site until control measures were implemented. All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	**C**		**D**
BD9	Temporary fencing to protect significant environmental features such as riparian zones.	**C**		**D**
BD10	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Pest and Weed Management Plan.	**C**	**O**	
BD11	Staff training and site briefing to communicate environmental features to be protected and measures to be implemented: • Site induction. • Toolbox talks. • Awareness training during site inductions regarding enforcing site speed limits. Site speed limits to be enforced to minimise fauna strike.	**C**	**O**	
BD12	Preparation of a vegetation management plan to regulate activity in vegetation: • Protection of native vegetation to be retained. • Best practice removal and disposal of vegetation. • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. • Weed management.	**C**		

No.	Safeguards and mitigation measures	C	O	D
	• Unexpected threatened species finds. Rehabilitation of disturbed areas.			
BD13	Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment: • An erosion and sediment control plan would be prepared and implemented in conjunction with the final design. Spill management procedures would be implemented.	**C**		
BD14	Appropriate landscape plantings of local indigenous species to replace loss of planted vegetation.	**Design Stage**		
VA1	Screening would be required on-site, generally in accordance with the draft Landscape Plan provided in the VIA (Appendix E): • Plantings would be three rows deep and where practical, planted on specific sections of the outside of the perimeter fence to break up views of infrastructure including the fencing. • The proposed plant species to be used in the screen are native, fast growing, with spreading habitat and mixed mature heights of 2-4 m, 3-5m and 5-10 m. Proposed plants derived from the naturally occurring vegetation community in this area. • Plants were selected in consultation with affected near neighbours and a botanist or landscape architect. • The timing is recommended to be within 2 months of completion of construction so that actual views of infrastructure can be more certain. The timing of planting should also be chosen to ensure the best chance of survival. The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.	**C**	**O**	**D**
VA2	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	**Design stage**		
VA3	Construction and operational night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations. Lighting will comply with *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*, including: • Eliminating upward light spill, directing light downwards and directing light away from sensitive receivers. • Use of shielded light fixtures. • Using asymmetric beams. Compile and record a complaint register.	**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 Yanco substation.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner			**D**

No.	Safeguards and mitigation measures	C	O	D
	prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above-ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the solar farm is decommissioned.			
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 Leeton Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	**C**	**O**	
LU5	The proponent would consult with GSNSW in relation to biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral resources.	**C**		**D**
LU6	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**
LU7	All underground cabling and infrastructure to be removed following decommissioning.	**C**		
LU8	If possible and practical, managed 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 7am to 6pm. • Saturday 8am to 1pm. No work on Sundays or public holidays.	**C**		**D**
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	**C**	**O**	**D**
NS3	A letter box drop would be prepared and provided to residences within 2km of the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	**C**	**O**	**D**
NS4	Implement noise control measures that are suggested in Australian Standard 2436-2010 “Guide to Noise Control on Construction, Demolition and Maintenance Sites”, to reduce predicted construction noise levels.	**C**		**D**
NS5	In addition to physical noise controls, the following general noise management measures should be followed: • Plant and equipment should be properly maintained. • Provide special attention to the use and maintenance of ‘noise control’ or ‘silencing’ kits fitted to machines to ensure they perform as intended. • Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	• Avoid any unnecessary noise when carrying out manual operations and when operating plant. Any equipment not in use for extended periods during construction work should be switched off.			
NS6	Establish a noise management procedure to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.	**C**	**O**	**D**
NS7	Establish good relations with people living and working in the vicinity of the construction site at the beginning of the proposal and maintain good relations throughout the project. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.	**C**		**D**
NS8	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	**C**		**D**
NS9	Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable. Allowing the construction activities to proceed despite the noise exceedance may be the preferred method in order to complete the works expeditiously.	**C**		**D**
SE1	A Community Consultation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). Protocols to respond to any complaints received.	**C**	**O**	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**	**O**	
SE3	Liaison with local representatives regarding accommodation options for staff to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**
AH1	The proponent should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	**C**		
AH2	Should any Aboriginal objects be uncovered by the work which are not covered by a valid Aboriginal Heritage Impact Permit (AHIP), excavation or disturbance of the area is to stop immediately and the Office of Environment and Heritage (OEH) is to be informed in accordance with the *National Parks and Wildlife Act 1974* (as amended). Works affecting Aboriginal objects on the site must not continue until OEH has been informed and the appropriate approvals are in	**C**		

No.	Safeguards and mitigation measures	C	O	D
	place. Aboriginal objects must be managed in accordance with the *National Parks and Wildlife Act 1974.*			
AH3	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**		
AH4	Avoidance of isolated artefact (YSF_IF_001) be achieved by utilising the proposed northern transmission line route. If the route is altered to the southern transmission line option in the future, then this site should be salvaged and reburied outside of the impact corridor in consultation with the Leeton & District LALC.	**C**		
AH5	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. The salvage of Aboriginal objects can only occur following development consent that is issued for State Significant Developments and must occur prior to works commencing. A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database. An Aboriginal Site Impact Recording Form must be completed and submitted to AHIMS following harm for each site collected or destroyed from salvage and/or construction works.	**C**		
AH6	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	**C**		
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plan 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: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation.	**Prior to and during construction**		**D**

No.	Safeguards and mitigation measures	C	O	D
	• Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. Areas of disturbed soil would be rehabilitated promptly and progressively during construction.			

SO2	A Groundcover Management Plan would be developed in consultation with a soil scientist and/or an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operational phase. The plan would cover:
	• Soil restoration and preparation requirements.
	• Species selection.
	• Soil preparation.
	• Establishment techniques.
	• Maintenance requirements.
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements:
	  • Live grass cover would always be maintained at or above 70% to protect soils, landscape function and water quality.
	  • Any grazing stock would be removed from the site when cover falls below this level.
	  • Grass cover would be monitored on a fortnightly basis using an accepted methodology.
	• Contingency measures to respond to declining soil or groundcover conditions.
	Identification of baseline conditions for rehabilitation following decommissioning.
		Pre- construction		

SO3	The array would be designed to allow sufficient space between panels to establish and maintain ground cover beneath the panels and facilitate weed control.	**Design Stage**		
SO4	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 soil, health and safety of firefighters and first responders in the case of a hazardous spill.	**C**	**O**	**D**
SO5	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: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation). 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.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
SO6	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored to original condition or revegetated with native plants.	**C**	**O**	**D**
SO7	Sodic soil should be treated with gypsum where required.	**C**		
SO8	Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation: • Preserve and stabilise disturbed areas, drainageways and steep slopes. • Minimise the extent and duration of disturbance. • Install perimeter controls. • Employ the use of sediment control measures to prevent off- and on-site damage. Inspect and maintain sediment and erosion control measures regularly. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. Provide access and general construction controls.	**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 would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for 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 through toolbox talks for the minimisation and management of accidental spills.	**C**		**D**
WA6	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	**C**	**O**	**D**
WA7	Ensure appropriate drainage controls are incorporated into the design.	**Design stage**		
WA8	If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	**C**	**O**	**D**
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Direction of traffic flow (both heavy and light). • Loads, weights and length of haulage and construction related vehicles and the number of movements of such vehicles.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).			
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan would be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan would include, but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network to be undertaken in consultation with Council. • Assessment of road condition prior to construction on all local roads that would be utilised. • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the project, especially at the access site along Research Road. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. • A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the Code. • Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads to minimise dust generation through increased traffic use. 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.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
TT3	Obtain a Section 138 Consent from the relevant council/agency to perform works within the road reserve.	**C**		
TT4	The proponent would continue consultation with Leeton Shire Council regarding the proposed access sites on Toorak Road and Research Road. The intersection upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT5	The proponent would consult with RMS, Crown Lands, Murrumbidgee Irrigation and Leeton Shire Council regarding any road upgrades. Upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT6	The proponent must engage an appropriately qualified person to prepare a Road Dilapidation Report for all road routes to be used during the construction (and decommissioning) activities, in consultation with the relevant road authority. This report is to address all road related infrastructure. Reports must be prepared prior to commencement of, and after completion of, construction (and decommissioning). Any damage resulting from the construction (or decommissioning) traffic, except that resulting from normal wear and tear, must be repaired at the Proponent's cost. Such work shall be undertaken at a time agreed upon between the Proponent and relevant road authorities.	**Pre-construction**		**D**
TT7	• Prior to the commencement of construction on-site, the Proponent must undertake all works to upgrade relevant state roads, their associated road reserve and any public infrastructure in that road reserve, to a standard suitable for use by heavy vehicles to meet any reasonable requirements that may be specified by RMS. The design and specifications, and construction, of these works must be completed and certified by an appropriately qualified person to be to a standard to accommodate the traffic generating requirements of the project. On Classified Roads the geometric road and pavement design must be to the satisfaction of the RMS.	**Pre-construction**		**D**
TT8	For works on the State Road network the developer is required to enter a Works Authorisation Deed (WAD) with RMS before finalising the design or undertaking any construction work within or connecting to the road reserve. The WAD documentation is to be submitted for each specific change to the state road network for assessment and approval by RMS prior to commencement of any works within the road reserve.	**Pre-construction**		
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	**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.	**C**	**O**	**D**
AQ3	Dust will be monitored and managed to prevent it leaving the development site. This includes covering loads and watering of unsealed roads and stockpiles.	**C**	**O**	**D**
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
AQ5	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**
AQ6	Maintain a 30 m buffer from solar infrastructure to nearby and adjacent agricultural activities.	**Design Stage**		
HA1	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids,* and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and bunded.	**C**	**O**	**D**
HA2	The design, storage, maintenance and 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.	**C**	**O**	**D**
HA3	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA4	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA5	Design of electrical infrastructure to minimise EMFs through the solar array (underground).	**C**		

HA6	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the local RFS centre, and include but not be limited to:
	• Management of activities with a risk of fire ignition.
	• Management of fuel loads onsite.
	• Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression.
	• 24-hour emergency contact details including alternative telephone contact.
	• Site infrastructure plan.
	• Firefighting water supply plan.
	• Site access and internal road plan.
	• Construction of asset protection zones, fire trails, access for firefighting and on-site suppression equipment and their continued maintenance.
	• Location of hazards (physical, chemical and electrical) that will impact on the firefighting operations and procedures to manage identified hazards during the firefighting operations.
	• Such additional matters as required by the NSW RFS District Office.
	• The below requirements of Planning for Bush Fire Protection 2006:
	  ○ Identifying asset protection zones.
	  ○ Providing adequate egress/access to the site.
	  ○ Emergency evacuation measures.
	• Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.
		C	**O**	**D**

HA7	A comprehensive Emergency Response Plan (ERP) would be developed and implemented during construction, operation and decommissioning, and include but not be limited to:	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Address foreseeable on-site and off-site fire events or other emergency incidents. • 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 will include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures to be instigated, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • 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 will be stored in a prominent location in a position directly adjacent the main entry point.			
HA8	To allow for emergency service personnel to undertake property protection activities, a 10 m defendable space managed as an APZ shall be provided around the buildings, switching station, battery storage units, the outside perimeter of the solar array, and all areas of unmanaged vegetation being retained within the site.	**C**	**O**	**D**
HA9	A 20,000-litre water supply (tank) fitted with a 65mm Stortz fitting shall be located adjoining the internal property access road within the required APZ.	**C**	**O**	**D**
HA10	Once constructed and prior to operation, the operator of the facility will contact the relevant local emergency management committee (LEMC).	**C**	**O**	
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: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**
HH1	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**
HH2	Should any skeletal remains be found, works will cease immediately, the area cordoned off and the Police contacted.	**C**	**O**	**D**

9 CONCLUSION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *The reasons why the development should be approved having regard to:*
  - *Relevant matters for consideration under the E*nvironmental Planning and Assessment Act 1979*, 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;*
  - *The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and*
  - *Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.*

9.1.1 Need and benefits

The proposed Yanco Solar Farm would involve the construction and operation of a proposed 72 MW DC PV solar farm at Yanco. The 210 ha development site is located on freehold rural land, approximately 1 km west of Yanco. The development footprint of the Proposal is approximately 183 ha.

The proposal would contribute to the NSW Renewable Energy Action Plan (NSW Government 2013), which supports the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013a). The proposal would also further the three goals of the Action Plan:

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

The proposal would also contribute to the Commonwealth Government's objective to achieve an additional 33 GW of energy from renewable sources by 2020 under the LRET.

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 120 direct and 190 indirect full-time staff for the 3 to 4 month peak of construction and five operational staff for the life of the project. Maintenance contracts for panel cleaning, fence repair, road grading, etc. would also be required and would likely be met by local contractors.
- Direct business volume benefits for local services, materials and contracting (e.g. accommodation, food and other retail).
- It is estimated that $560,000 in wage spending would be directed at local and regional businesses and service providers during the construction period. Spending would include housing expenditure, retail, recreational spending, and personal, medical and other services.

9.1.2 Environmental assessment and mitigation of impacts

NGH Environmental, with input from specialists as required, has prepared this EIS on behalf of the proponent, ib vogt. This EIS has assessed the broader proposal and development site where infrastructure may be located. Overall, the Proposal 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 is a commitment of the project.

The key environmental risks have been investigated through detailed specialist investigations. These included:

- Biodiversity impacts – the BDAR concluded that no significant impacts to threatened species and ecological communities would result. No referrals under the EPBC or BC Act are considered to be required. An offset requirement has been calculated for the project and would ensure an in-perpetuity commitment to account for the small area of native vegetation along Toorak Road that the proposal cannot avoid.
- Visual impact - the VIA concluded that the level of visual impact from the local road network would be low to negligible immediately after construction and would reduce to nil or positive once proposed visual screening was established. Visual impact from the private domain is limited to a few houses and has a negligible to nil visual impact. One house has been assessed as having a medium impact, which would be remediated to nil or positive with visual screening.
- 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 Yanco and Leeton areas. The proposal is reversible and would not result in the permanent loss of agricultural land.
- Noise impacts – the noise assessment concluded that construction noise exceedances can be expected at a number of residences. These would be short term during working hours, with activities moving progressively over the site. Mitigation measures would be implemented to reduce any impacts. No noise exceedances are expected during the operational phase of the proposal.
- Socioeconomic and community – It is likely that some adverse impact can be expected including increased traffic and hazards associated with construction, change in the rural landscape character, influx of workers and pressure on local business and demand for accommodation. This does not outweigh the significant benefits including a boost to the local and regional economy, range of employment opportunities (both direct and indirect) and boost in local spending.

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 management measures account for uncertainty and are precautionary where required. The impacts and risks identified are considered highly manageable with the effective implementation of the measures stipulated in this EIS.

9.1.3 Ability to be approved

- The development site is highly appropriate to solar energy generation.
- The proposal is consistent with local, state and Federal planning provisions.
- The development site has been selected to avoid or minimise environmental impacts where possible through an iterative constraints' investigation / design process.
- The development footprint has been designed/reduced to avoid or minimise impacts to vegetation, habitat and Aboriginal artefacts.
- Visual impacts have been reduced through proposed vegetative screening.
- Land use conflicts and hazard risks are considered manageable and acceptable.

The residual impacts are considered justifiable and acceptable in the context of the proposal's benefits.

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