Environmental Impact Statement

JINDERA SOLAR FARM

SEPTEMBER 2019

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

EIS prepared by: NGH Pty Ltd

Applicant: Jindera Solar Farm Pty Ltd

Proposed development:

The Jindera Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm with an installed capacity of approximately 120 Megawatts of electricity (alternating current), comprising of inverter stations, high voltage substation, powerline, Battery Energy Storage System (BESS), control room, storage area, staff amenities, internal access tracks and fencing, and all other associated ancillary infrastructures.

Land to be developed:

Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, and 153-155 DP753342, Lots 1-3 DP1080215, Lot 1 DP588720 and former Crown Roads CADID 105306258 and CADID 105338106.

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.

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Terms and definitions

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACHAR	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
BESS	Battery Energy Storage System
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.
DOEE	Department of the Environment and Energy (Commonwealth)
DPE	Department of Planning and Environment
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
PCT	Plant Community Type
Property	The boundary of a property. A property can be made up of multiple lots, and can have an associated residence or be a vacant agricultural lot.
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)
Receiver	Landowners within the vicinity of the proposal. Receivers are made up of landowners involved/associated with the proposal, landowners that are not involved/non-associated with the proposal and vacant agricultural properties.
Residence	A home or occupied dwelling.
RFS	NSW Rural Fire Service
RNP	NSW *Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
RMS	(NSW) Roads and Maritime Services
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)
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
ZVI	Zone of Visual Influence
The proposal	The construction and operation of the proposed Solar Farm
The proponent	Jindera Solar Farm Pty Ltd
Subject land	All land within the affected lot boundaries. The subject land comprises Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, 153-155 DP753342, Lots 1-3 DP1080215, Lot 1 DP588720 (owned by TransGrid) and Crown/Council roads (CADID 105306258 and CADID 105338106) and is approximately 521 ha.

Development site	The area of land that is subject to the proposal. The development site is made up of 404 ha and includes the location of the proposed transmission line outside of the subject land. The development site is the area surveyed for this assessment prior to identifying the 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, vegetative screening and areas used to store construction materials. The development footprint is approximately 337 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, operation and decommissioning of approximately 120 Megawatt (MW) Alternating Current (AC) photovoltaic (PV) solar farm at Jindera, southern NSW (equivalent to up to 150 MW Direct Current; DC). The 521 hectare (ha) Subject Land is located on freehold rural land approximately 4 kilometres (km) north of the township of Jindera.

NGH Environmental has prepared the EIS on behalf of the proponent, Jindera Solar Farm Pty Ltd (JSF). 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 14 September 2018.

PROPOSAL DESCRIPTION

The proposed Jindera Solar Farm would have a total installed capacity of up to 150 MW (DC), and would include:

- Single axis tracker photovoltaic (PV) solar panels, mounted on steel frames at about 3 m above ground level at maximum tilt.
- Battery Energy Storage System (BESS) with maximum capacity of 30MW/60MWh.
- Electrical cables and conduits.
- Inverter stations which have an aggregate capacity of approximately 155 MVA.
- Weather station.
- On-site high voltage substation.
- Control room and storage facility.
- Site office, staff amenities, parking area and perimeter fencing, and CCTV.
- Overhead transmission line infrastructure on poles connecting the project's on-site high voltage substation to the existing TransGrid Jindera 330/132kV substation.
- Internal access tracks.
- Access road entrances from public roads.
- Upgrade to existing roads.
- On-site vegetative screening.
- Other associated ancillary infrastructure.

The solar farm would connect from the on-site substation to the TransGrid Jindera substation via a new overhead 132kV transmission line adjacent to Ortlipp Road, crossing to the eastern side of the Ortlipp road corridor to access the TransGrid substation property frontage, and continuing to the TransGrid Jindera 330/132kV substation switchyard inside the property. The works inside the TransGrid switchyard includes new overhead or underground transmission line infrastructure (depending on TransGrid requirements and design, to cross existing transmission lines), construction of a new circuit breaker bay, and associated works and equipment. The final details and configuration of the transmission line and substation works inside TransGrid land are subject to detail design and approval from TransGrid.

The proposal would also require underground cabling across the Walla Walla Jindera Road and south of Sparkes Road (an unformed crown road).

The proposal would have major construction and operational access off Urana and Walla Walla Jindera Road. During operation, there would be additional maintenance and emergency access off Klinberg Road and Ortlipp Road. Urana Road forms the major transport route to and from the site.

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

The development site will be leased from the relevant landowners for the life of the proposal, with subdivision of the property for agricultural purposes required.

The proposal is expected to operate for 30 years. The construction phase of the proposal is expected to take approximately 12-18 months and is anticipated to commence in 2020. After the operating phase, the proposal would either be decommissioned, removing all above and below ground infrastructure and returning the site to its existing land capability, or upgraded with new photovoltaic equipment subject to planning approvals.

PROJECT NEED

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and disturb 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 (DEE 2017). Once constructed, the proposal would provide around 275,000 MWh per year of GHG emission-free electricity. This represents the power consumption of about 65,000 homes (assuming an average household consumption of 4,215 kWh pa). Generation figures may change subject to final site design and technology selection. The proposal would save about 92,000 tonnes of GHG emissions per year.

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

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013. The Government's vision is for a secure, affordable and clean energy future for NSW. The Plan positions the state to increase energy from renewable sources by attracting investment, building community support and growing expertise in renewable energy at 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 2013. 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 Australian Government's objective to achieve an additional 33 GW 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 200 employees for the 3 to 4 month peak of construction and two to three operational staff for the life of the project. Maintenance contracts for panel cleaning, fence repair, road grading, security, 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).
- Significant 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.
- Increased economic security to rural economies through diversification of employment opportunities and income streams.

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 screening and other measures 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 help reduce Australia's GHG emissions and help meet future energy demands. It would contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. It would contribute to economic development in Jindera and Albury, 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. Homes on Urana Road have a slightly elevated view. Screening is proposed.
- Minimal impacts to biodiversity are expected due to historical disturbance and agricultural activities.
- There would to no land use conflicts due to zoning.
- The proposal is not located on Strategic Agricultural Land. However, it is partially 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 permanently 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 flood prone land
- Parts of the site are defined as category 2 vegetation bushfire prone land. Management measures would be put in place in accordance with statutory requirements.
- The proposal is partly located on prospective resource developments.
- The proposal is not located on Crown land, with previous Crown and Council Roads (CADID 105306258 and CADID 105338106) in the process of being purchased by the landowner.

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 (flora and fauna).
- Aboriginal heritage.
- Visual impact.
- Land use impacts.
- Noise impacts.

Biodiversity (flora and fauna)

A Biodiversity Development Assessment Report (BDAR) was prepared to investigate and assess the potential impacts of the proposal on biodiversity. The development site is located in the Lower Slopes subregion of the NSW South West Slopes Bioregion. Cleared and highly modified agricultural land occupies about 75.44% of the development site. Three Plant Community Types (PCTs) were identified in the development site:

1. River Red Gum – wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion.
2. Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (forms part of the *White Box-Yellow Box-Blakely's Red Gum Woodland* EEC under the BC Act).
3. Gilgai wetland mosaic in the southern NSW South Western Slopes Bioregion.

The development site has been designed to minimise impact to these communities. No EPBC listed communities were present within the development site.

Twenty-three threatened species required survey. One threatened species, the Flame Robin, was detected within the development site. Five species were unable to be surveyed during the recommended survey window and these species were assumed to be present:

- Eastern Pygmy Possum.
- Southern Myotis.
- Silky Swainson-pea.
- Small Purple-pea.
- Small Scurf-pea.

Four threatened species and 2 migratory species listed under the EPBC Act were considered likely to occur in the development site, although none were 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 Australian Government's Department of Environment and Energy (DEE).

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

- Ecosystem credits – 253 Ecosystem credits were generated from the removal of 17.41 ha of native vegetation and 11 paddock trees.
- Species credits – 374 species credits were generated from impacts to 6 threatened species.

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.

Aboriginal heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared 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 assessment was undertaken in consultation with Aboriginal stakeholders.

Jindera is in an area identified as part of the Wiradjuri language group. The proposal area is within the Murray Catchment, 15 km north of the Murray River. The proposal area is located just inside the barrier between the two subregions, lying within the Lower Slopes subregion and surrounded by the Upper Slopes subregion. Landscape mapping as part of the Mitchell landscapes system (2002) divides the proposal area into two differing landscape types, the Brokong Plains (Bro), and Murray Lakes, Swamps and Lunettes. The two closest surface water drainage lines are ephemeral creeks; Dead Horse Creek and Kilnacroft Creek, and several farms dams within the development footprint.

50 known Aboriginal sites have been previously recorded in the general locality. None of these occur within the proposal area.

A series of pedestrian survey transects was undertaken across the proposal area. The survey was undertaken by an archaeologist from NGH Environmental with representatives of the Aboriginal community.

Despite the variable visibility encountered during the survey a total of 10 artefacts scatters and 15 isolated finds were found across the proposal area. The Aboriginal community representatives identified 3 cultural trees. Four areas of potential archaeological deposit (PAD sites) were also identified that required subsurface testing. A total of 52 test pits were excavated across the 4 PAD sites. Of the 52 test pits excavated, stone artefacts were recovered from 25 pits. In total there were 80 stone artefacts recovered.

Based on the land use history and an appraisal of the results from the field survey, there is low potential for the presence of high density intact subsurface deposits or cultural material within the proposal area. However, the assessment concluded that it is possible that additional *in situ* stone artefacts could occur within the proposed development footprint.

Direct impacts are likely to be most extensive where earthworks are to occur. Impacts could result from the installation of cabling and piles driven into the ground for the solar arrays. The proposed level of disturbance for the construction of the solar farm could impact 24 sites with stone artefacts recorded during the field survey. Overall, impacts on Aboriginal cultural heritage have been assessed as moderate. An Unexpected Finds Protocol (UFP) would be prepared and followed should there be an inadvertent discovery of Aboriginal objects during construction.

Land use impacts

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

The site is not located in an area mapped for Important Agricultural Land. The land capability class of the site is Class 3 and Class 6. As per the Land and Soil Capability Assessment Scheme, Class 3 is classed as “High Capability Land” and Class 6 as “Low Capability Land”. Class 3 is described as land capable of sustaining cultivation on a rotational basis. Class 6 is described as land that has very high limitations for high-impact land uses and is restricted to low-impact land uses.

The development site is zoned RU1 land for primary production. The land surrounding the development site is also RU1 (Primary Production). Surrounding agricultural land consists of cropping and grazing activities. Benambra National Park is located within 12 km of the development site, and Lake Hume is within 13 km of the site.

One mining exploration lease exists within the development site. The proposal will potentially impact a maximum 9 ha of the 4-block exploration area of well over 1,000 ha licence area (less than 1%).

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, dust, weed and pest control, noise, agricultural spraying and visual amenity had moderate to high risk rankings. These potential conflicts have been addressed with appropriate management strategies and now have a revised risk rating of low.

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

Visual impacts

A Visual Impact Assessment (VIA) was completed involving modelling the viewshed of proposed infrastructure and on ground assessment to inspect local vantages to assess the operational visual impact of the proposal.

Two involved and 23 uninvolved residences are located within 1km of the subject land. Four Landscape Character Units (LCU) were identified within Jindera and surrounding areas:

- Rural (including agricultural lands).
- Residential (viewpoints near rural residents/homes).
- Industrial (major roads, electrical and other built infrastructure).
- Commercial (businesses, town centre).

Representative viewpoints within each LCU were identified and modelled. The predicted sensitivity of each viewpoint was assessed. The residential viewpoints were found to have 'Moderate' to 'High' sensitivity. Industrial viewpoints were generally found to have 'Low' sensitivity, with rural viewpoints found to have 'Moderate' to 'Low' sensitivity.

The operational visual impact assessment was undertaken considering:

- The proposed solar farm components.
- Their potential impact on landscape character units and representative viewpoints.
- The degree of contrast the development would have and if these are considered acceptable.
- The potential impact from glare.

High impacts were assessed for three viewpoints adjacent to the proposal boundary along Glenellen Road and Ortlipp Road. High impacts are expected for two receivers along Glenellen Road. On-site vegetative screening as a mitigation strategy has been considered and consultation has been undertaken with the landholder.

A medium impact was seen for two viewpoints directly adjacent to the southern side of the proposal along Klinberg Road and the western boundary of the proposal site along Urana Road. Both viewpoints were assessed as having a medium impact. On-site vegetative screening as a mitigation strategy has been considered in consultation with the landowners at both viewpoints. Temporary screening is also being considered to block views while the vegetation screening matures along Klinberg Road.

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.

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.

The potential for cumulative visual impacts may occur where the proposed Glenellen Solar Farm site is adjacent to the Jindera Solar Farm for specific properties on Ortlipp Road (Receivers 9, 10, 11, 12 and 28). If construction of the Glenellen Solar Farm occurs, a 15 m vegetative buffer for the full length of Ortlipp Road is proposed to screen views of the Jindera Solar Farm.

Noise impacts

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

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

- Road work/compound construction equipment.
- Piling, panel framing and panel installation.

Daytime construction noise levels were assessed for all receivers located within 2 km of the development footprint. The highest predicted noise level is within the range for the Noise Management Levels (NMLs) within standard hours and complies at 49 receivers. An exceedance of 21 dB LAeq was noted for the nearest sensitive receiver (20) during piling operations.

The predicted operational noise levels were assessed for the all receivers located within 2 km of the development footprint for the following scenarios:

- Operation of tracking motors, internal substation and the inverter stations.
- Maintenance vehicles accessing the site.
- Grass slashing and panel cleaning.
- Repairing faulty equipment.

Four sensitive receivers are expected to have minor exceedances during daytime hours, with a further 2 during evening hours, during the general operation of the solar farm (tracking motors, substation and inverter substation). This is considered a worst-case scenario and validation would occur during operation.

Operational maintenance activities are likely to cause short term and infrequent noise exceedances at a number of sensitive receivers, most notably during slashing activities. These exceedances would be short in duration, typically a few hours, and occur only several times per year.

The results of the noise assessment demonstrate that construction noise levels satisfy relevant regulatory construction. Specific mitigation measures have been recommended where exceedances are expected.

The predicted cumulative construction and operation noise levels were assessed for all receivers located within 300 m of both the proposal and Glenellen Solar Farm. The only receiver located within 300 m is an unoccupied residence, receiver R10. An exceedance of 13 dB LAeq was noted during concurrent piling operations at both solar farms, and an exceedance of 17 dB LAeq was noted in the event grass slashing occurs simultaneously on both solar farms.

LOWER RISK ISSUES

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

Soil

A soil report was prepared 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 landscape was identified at the development site. The soils were classified as Chromosols. These soils have a low risk of erosion, a low salinity risk, and a low 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 lead to the removal of vegetation and ground cover, increased compacted surfaces and decreased permeability.

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

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

These potential impacts have been 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 water quality

The development site is situated in the Upper Murray Catchment. The proposal is approximately 18 km north of the Murray River. Two ephemeral creek systems, Dead Horse Creek and Kilnacroft Creek, traverse the western side of the proposal. These creeks are tributaries of Bowna Creek, which flows into the northern arm of Lake Hume.

The development site is situated within an outcropped area of the Lachlan Fold Belt MDB Groundwater Source (NSW Government 2011) and falls under the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011 (NSW Government 2011). There are no groundwater sites within the development site.

High potential for aquatic groundwater dependant ecosystems (GDE) is shown in the man-made dam/wetland on the eastern portion of the proposal, with a low to high potential for terrestrial GDE across the site. These areas are, however, located within proposed retained vegetation.

The site is not mapped as flood prone land under the Greater Hume LEP 2014. The proposed development is not considered to impact on flood behaviour that could be detrimental to other developments or land.

Water during construction would be sourced from standpipes operated by Greater Hume Shire Council. The anticipated amount of non-potable water required during construction is 30 ML. This water is predominantly used for dust control.

During operation, water for panel washing and other maintenance activities would similarly be sourced from the available standpipes. It is expected 1.2 ML of water would be required each year.

Operation of the proposal would increase peak flow by 0.3% for a 10% AEP and 0.1% for a 1% AEP. Operation of the proposal would not cause any impact downstream or be a nuisance for any downstream property owners.

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.

Traffic, transport and road safety

Access requirements can be separated into cars, 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.

As well as increased traffic numbers, transmission line installation works near roads, where overhead or underground, may cause minor traffic interruptions for works undertaken in and adjacent to the road reserve. These are expected to be minor and managed via traffic controls, within a Traffic Management Plan. No access interruptions are expected for any private residence.

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. Up to two cars per day would be expected during normal operation of the solar farm. 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.

The potential for cumulative traffic impacts may occur where the construction of both the proposed Glenellen Solar Farm and Jindera Solar Farm coincide. A channelised Right Turn (CHR) has been recommended to be provided on Urana Road to facilitate additional movements during the construction of both the proposal and Glenellen Solar Farm. No substantive impact upon traffic volumes and local road users is expected during the operation of both solar farms.

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

Climate and air quality

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

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

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

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

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

Hazards

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development and 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. It was determined that the BESS on site would not exceed screening thresholds, therefore a PHA is not required.

The development site is currently agricultural land comprising several large paddocks which are gently undulating, with small remnant patches of vegetation located throughout the site. Two creeks, Dead Horse Creek and Kilnacroft Creek, run west-east through the western portion of the subject land. These creeks are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted native vegetation. Remnant roadside vegetation also occurs along the internal boundaries and roads. The site is not identified as bush fire prone land (NSW RFS 2019), however areas surrounding the site have been identified as bush fire prone under the Greater Hume LEP 2012.

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. 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.

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.

Socioeconomic and community

Greater Hume Shire Council has four key strategic themes in their Community Strategic Plan 2030 (Greater Hume Shire Council 2012). The plan identifies the community's main priorities and aspirations for the future. The four key themes include:

- Greater ideas by our people
- A simply greater place to live
- Simply greater natural surroundings
- A simply greater place to work

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan. The proposal would generate economic activity, increase job diversity in the LGA, and manage impacts to the natural environment.

Community feedback has been sought through two community open days and direct engagement through letters, emails, phone calls and face to face meetings. It is estimated over 2000 people have received information about the solar farm during the community engagement process. A dedicated website and email address were created for the provision of information and for seeking feedback from the general public. The community open days were advertised in a flyer detailing the dates and location for the Open Day. The flyer was emailed to all interested parties that provided an email address, posted to all residences within a 2 km radius of the proposal, placed in every Post Office Box at the Jindera Post Office, advertised at the local IGA and community bulletin board, and advertised twice in the Eastern Riverina Chronicle newspaper. Twelve people provided feedback forms. The feedback has been mixed - positive and negative views, with concerns raised regarding:

- Local values – Respondents value the views of the farmland, local heritage, investment in land values, lifestyle, and open spaces. The land is seen as highly productive and sustainable agricultural land.
- General attitudes towards solar – The general attitude towards solar was mixed, with the vast majority of respondents in favour of solar power. This was however dependent on the location, with the majority of respondents being against solar farms located on productive agricultural land.
- Attitude towards the proposal – The attitude towards the proposal was also mixed, with the majority of respondents against the proposal in its current location.

Positive socio-economic impacts from the proposal include a boost to the local and regional economy through the employment of up to 200 staff during peak construction and through increased demand for accommodation, goods and services.

Potential adverse impacts include those associated with increased traffic on the roads, minor traffic interruptions where underground or overhead transmission lines are installed in or adjacent to the road reserve, as well as a change in the rural landscape and visual amenity of the area (no access interruptions are expected for any private residence). Most of these impacts will be temporary and reduced during the operation and decommissioning stages of the project, with less staff and reduced traffic numbers required during these stages.

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

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. Recyclable construction waste such as carboard, plastic and timber would be separated and taken by an appropriate contractor. During operation, waste materials would be fuels, lubricants, plastics, excess building materials and metals. Items that cannot be reused or recycled would be disposed of in accordance with the *Protection of the Environmental Operations Act 1997* (POEO Act).

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

Historic heritage

In the Greater Hume LGA, there are no items listed on the Commonwealth Heritage List, four listed items on the NSW State Heritage Register and twelve listed items/places on the NSW State Agency Heritage Register. There are 172 listed items/places on Schedule 5 in the *Greater Hume Local Environment Plan (LEP) 2012*. Two items of heritage listed under the LEP are located within 1.5 km of the development site:

- Drumwood homestead and outbuildings, located at 344 Drumwood Road, Jindera (I128).
- Jindera General Cemetery, corner Drumwood Road and Hannah Lane, Jindera (I131).

No items were located 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, increased pressure on local facilities, goods and services, and local agriculture impacts.

There are twenty-six active major projects listed on the Major Projects Register within the Greater Hume Shire. Cumulative impacts may have a minor impact to SSD proposals occurring within the LGA. Mechanisms to consult with local industry would assist to manage cumulative impacts should additional developments become relevant to the proposal.

The cumulative impacts identified for the proposal are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

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 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. 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. The assessment must include all ancillary infrastructure associated with the project and Rural Fire Service requirements for asset protection.

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the proposed construction, operation and decommissioning of approximately 120 Megawatt (MW) Alternating Current (AC) photovoltaic (PV) solar farm; equivalent to up to 150 MW Direct Current (DC) ('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 DPIE on 14 September 2018 (Appendix A). Detail from the SEARs that requires addressing has been included at the beginning of each relevant section.

The EIS also addresses the assessment requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act). Although the proposal is not a Controlled Activity, this EIS does address the screening requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Jindera Solar Farm Pty Ltd (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

Jindera Solar Farm Pty Ltd (JSF) is based in NSW. It is a partnership involving Hanwha Energy Corporation (Hanwha Energy) and Green Switch Australia. Hanwha Energy is a major owner of solar farms in Australia, the United States of America and Asia. Green Switch Australia is a developer that specialises in creating utility scale solar projects. Together they have many years' experience in developing, building and operating solar power projects.

1.2.2 Development site location

The proposal is in the Greater Hume Government Area (LGA) approximately 4 km north of Jindera township (Figure 1-1). The subject land comprises of Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, 153-155 DP753342, Lots 1-3 DP1080215, Lot 1 DP588720 (40 m wide proposed transmission line easement owned by TransGrid))and Crown and Council Road currently being purchased by the Landowner (CADID 105306258 and CADID 105338106) (Figure 1-2 and Figure 1-3).

The subject land is currently agricultural land comprising several large paddocks which are gently undulating, mostly cleared of native vegetation and have been historically cultivated for cropping and grazing. Two creeks, Dead Horse Creek and Kilnacroft Creek, run west-east through the western portion of the subject land. These creeks are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creeks are bordered by planted native vegetation. 26 dams are also scattered throughout the subject land, which includes a large man-made dam/wetland.

The surrounding landscape is gently undulating and similarly agricultural. The proposal area is bound by Urana Road, Nation Road, and Ortlipp Road, and intersected by Walla Walla Jindera Road, Sparkes Road, Glenellen Road and Klinberg Road. Proposed transmission lines would connect to an existing TransGrid substation located 600 m to the south-east of the proposal.

The proposal is in the Murrumbidgee River catchment. Local land use is primarily agricultural, including cropping and grazing.

The Locality

Greater Hume LGA is located within the NSW Riverina region between the major regional centres of Albury/Wodonga and Wagga Wagga. The shire was formed in 2004 incorporating Culcairn Shire, the majority of Holbrook Shire and part of Hume Shire.

The shire has several major towns including Culcairn, Henty, Holbrook, Jindera, and Walla Walla, with smaller villages of Brocklesby, Burrumbuttock, Gerogery, Gerogery West, Morven, Walbundrie and Woomargama.

Greater Hume Shire has an area of 5,746 km^2, and at the 2016 Census had a population of 10,351 people (ABS 2019).

Jindera

The town of Jindera is located approximately 40 km south-west of Culcairn and 16 km north of the major city of Albury, with a population of 2,222 as at the 2016 Census (ABS 2019). Jindera has a number of attractions including the Jindera Pioneer Museum, the Jindera Country Golf Club, Four Mile Creek, Jindera Wetland, Jindera Village Green and a number of recreational reserves.

1.3 KEY COMPONENTS OF THE PROPOSED JINDERA SOLAR FARM

The development footprint would occupy around 327 hectares (ha) of the 521 ha subject land. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar array generating around 150 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 (PV) solar panels, mounted on steel frames at about 3 m above ground level at maximum tilt.

- Battery Energy Storage System (BESS) with maximum capacity of 30MW/60MWh.
- Electrical cables and conduits.
- Inverter stations which have an aggregate capacity of approximately 155 MVA.
- Weather station.
- On-site high voltage substation.
- Control room and storage facility.
- Site office, staff amenities, parking area and perimeter fencing, and CCTV.
- Overhead transmission line infrastructure on poles connecting the project's on-site high voltage substation to the existing TransGrid Jindera 330/132kV substation.
- Internal access tracks.
- Access road entrances from public roads.
- Upgrade to existing roads.
- On-site vegetative screening.
- Other associated ancillary infrastructure.

The proposed infrastructure map (Figure 1-4) illustrates the indicative layout, including a concept development footprint for the solar arrays. Detailed design would allow for avoidance of sensitive features on the site. A native vegetation buffer would be established post-construction to minimise visual impacts in specific locations.

In total, the construction phase of the proposal is expected to take approximately 12 months, and the facility would be expected to operate for around 30 years. Two to three operations and maintenance staff and an expected 6 service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All above and below ground infrastructure would be removed in consultation with the landowner, and the site returned to its existing land capability.

1.4 CAPITAL INVESTMENT

The proposal would have a capital investment of around $167.5 million.

1.5 LAND OWNERSHIP

The subject land is owned by three title holders (Table 1-1), two of which are managed by the same landowner.

Table 1-1 Land ownership

Property Description		Land Owner
Lot 90, 136, 140 and 141 DP 753342	1	Managed by Land Owner 1
Lot 70, 133, 134, 135, 138, 139, 154, 155 DP 753342	2	
Lot 1, 2, 3 DP 1080215, Lot 2 DP 213465, Lot 147, 148, 153 DP 753342, Lot 1 DP588720	3	

The use of the site would be based on a lease agreement between the proponent and the landowners. A single dwelling exists on Lot 139 DP 753342. The proponent has signed an Option Deed with the owners of these properties to lease the land for the purpose of a solar farm.

A Crown Road (CADID 105306258) is in the final process of being purchased by Landowner 2, with an additional section of road (CADID 105338106) being purchased from Council. The purchase and transfer of the crown roads has not been finalised, with no Lot or Deposited Plan (DP) number assigned yet.

The 40 m wide proposed transmission line easement connecting to the Jindera Substation compound occurs on lot 1 DP588720. This lot is owned by TransGrid. To date TransGrid have not been able to define the scope of any works which may be required within the Jindera Substation lot.

1.6 DEVELOPMENT HISTORY IN THE LGA

A search for State Significant Development on the Major Projects website (accessed 14 June 2019) of Greater Hume LGA indicated the following major development:

- Glenellen Solar Farm.
- Walla Walla Solar Farm.
- Culcairn Solar Farm.
- Rockley Falls Quarry.

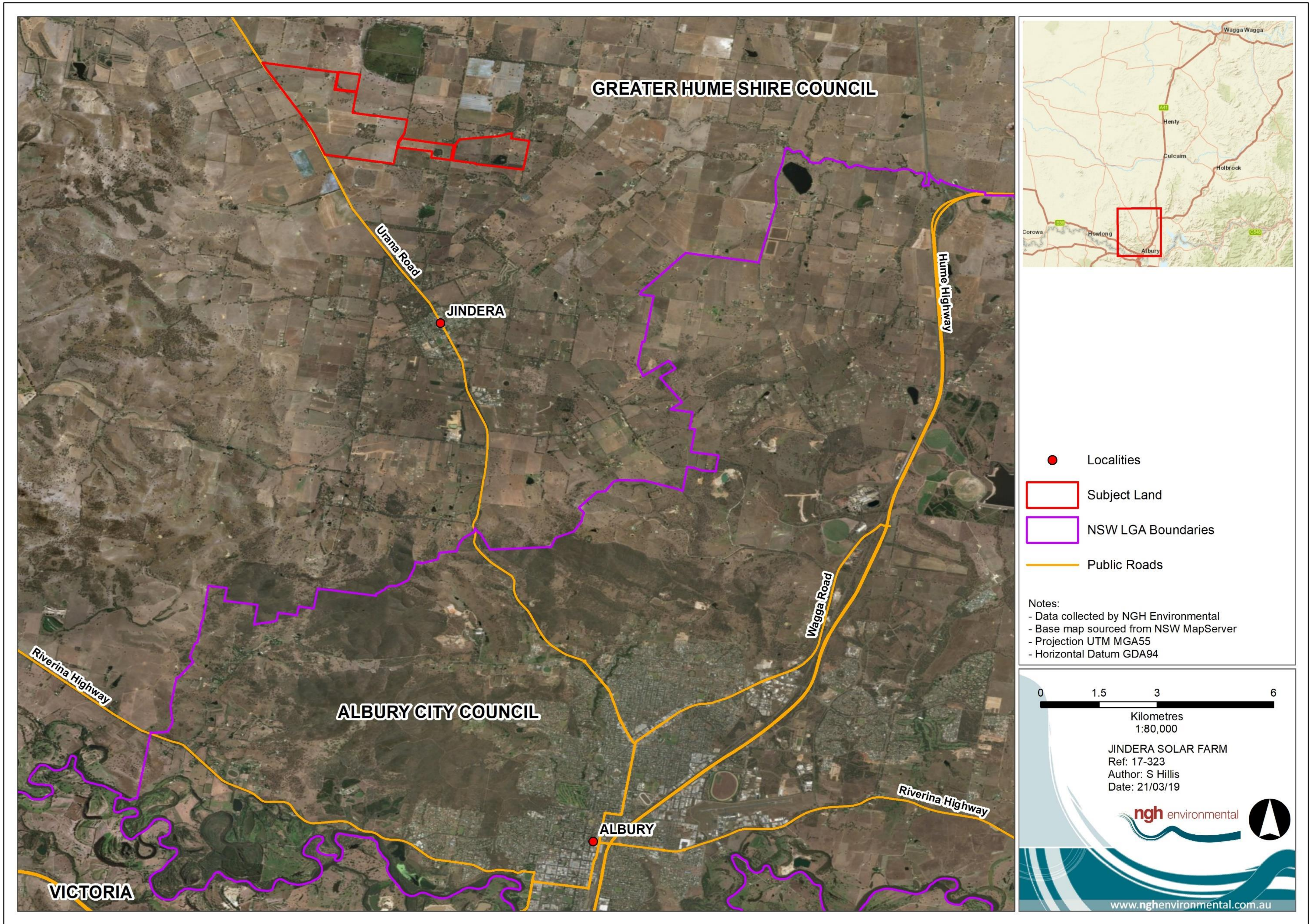

Figure 1-1 General location of the subject land

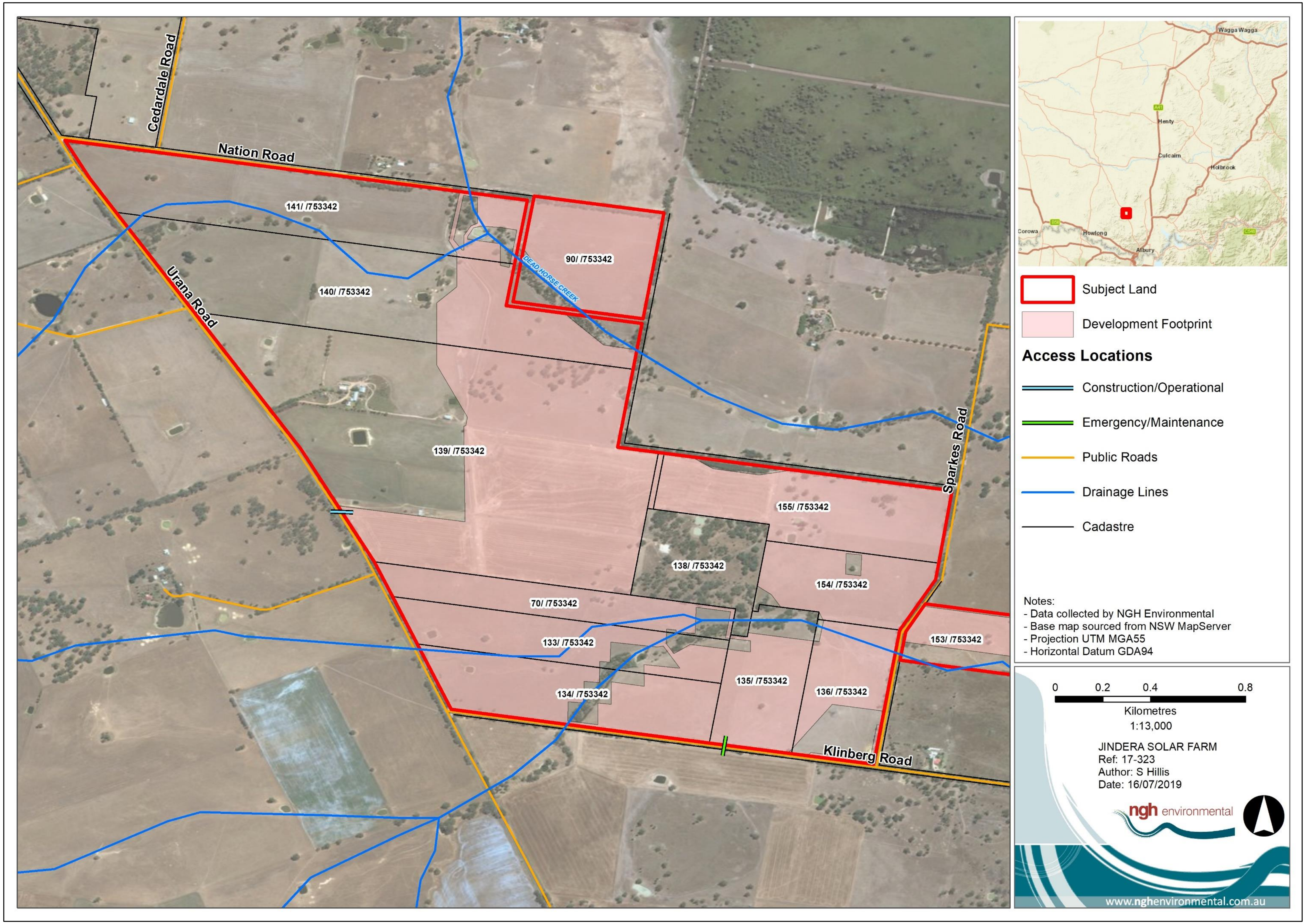

Figure 1-2 Subject land (1 of 2)

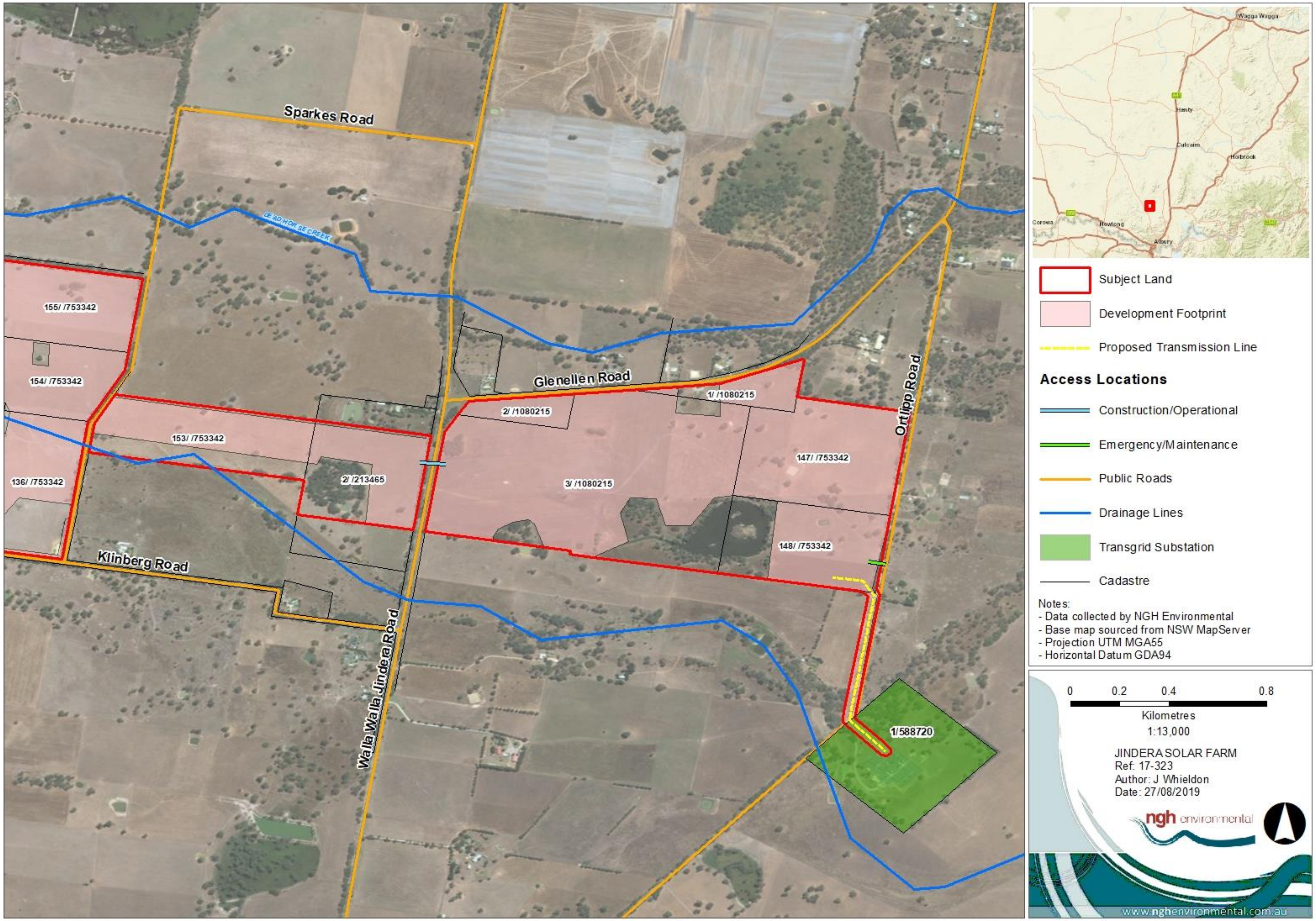

Figure 1-3 Subject Land (2 of 2)

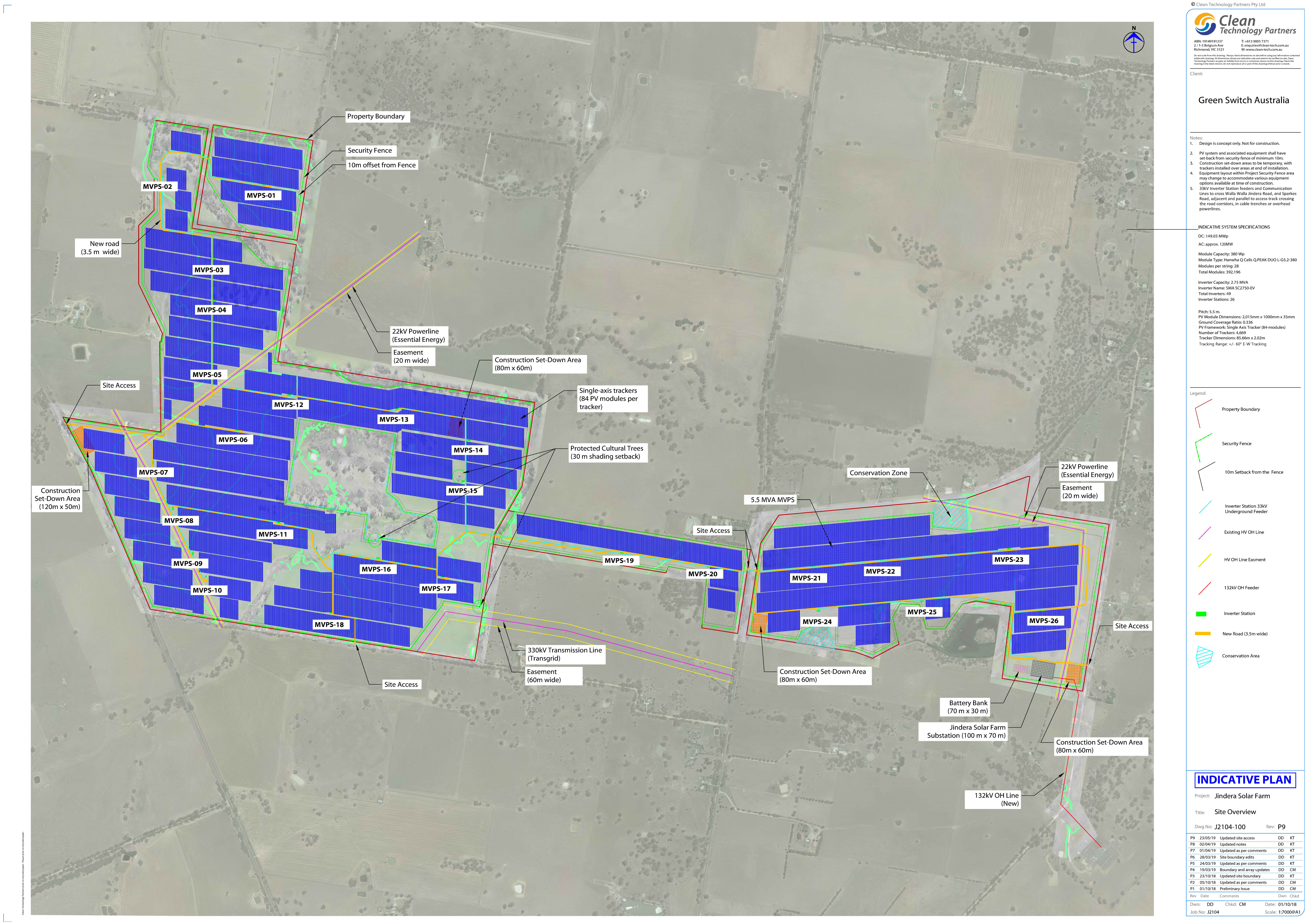

Figure 1-4 Proposed Infrastructure

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 other proposed or approved solar farms, rural residential development and subdivision potential).*
- *The reasons why the development should be approved having regard to:*
  - *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.*
- *A detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.*

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 2018). 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 9,500 gigawatt hours (GWh) of new renewable energy generation by 2010.

This target was revised and increased to 45,000 GWh from 2001 to 2020 in January 2011. 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 Australian 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 Australian Government by 2030 and determined that renewable energy would constitute approximately 42% of the NEM. With the current projection that renewable energy would make up 23.5% by 2020, the Jindera Solar Farm would help close the gap to the 2030 target.

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 production from renewable sources to reduce costs for energy consumers, for the greater benefit of NSW as a whole.

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

2.1.7 NSW 2021: A Plan to Make NSW Number One

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

A commitment is made to:

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

Specific initiatives under this target that directly support building solar power plants includes the Solar Flagships Program, in partnership with the Australian 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

Lifecycle 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 lifecycle GHG emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al* 2008).

Unlike fossil fuel systems, most of the GHG emissions for solar technology occur upstream of the lifecycle, with most of the emissions (50-80%) arising during the production of the module (Weisser n.d). Other lifecycle emissions relate to construction and decommissioning activities. During 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.

2.1.9 Electricity Supply

The Australian Energy Market Operator (AEMO 2018) forecasts that grid-supplied electricity consumption will remain flat for the next 20 years, despite projected 30% growth in population. Although not required to meet projected electricity demand, the proposal would benefit the network by shifting electricity production closer to local consumption and regulating inputs to the grid using a BESS facility.

The electricity network was designed to deal with a small number of very large power generating stations. The localisation of power generation helps the grid to cope with the supply from diversified renewable energy projects.

The project is located within an area subject to a number of different renewable energy projects, including the adjacent Glenellen Solar Farm. Both projects aim to connect into the same local substation.

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 Australian 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 275,000 MWh of renewable electricity per year.
- Supply enough power each year to service approximately 65,000 households (assuming average household consumption of 4,215 kWh p.a.).
- Save around 92,000 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 92,000 tonnes of CO_2 per annum is the equivalent of taking about 40,500 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. Nine coal-fired power stations have closed since 2011-2012, representing around 3,600MW of installed capacity (AER 2018).

Even with demand-management initiatives, 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.* 2016). 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.* 2016).

While grid-supplied electricity consumption is expected to remain stable (AEMO 2018), 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 2019). 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, more competition means lower 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*., 2016).

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 200 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 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 Greater Hume Shire Council and the proponent.

- Introduce additional sources of employment and income to the region.

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 and other measures 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.

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 Australian 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 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.
- Minimise the loss of viable agricultural land and agricultural activities.
- Ensure complete return of the land to agricultural use following decommissioning of the solar scheme.

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 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.

PV 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.

Superior solar resources have been identified in NSW, providing excellent opportunities for solar projects.

Energy Storage Technology

There are several alternative technologies that could be used for the proposed BESS 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.* 2016).

Alternative battery technologies include lead acid and relatively new technologies such as hydrogen, molten-state, sodium-ion, flow (vanadium redox, hydrogen bromide or zinc bromide) and saltwater 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 LIB.

LIB 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 Jindera Substation south east of the site was also instrumental in making Jindera 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 existing on-site dams, 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 commenced a grid connection process with TransGrid, which includes detailed electrical load-flow modelling of the NSW electricity transmission system. This detailed modelling has shown available capacity at the Jindera Substation sufficient to support a proposal of this scale. The modelling also considered other committed future generation. These assessments have been discussed with TransGrid as part of the ongoing grid connection consultation and agreement process.

2.5 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 Jindera 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 are detailed in Table 2-1 below:

Table 2-1 Site conditions and constraints (NSW Large-scale Solar Energy Guideline for State Significant Development (DPE 2018))

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 and is not located within a valley with residences with elevated views looking towards the site. A small number of residences are however located off Urana Road, which has a slightly higher elevation than the proposal. It is also proposed to screen the proposal with a mixture of native vegetation.
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 and 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 25 occupied residences within 1 km of the development site. It is proposed to screen views of the proposal with a mixture of native vegetation and other specific mitigation measures. 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	The proposal is not located on Strategic Agricultural Land, including industry clusters and biophysical strategic agricultural land. The proposal is however mostly located on Land and Soil Capability Class 3 land. However: • The proposal is not expected to adversely affect the biophysical nature of the land.

Areas of constraint	Site justification
cumulative impacts of multiple developments.	• 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.	Parts of the development site are identified as category 2 vegetation bushfire prone land in the Greater Hume Shire Council online mapping. The proposal is unlikely to create any additional bushfire risk, as detailed within this EIS. The development site is not identified as flood prone land under the Greater Hume Local Environmental Plan (LEP).
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.	Email correspondence DPIE, Resource and Geoscience Division detail that there are no current operating mines of quarries over the proposal or adjacent lands (Appendix C.1). However, a small portion of Lot 90 DP 753342 is covered by Exploration Licence EL8467 (approximately 9 ha of the 20 ha block or 9 ha out of the total 1000 ha of exploration licence). The owner of said licence has shown preliminary concern that the proposal would limit any mining operations if exploration proves to be successful.
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.	The development footprint impacts a previous Crown road. The Landowner is however currently in the process of purchasing the road and consolidating into his property (CADID 105306258). Lot 90 DP 753342 is also surrounded by a previous council road. The Landowner is also currently in the process of purchasing the road (CADID 105338106).

2.6 INTERACTION WITH OTHER RENEWABLE PROJECTS

The proposal is located within an area subject to a number of different renewable energy projects, including the proposed Glenellen Solar Farm, which would be located adjacent to Jindera Solar Farm. In consideration of the strategic need for the proposed Jindera Solar Farm, and the potential for it to be one of several local solar farms:

- The contribution of the proposal to global warming, RETs and other state and federal targets would not be affected; the proposal makes the same contribution irrespective of the development of other solar projects. There is a need for more renewable energy development to meet these targets.
- Localisation of power generation helps the grid to cope with the supply from diversified renewable energy projects. The development of more regional solar farms is of benefit in this regard.
- Broad benefits of the proposal would not be affected; the proposal makes the same contribution to reducing emissions and diversifying landuse, irrespective of the development of other solar projects.
- Local benefits of the proposal would not be affected; the proposal would generate the same employment numbers and local economic stimulus. However, the region may become better able to capitalise on these opportunities with a greater number of solar farms developed in the area; for example, the growth of local capacity in the skills required particularly during the construction phases.

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 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. 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. The assessment must include all ancillary infrastructure associated with the project and Rural Fire Service requirements for asset protection.

3.1 PROPOSAL AREA DESCRIPTION

The Subject Land (521 ha) comprises of Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, 153-155 DP753342, Lots 1-3 DP1080215, Lot 1 DP588720 and two Crown and Council Road currently in the process of being purchased by the Landowner (CADID 105306258 and CADID 105338106) (Figure 1-2 and Figure 1-3). The proposal area is bound by Urana Road, Nation Road, and Ortlipp Road, and intersected by Walla Walla Jindera Road, Sparkes Road, Glenellen Road and Klinberg Road.

The proposal would have major construction and operational access off Urana and Walla Walla Jindera Road. During operation, there would be additional maintenance and emergency access off Klinberg Road and Ortlipp Road. Urana Road forms the major transport route to and from the site.

Several transmission lines run through the development site including 3 Essential Energy 22 kV transmission lines and a TransGrid 330 kV transmission line which is part of the electricity distribution network that originates at TransGrid's Jindera Substation. Proposed transmission lines would connect to an existing TransGrid substation located 600 m to the south-east of the proposal. The connection route within the substation lot has not yet been defined by TransGrid. A 40 m wide easement connecting the transmission line to the substation has been included within the development footprint.

The subject land is currently agricultural land comprising several large paddocks which are gently undulating, mostly cleared of native vegetation and which have been historically cultivated for cropping and grazing (Figure 3-1 and Figure 3-2). Remnant native vegetation in the form of paddock trees, small mixed stands of remnant native woodlands and native grassland are present within the development footprint (Figure 3-3 to Figure 3-5).

Two creeks, Dead Horse Creek and Kilnacroft Creek, run west-east through the western portion of the subject land. These creeks are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted native vegetation. 26 dams (Figure 3-6) are also scattered throughout the subject land, which includes a large man-made dam/wetland area (Figure 3-7).

The surrounding landscape is gently undulating and similarly agricultural, located in the Murrumbidgee River Catchment.

There are no residences within the development footprint. The subject land and the majority of adjoining land is used for agriculture, including grazing and cropping. The nearest non-associated resident is located on Glenellen Road, and is within 50 m of the subject land (Figure 3-8).

Table 3-1 Tenanted non-associated residences directly adjacent to the Subject Land

Adjacent Residence	Distance to Subject Land (m)
R01	210
R02	360
R03	450
R08	410
R09	300
R15	200
R16	50
R17	60
R18	90
R20	55
R21	100
R22	600
R23	50
R24	900
R25	740

Figure 3-1 Example of cleared, highly modified agricultural paddocks.

Figure 3-2 Example of cleared, highly modified agricultural paddocks.

Figure 3-3 Example of stands of native vegetation.

Figure 3-4 Example of stands of native vegetation.

Figure 3-5 Example of stands of native vegetation with weed understorey including barley grass and small leafed marshmallow grass

Figure 3-6 Example of typical farm dam

Figure 3-7 Man-made wetland

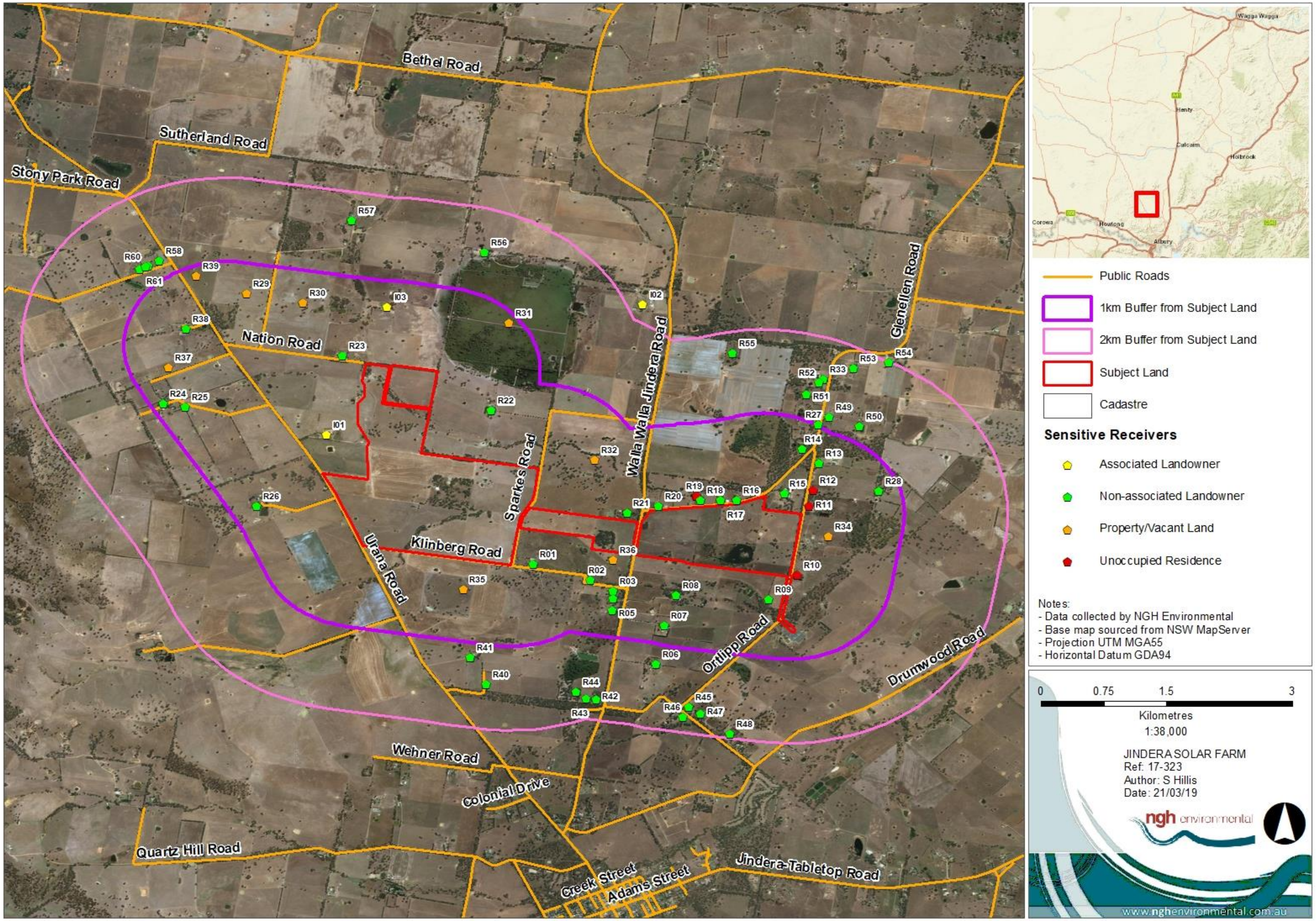

Figure 3-8 Sensitive residence within 2 km of the subject land.

3.2 PROPOSED JINDERA 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 Jindera Solar Farm.

Proposal element	Description
Proposal	Jindera Solar Farm
Proponent	Jindera Solar Farm Pty Ltd.
Capacity	Approximately 120 MW AC (equivalent to up to 150 MW DC). 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	521 ha
Development site	404 ha
Development footprint	337 ha
Site description	Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, and 153-155 DP753342, Lots 1-3 DP1080215, Lot 1 DP588720 and two Crown and Council roads currently in the process of being purchased by the Landowner (CADID 105306258 and CADID 105338106). Agricultural land zoned RU1 (Primary Production) under the Greater Hume Local Environmental Plan.
Local Government Area	Greater Hume
Subdivision	Approximately 119 ha of the property would be subdivided for the landowner to retain current farming practices.
Solar array	Around 400,000 solar panels mounted in arrays, with ~5.5 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 3 m above the natural ground level. The PV mounting structure would comprise steel posts driven approximately 2.5 m to 3.0 m into the ground using a small pile driver.
Battery Energy Storage System (BESS)	Subject to economic and technical considerations, the proposal would include approximately 30MW/60MWh rated capacity units. The facility would comprise of lithium-ion batteries housed adjacent to the on-site substation.
Inverters/transformers	The proposal would include approximately 25 containerised inverter stations across the site.
Substation	An on-site substation occupying around 6400 m² (in a 1 ha compound) with gravelled hardstand and security fencing, approximately 3.5 m in height. Approximately 750 m of 132 kV overhead cabling would connect the on-site substation to the existing TransGrid substation. The connection type (underground/overhead transmission line) and route within the substation lot has not yet been defined by TransGrid. A 40 m wide easement connecting an overhead transmission line to the substation has been included within the development footprint.
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. Approximately 12.3 km of internal access tracks are required.
Operations and maintenance buildings	Buildings would be constructed to provide a control room, switch room and storage facilities for the solar farm. Maximum building height will be 3.5 m.
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

Proposal element	Description
	maintenance buildings. Security fencing installed around the site would indicatively be 2 m high.
Construction hours	Standard daytime construction hours would be 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. In general, no construction activities would occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. Greater Hume Shire Council and surrounding landholders would be notified of any exceptions.
Construction timing	12-18 months commencing 2020
Workforce	Construction – peak of up to 200 workers Operation – 2 – 3 full time equivalent staff and up to 6 service contractors
Operation period	30 years
Decommissioning	At the end of its operating life, the site would be returned to its pre-works state. All above and below ground infrastructure would be removed. The site would be rehabilitated in consultation with the landowner consistent with land use requirements.
Capital investment	Estimated $167.5 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 3-9 and Figure 3-10). In terms of biodiversity values, Endangered Ecological Communities (EEC) vegetation and threatened flora and fauna habitat were avoided as far as practicable.

Table 3-3 Environmental constraints at Jindera development site

High constraint
Remnant woodland vegetation Remnant woodland with native understorey, including EEC in moderate-good Biometric condition. Woodland remnants have high conservation value. Majority of trees are hollow-bearing and provide potential threatened bird and mammal habitat.
Near neighbours A number of non-associated residences are located directly adjacent to the subject land boundary.
Scarred trees Scarred trees with Aboriginal cultural significance were identified within the development footprint.
Moderate constraint
Isolated paddock trees Isolated trees in cropland (some derived from an EEC and some hollow-bearing) have habitat and connectivity value for native wildlife.

Water storage dams 26 dams are present on the property, which present a practical constraint for the solar farm.
Isolated artefacts A number of isolated Aboriginal artefacts were identified within the development footprint.
Low constraint
Cleared, cultivated paddocks with no paddock trees These areas do not contain native vegetation and have low habitat value.

3.4 SUBDIVISION

The proposal would require subdivision of the subject land within the Greater Hume LGA. The following configuration is proposed:

Lot 141 DP 753342

Subdivide an area of approximately 35.25 ha from existing Lot 141. This land would be retained by the current landowner for the purpose of carrying out agricultural activities. The balance of the land would contain solar infrastructure and would comprise of approximately 6.34 ha.

Lot 140 DP 753342

Subdivide an area of approximately 36.30 ha from existing Lot 140. This land would be retained by the current landowner for the purpose of carrying out agricultural activities. The balance of the land would contain solar infrastructure and would comprise of approximately 16.75 ha.

Consolidation of lots

Land retained by Landowner 1 would be consolidated into one larger ‘Lot A’ of approximately 71.55 ha. The balance of the land proposed for solar infrastructure would be consolidated into one larger ‘Lot B’ of approximately 23.09 ha.

Lot 139 DP 753342

Subdivide an area of 47.35 ha from existing Lot 139 (Proposed ‘Lot C’). This land would be retained by the current landowner for the purpose of carrying out agricultural activities. The balance of the land would contain solar infrastructure and would comprise of approximately 65.89 ha (Proposed ‘Lot D’).

Council provided NGH Environmental with a letter (dated 20 May 2019), stating that the configuration of the land is not permanently altered by the subdivision of land for leasehold purposes, as a result council do not apply the provisions of the Greater Hume LEP. Council would not be concerned by subdivision for leasehold purposes (Appendix C.1).

A subdivision plan, with the proposed consolidation, is provided at Figure 3-11.

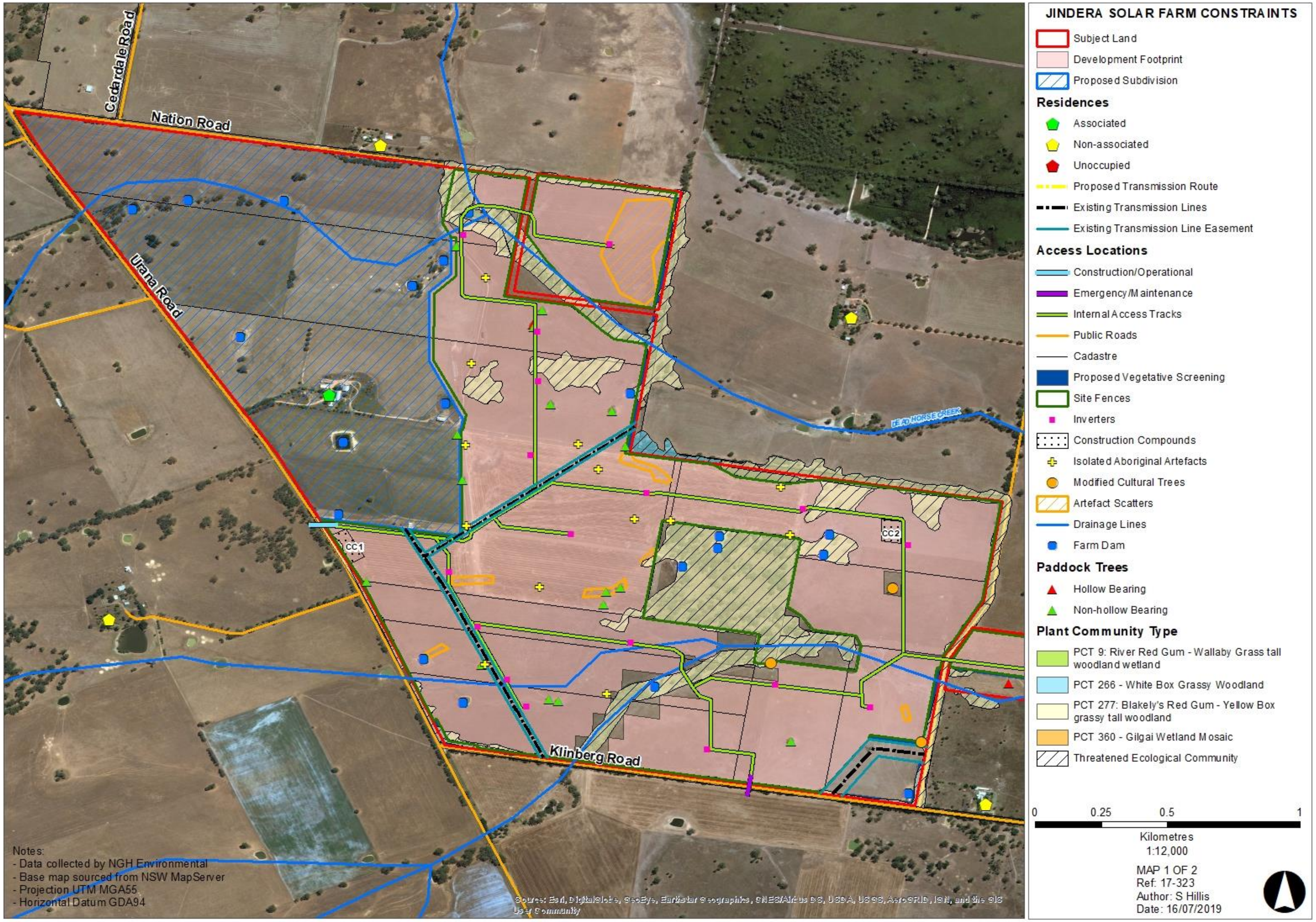

Figure 3-9 Proposal infrastructure layout and site environmental constraints Map 1 of 2

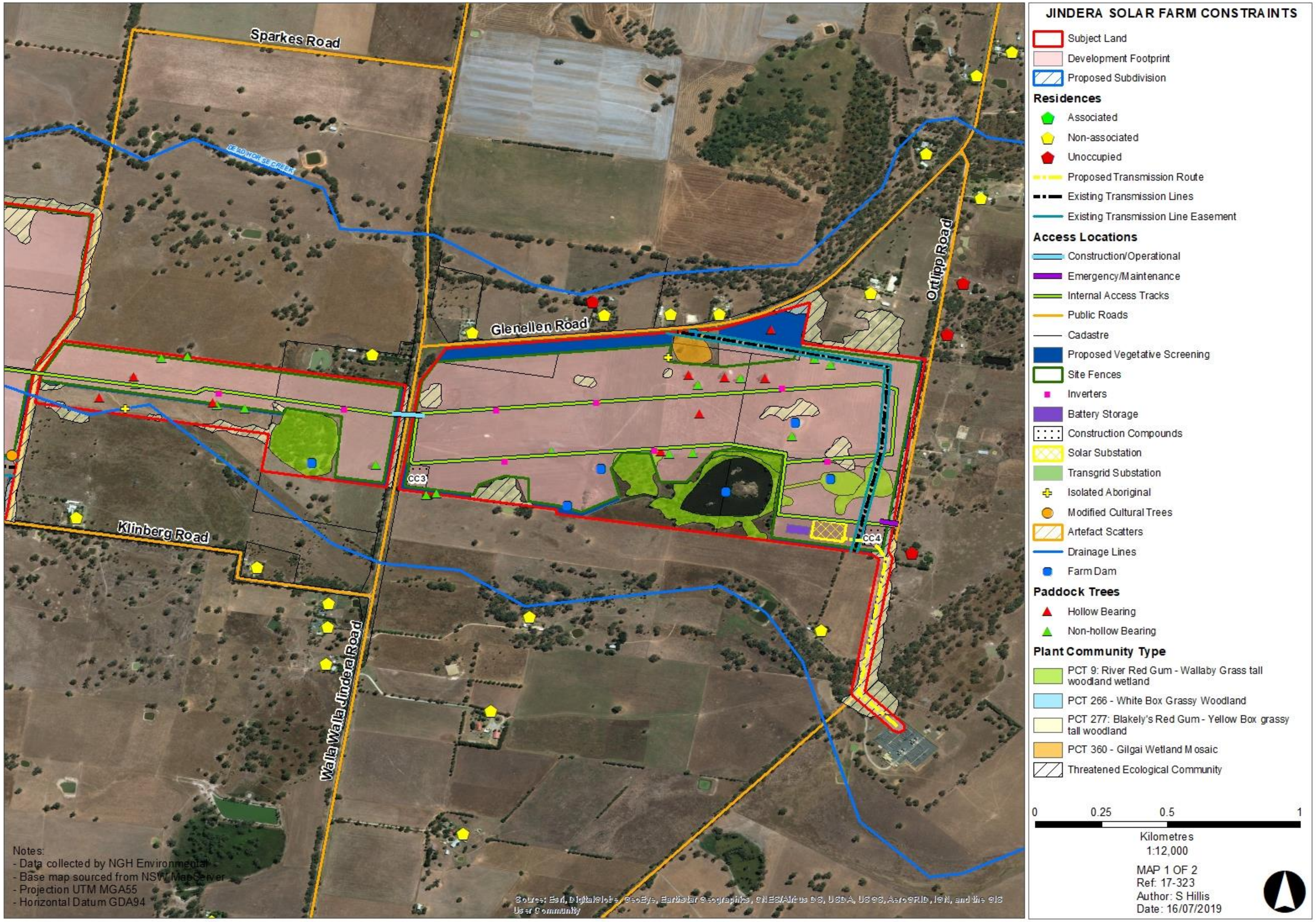

Figure 3-10 Proposal infrastructure layout and site environmental constraints Map 2 of 2

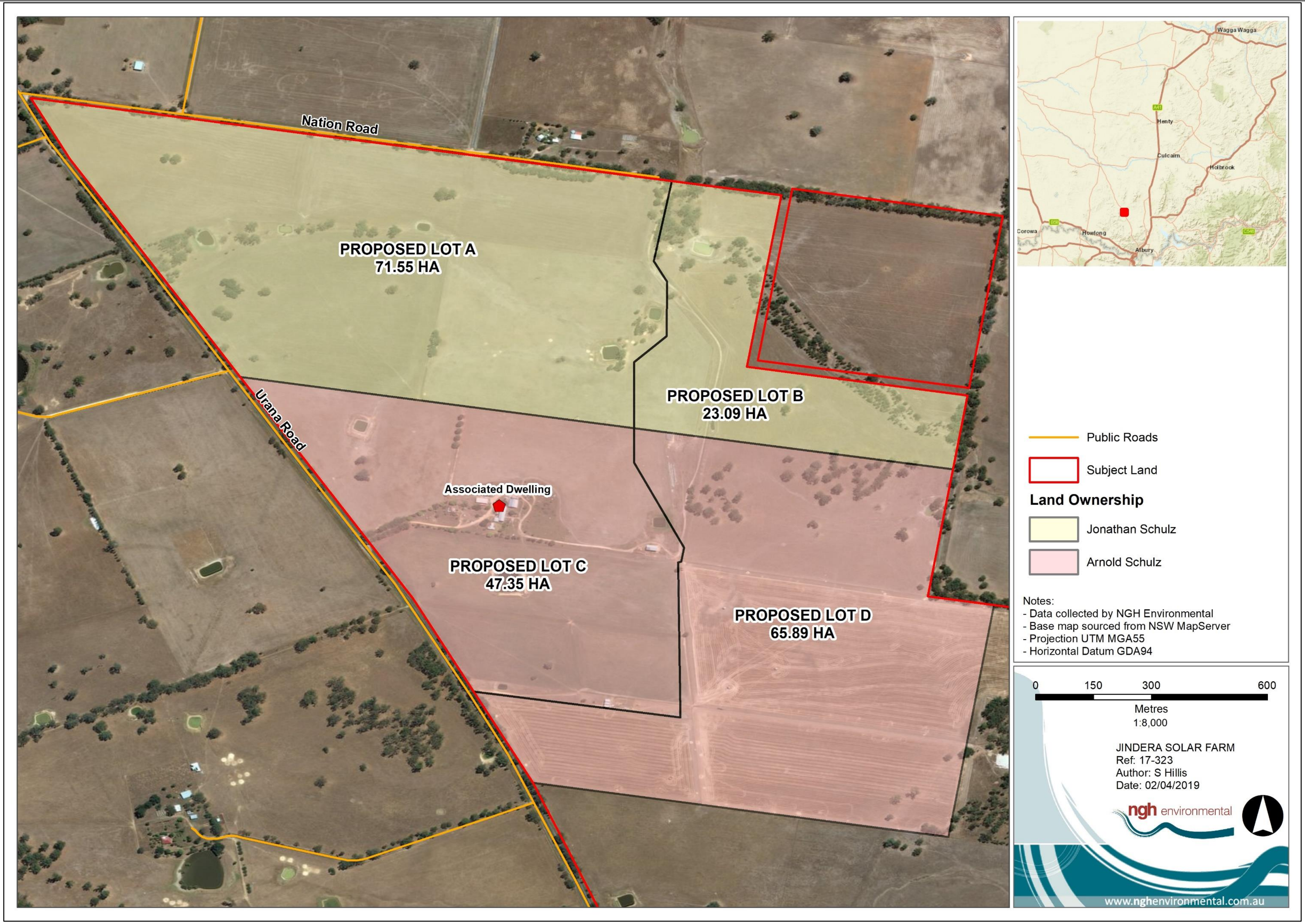

Figure 3-11 Proposed subdivision plan

3.5 PROPOSED INFRASTRUCTURE

The proposal involves the construction and operation of a ground mounted photovoltaic solar array which would have capacity to generate approximately 120 MW AC (equivalent to up to 150 MW DC) of renewable energy. The solar farm would connect into TransGrid's Jindera substation.

The proposal would consist of the following components:

- Single axis tracker photovoltaic (PV) solar panels, mounted on steel frames at about 3 m above ground level at maximum tilt.
- Battery Energy Storage System (BESS) with maximum capacity of 30MW/60MWh.
- Electrical cables and conduits.
- Inverter stations which have an aggregate capacity of approximately 155 MVA.
- Weather station.
- On-site high voltage substation.
- Control room and storage facility.
- Site office, staff amenities, parking area and perimeter fencing, and CCTV.
- Overhead transmission line infrastructure on poles connecting the project's on-site high voltage substation to the existing TransGrid Jindera 330/132kV substation.
- Internal access tracks.
- Access road entrances from public roads.
- Upgrade to existing roads.
- On-site vegetative screening.
- Other associated ancillary infrastructure.

The solar farm arrangement is flexible and adaptable and has been designed to avoid impacts where feasible and minimise and mitigate environmental impacts if avoidance is not possible. The final detailed design would further consider the outcomes of the EIS.

The proposed infrastructure footprint is shown in Figure 1-2 and Figure 1-3. This includes all land likely to be directly impacted by the construction, operation and decommissioning of the proposal, including auxiliary construction facilities (site compound, laydown, stockpiling etc.) and all considered options. It is important to note that the proposed footprint is indicative only and will be refined as part of the detailed design process (considering environmental constraints and engineering studies).

The layout of the infrastructure components is shown in Figure 1-4 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.

3.5.1 Solar arrays

It is expected that the array would comprise up to around 400,000 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 mounted on single axis trackers (Figure 3-12 and Figure 3-13) with a maximum height not exceeding 3 m above the natural ground level (Figure 3-14). Approximately 4655 tracking units will be installed.

Approximately 57,000 piles would be driven or screwed into the ground to support the solar array. The pile depth would be determined following detailed geotechnical site investigation; depths are typically 2 to 3 m. Pile heights would vary according to topography. This minimises ground disturbance.

The solar PV panels installed on the mounting system would be interconnected. These module interconnections would be as short as possible and would shorten the cabling loops. Long cabling loops pose a higher risk for lightning strikes.

Figure 3-12 Example single axis mounting system after panel installation from Mount Majura Solar Farm, ACT (SEREE).

Figure 3-13 Example of single axis tracking solar array from Mount Majura Solar Farm, ACT (SEREE).

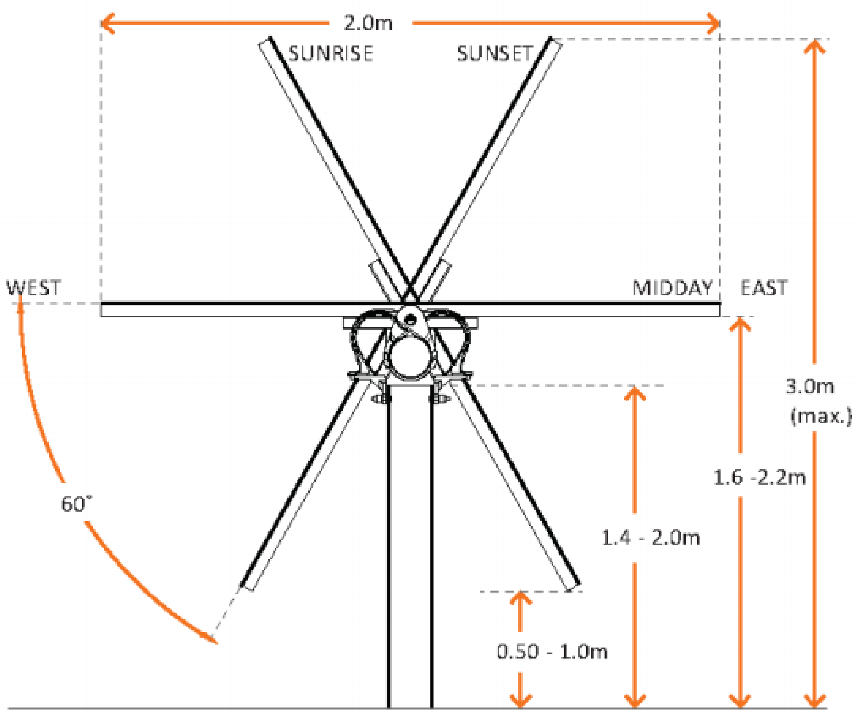

Figure 3-14 Maximum height of solar panel at full tilt

3.5.2 Inverter stations

The proposal includes approximately 25 containerised inverter stations evenly distributed across the site (locations illustrated in Figure 3-9 and Figure 3-10). Appendix B provides diagrams of the proposed inverter stations and Figure 3-15 illustrates an example of the internal elements of the equipment. The inverter stations would be constructed on concrete footings approximately 300 mm above ground level. The unit would measure approximately 13.0 m long, 3.5 m high and 2.5 m wide. Depending on the final manufacturer and model of the units, these dimensions may change.

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 3-15 Example of a containerised inverter station.

3.5.3 Battery Energy Storage System Facility (BESS)

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 for the purpose of realising it during periods of higher usage, thus matching output to market demand.

Subject to economic and technical considerations, the proposal would include approximately 30MW/60MWh rated capacity units. The batteries would be containerised and would include a temperature management and fire suppression system.

Similar to the inverter stations, the BESS would be constructed on concrete footings approximately 300 mm above ground level. Each unit would measure approximately 13.0 m long, 3.5 m high and 2.5 m wide (standard shipping container). Depending on the final manufacturer and model of the units, these dimensions may change.

3.5.4 Underground cabling

Most cabling at the site would be buried and located along the access tracks. The proposal would also require underground cabling across the Walla Walla Jindera Road and south of Sparkes Road (an unformed crown road).

All underground cabling would be installed at a depth of at least 500 mm with the electrical reticulation buried in the range of 600 mm to 1,000 mm deep, in accordance with the relevant Australian Standard (Figure 3-16).

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*.

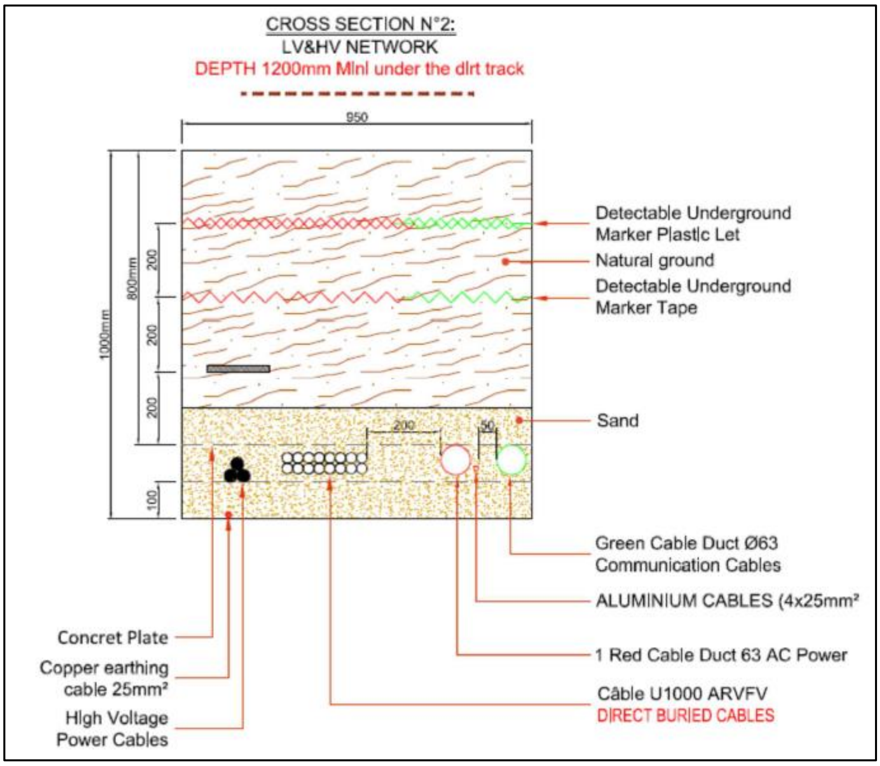

Figure 3-16 Typical trench design

3.5.5 Substation

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

Each inverter station will feed power to the solar substation. The separate inverter inputs will be fed via control and monitoring equipment within the substation before all the inputs are combined prior to the transformer. Two transformers may be deployed depending on final project technical and commercial requirements, and of the receiving network operator (TransGrid). The substation will be located in the south east corner of the site as near as possible to the TransGrid Jindera Substation, which will provide the point of connection between the power exported from the site and the electricity grid.

3.5.6 Transmission network connection

The solar farm would connect from the on-site substation to the TransGrid Jindera substation via a new overhead 132kV transmission line adjacent to Ortlipp Road, crossing to the eastern side of the Ortlipp road corridor to access the TransGrid substation property frontage, and continuing to the TransGrid Jindera 330/132kV substation switchyard inside the property. The final details and configuration of the transmission line and substation works inside TransGrid land are subject to detail design and approval from TransGrid. Ongoing consultation with Transgrid is continuing relating to the final connection details.

3.5.7 Site access and internal tracks

The development area would be accessed during operations from Urana Road and Walla Walla Jindera Road. Although the final design has not yet been completed, the location and form of the access road intersections 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 Greater Hume Shire following approval of the proposal.

The internal access roads would involve upgrading the proposed entrances and connecting with a network of tracks accessing the solar farm infrastructure for maintenance. Approximately 12.3 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 1-4, Figure 3-9 and Figure 3-10.

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

3.5.8 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 2.1 m high, providing adequate access points for project maintenance, land management purposes and for emergency egress. The security fence will be located behind the proposed vegetative screening, obstructing views of all proposed infrastructure.

3.5.9 Landscaping and revegetation

Landscaping and screen planting would be undertaken 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 1 - 3 rows 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 and proposed Landscape Plan (Appendix F).

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).

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.

3.5.10 Temporary construction facilities

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

- Material laydown areas.
- Temporary construction site offices.
- Temporary car 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.

Where required, chain link fencing approximately 2.1 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 200 workers).

3.6 CONSTRUCTION

3.6.1 Pre-construction activities

Prior to construction commencing, a number of activities are proposed to enable construction to commence:

- Fencing.
- Use of temporary site access points (e.g. existing farm accesses).
- Survey, geotechnical and other preliminary investigations.
- Slashing and/or removal of areas of non-native vegetation.
- Establish ancillary facilities including the site compound and laydown areas.

3.6.2 Construction activities

The construction phase is expected to last approximately 12-18 months with a peak construction period of 3 to 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, underground and overhead transmission lines and grid connections works at the Transgrid substation.
- Construction of BESS units.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.
- Landscaping

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently. Temporary construction facilities would be housed in three compounds (Figure 1-4).

Battery Energy Storage System (BESS)

The construction of the BESS 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.

3.6.3 Site preparation and earthworks

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

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of approximately 2.0 – 3.0 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 1,000 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 is expected to 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.

3.6.4 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/EPA. 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.

3.6.5 Materials and resources

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

Labour, machinery and equipment

It is anticipated that approximately 200 construction personnel would be required onsite during the peak construction period of approximately 3 to 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 Albury, Culcairn, Jindera, Holbrook and Bowna.

Equipment used during construction would include:

- Earth-moving equipment for civil works (excavators, graders, etc.).
- 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. Jindera, Culcairn and Albury are the nearest towns which are a possible source of the bulk of the aggregate material required for construction, followed by Holbrook, Wodonga, and Walla Walla.

Approximately 7,000 m^3 of gravel would be required to surface the access road and internal service track network, inverters, BESS areas and substation hardstand. Approximately 1,600 m^3 of sand may be required for the bedding of underground cables, depending on electrical design and ground conditions. Approximately 300 m^3 of concrete would be required to construct the inverter, substation, CCTV and BESS foundations.

Approximately 30 ML of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, onsite amenities and landscaping. The bulk of this water would be commercially available from an approved Council standpipe in Jindera. Approval in principle for use of a council standpipe was received from Greater Hume Shire Council on 23 April 2019 (Appendix C.1).

A small amount of potable (drinking) water (approximately 1.2 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.

3.6.6 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 Impact Assessment of the proposal (Appendix G).

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. All construction traffic would be from the south (through Albury) via Urana Road and Walla Walla Jindera Road. Access to the site from the north is not recommended due to the unsealed nature of some roads, high number of sensitive receivers and as a direct result of consultation with landowners.

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 Greater Hume Shire Council. During construction the sections of the road network utilised by the proposal would be monitored and maintained to ensure continued safe use by all road users and any faults attributed to construction of the solar farm would be rectified in consultation with Greater Hume Shire Council. At the end of construction, a post-condition survey would be undertaken to ensure the road network is left in the same 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.

Approximately 20 trucks would access the site per day through the peak construction period, and 100 light vehicles. The largest design vehicle is expected to be a 26 m long B-Double truck, which would occasionally be used to transport larger plant. A customised over dimensional vehicle for the transport of the Power Transformer for the on-site substation would require a separate permit from the relevant road authorities.

Most transmission lines for the project are anticipated to be underground however, TransGrid may require overhead lines for the Ortlipp Road section. Transmission line installation works near roads, where overhead or underground, may cause minor traffic interruptions for works undertaken in and adjacent to the road reserve; Ortlipp Road and Walla Walla Jindera Road. These are expected to be minor and managed via traffic controls, within a Traffic Management Plan. No access interruptions are expected for any private residence. Where cabling crosses the unformed crown road south of Sparkes Road, underground cabling would be used and no impact on local traffic would result.

3.7 OPERATION

3.7.1 Operation activities

Operation activities would include:

- Tracking movement of the panel arrays, operation of the inverter stations and the on site substation.

- Routine visual inspections, general maintenance, testing and cleaning operations of the solar arrays as required.
- Routine visual inspections, general maintenance, testing 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.

3.7.2 Materials and resources

During operation, non-potable water would be required for cleaning panels, landscaping and animal care. Approximately 314 kL per year would be required for cleaning, likely transported to site using tanker trucks when required. Two 20,000 L steel or concrete tanks 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 rainwater collected from tanks beside site buildings.

3.7.3 Transport and access

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

Water for use during cleaning and other activities would be delivered to the site by tanker trucks.

Traffic associated with the operation and maintenance of the solar farm would also use the routes specified for the construction phase (refer section 3.6.6).

3.7.4 Personnel and work hours

The solar farm would be monitored and operated remotely and would require a small number of maintenance personnel (2 to 3 full time equivalent staff) to be based at the site. Staff would utilise an onsite operation and maintenance building (OAM building) located in the onsite substation.

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

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

- Monday – Friday 7.00 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.

3.7.5 Lighting

There would be no permanently lit night lighting installed within the array, but lighting would be included in each inverter stations for maintenance purposes. There would also be maintenance lighting installed at the substation that would 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 adjacent to the security fencing and operation and maintenance buildings.

3.7.6 Refurbishment and upgrading

The solar farm operator may replace or upgrade solar panels or other infrastructure within the existing development footprint during the projected 30 year life of the solar farm. If any upgrade works would extend beyond the existing impact footprint, increase the electricity generating or storage capacity, or alter the nature or scale of environmental impacts, the proponent would consult DPIE regarding the need for further assessment or approval.

3.8 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. At the end of its operational life, the solar farm would be decommissioned. Before the site is decommissioned, a Rehabilitation and Decommissioning Management Plan (RDMP) will be prepared and approved by the relevant authorities.

3.8.1 Plan objectives

The objectives of the RDMP will be 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.
- Providing a description of the development process and how it will be integrated with rehabilitation.
- Identifying a benchmark site that is used to determine realistic performance criteria.
- Including a timeline for rehabilitation activities.
- Outlining a program for monitoring rehabilitation success using appropriate indicators.

3.8.2 Timeline and methodology

Decommissioning would aim to return the site to its pre-works state, specifically cropping, grazing and general 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.
- 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 farmland 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. The RDMP 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 RDMP.

3.8.3 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 placed 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.

3.9 INDICATIVE TIMELINE

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 12-18 months construction period.

3.10 CAPITAL INVESTMENT

The proposal would have an estimated capital investment of $167.5 million. A Capital Investment Valuation Report has been provided to DPIE 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(1) 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);	Greater Hume Shire has the *Greater Hume Development Control Plan 2013.* However, clause 11 of the SRD SEPP provides that DCPs do not apply to SSD.
Any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4;	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 is relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that applies to the land to which the development application relates;	Repealed and no longer applicable.
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 6 and 7 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have been avoided or minimized through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development;	The suitability of the site for the development is assessed in section 2.5. 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 determination process. The proponent would consider and respond

Provision	Relevance to the proposal
	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 contribute to climate change. • Meeting State and Australian Government policies to increase renewable energy supply. • Providing local employment and regional development opportunities. • Providing electrical reliability and security benefits. • Downward pressure on electricity prices.

4.2.2 Environmental Planning and Assessment Regulation 2000

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

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

4.2.3 Greater Hume Local Environmental Plan 2014

The development area is located within Greater Hume LGA and is subject to the provisions of the *Greater Hume Local Environmental Plan 2012* (Greater Hume LEP). The Greater Hume LEP aims:

> *(2) The particular aims of this Plan are:*
>
> > *(a) to encourage sustainable economic growth and development in Greater Hume,*
> >
> > *(b) to protect and retain productive agricultural land,*
> >
> > *(c) to protect, conserve and enhance natural assets,*
> >
> > *(d) to protect built and cultural heritage assets,*
> >
> > *(e) to provide opportunities for the growth of townships.*

It is considered that the proposal is compatible with the aims of the Greater Hume LEP, especially in encouraging sustainable economic growth and development, conserving natural and cultural heritage assets and providing opportunities for the growth of townships.

The proposal is located within land not zoned as water sensitive under the LEP. Neither the proposed development land nor transmission line are located within biodiversity sensitive land. The LEP does not contain any mapping of flood prone land.

Land zoning

The development area is zoned RU1 - Primary Production under the Greater Hume LEP. Electrical generation is not listed among developments that are permitted within the zone. However, the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) takes precedence over an LEP and permits electricity generating works with consent in the RU1 zone. The *State Environmental Planning Policy (State and Regional Development) 2011* (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 Greater Hume 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 encourage sustainable primary industry production by maintaining and enhancing the natural resource base;*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area;*
- *To minimise the fragmentation and alienation of resource lands;*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones; and*
- *To maintain the rural landscape character of the land.*

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 and minimise land use conflict. 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 development. Upon decommissioning of the proposal, the development footprint would be rehabilitated to restore land capability to pre-existing agricultural use.

It is also important to note that solar farms do not preclude the use of land for primary industry production. Some agricultural and production activity is still possible whilst a solar farm is operating (e.g. grazing).

4.2.4 Development Control Plans and Council policies

The Greater Hume Development Control Plan 2013 (DCP) applies to all land within the LGA of Greater Hume. Clause 3 of the DCP provides specific development requirements relating to industrial development with the following objectives relevant to the proposal:

- *Encourage industrial development, which will not detract from the quality of the surrounding environment;*
- *Minimise the impact of the development on the natural features of the area;*
- *Encourage the development of industrial undertakings which will be employment generating;*
- *Focus the development of industries outside of commercial and residential areas so as to minimise conflict between the different uses;*
- *Direct different types of industrial development to locations best suited for that activity;*
- *Provide for a range of industrial activities in industrial precincts; and*
- *Ensure that development incorporates safe and functional movement of vehicles on and off site.*

The DCP should be read in conjunction with any relevant SEPPs. Where there is any conflict between a provision in the DCP and the SEPP, the provision of the SEPP shall prevail to the extent of the inconsistency.

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.

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 Greater Hume 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 and regionally significant development.

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 $167.5 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 Greater Hume LGA on 17 April 2019. The research returned no results for contaminated land within the Greater Hume LGA.

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' is 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 DPIE is used to help determine whether a development is considered potentially hazardous industry. 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 7.5.

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 7.5).

4.2.9 State Environmental Planning Policy (Primary Production and Rural Development) 2019

The new *State Environmental Planning Policy (*Primary Production and Rural Development), known as the PPRD SEPP, is a new framework that commenced on 28 February 2019. The new framework simplifies the NSW planning system by consolidating, updating and repealing provisions in five former agriculture-themed SEPPs, including the Rural Lands SEPP. The intention is to provide for better outcomes in balancing rural needs, including farming, and development, and to reduce the risk of land use conflict and rural land fragmentation. Many of the provisions in the repealed SEPPs were local-level land use planning matters, which have now been transferred to local LEPs. This aims to ensure local industry and community have greater access to and awareness of the agricultural land use planning provisions that apply. The intent of the new SEPP is to deal with agricultural land use matters of State or regional significance only.

The aims of the *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (Primary Production SEPP) are:

(a) to facilitate the orderly economic use and development of lands for primary production,

(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,

(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,

(d) to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,

(e) to encourage sustainable agriculture, including sustainable aquaculture,

(f) to require consideration of the effects of all proposed development in the State on oyster aquaculture,

(g) to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.

The objectives of Part 2 (State Significant Agricultural Land) of Primary Production SEPP are as follows:

(a) to identify State significant agricultural land and to provide for the carrying out of development on that land,

(b) to provide for the protection of agricultural land:

i. that is of State or regional agricultural significance, and

ii. that may be subject to demand for uses that are not compatible with agriculture, and

iii. if the protection will result in a public benefit.

Land that is considered State Significant Agricultural Land is listed in Schedule 1 of the Primary Production SEPP. Schedule 1 of the SEPP is currently incomplete/blank, with mapping yet to be completed or publicly available (*pers comm* DPI 12/06/19). As such, reference to the significance of agricultural land from Schedule 2 of the previously repealed *State Environmental Planning Policy (Rural Lands) 2008* is applied within this EIS (see below).

4.2.10 State Environmental Planning Policy (Rural Lands) 2008 (repealed)

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 proposal area is not identified in schedule 2 as state significant agricultural land.

4.2.11 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

This SEPP (The Mining SEPP) is designed to provide for the proper management and development of mineral, petroleum and extractive material resources and establish appropriate planning controls to encourage ecologically sustainable development through environmental assessment and management.

In particular, the SEPP outlines land that has been classed as Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CIC).

The proposal has not been identified as BSAL or CIC.

4.2.12 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 are 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.

4.2.13 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. Greater Hume Shire Council is the roads authority for all local roads surrounding the proposal (including Klinberg, Walla Walla Jindera and Ortlipp Roads). Given that some roadworks may be required, section 138 consent will be required.

4.2.14 Crown Lands Management Act 2016

The main aims of the *Crown Lands Management Act 2016* are 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.

Two previously listed Crown and Council roads (CADID 105306258 and CADID 105338106) are currently in the process of being purchased by the landowner, with sale and transfer of the parcel expected to be complete prior to construction of the proposal. As such, no impact to Crown Land is expected as a result of the proposal.

4.2.15 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 would be sourced from a Council owned standpipe in Jindera, as agreed in principle with Greater Hume Shire Council on 23 April 2019 (Appendix C.1). As such, any water sources specified under the WM Act are not required.

4.2.16 Fisheries Management Act 1994

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

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

4.2.17 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 not located within 10 km of any nature reserve or forest protected under the NPW Act, with the closest nature reserve being Tabletop Nature Reserve located more than 15 km east of the proposal. No impact on these areas is 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.

4.2.18 Heritage Act 1977

The Heritage 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 register. 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.

A search of the NSW Heritage Register on 17 April 2019 for the Greater Hume LGA identified 4 items under the NSW Heritage Act, 61 items listed under the Greater Hume LEP and by state agencies, and 12 items on the Australian Heritage Database.

The closest listed heritage item is the property "Westerndale" directly adjacent to the west of the proposal, the former Glenellen School directly adjacent to the north-east of the proposal, and Big Gum Swamp, 200 m north-west of the proposal. 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.

4.2.19 Biosecurity Act 2015

The objects of this Act are:

> *(1) The primary object of this Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.*
>
> *(2) The other objects of this Act are as follows:*
>
> > *(a) To promote biosecurity as a shared responsibility between government, industry and communities;*
> >
> > *(b) To provide a framework for the timely and effective management of the following:*
> >
> > > *(i) pests, diseases, contaminants and other biosecurity matter that are economically significant for primary production industries;*
> > >
> > > *(ii) threats to terrestrial and aquatic environments arising from pests, diseases, contaminants and other biosecurity matter;*
> > >
> > > *(iii) public health and safety risks arising from contaminants, non-indigenous animals, bees, weeds and other biosecurity matter known to contribute to human health problems;*
> > >
> > > *(iv) pests, diseases, contaminants and other biosecurity matter that may have an adverse effect on community activities and infrastructure.*
> >
> > *(c) To provide a framework for risk-based decision-making in relation to biosecurity;*
> >
> > *(d) To give effect to intergovernmental biosecurity agreements to which the State is a party;*
> >
> > *(e) To provide the means by which biosecurity requirements in other jurisdictions can be met, so as to maintain market access for industry.*

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 (Section 6.5).

4.2.20 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).

4.2.21 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 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 required as part of the proposal (refer Section 3.4).

4.2.22 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 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 nine 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).
- A water resource, in relation to coal seam gas development and large coal mining development.

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 18 March 2019 indicated that there are no World Heritage Properties or National Heritage Places within the proposal area (refer Appendix D). Search results listed seven Wetlands of International Importance that are either known to occur or have potential to occur in the area, however no Ramsar wetlands are located within 10 km of the proposal sites and are not relevant to the site or proposal (listed wetlands are more than 100 km or more from the 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	1
Commonwealth Heritage Places	N/A
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
State and Territory Reserves	0
Regional Forest Agreements	0
Invasive Species	Section 6.2 – significant impacts not anticipated.
Nationally Important Wetlands	10
Key Ecological Features (Marine)	0

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.

4.3.2 *Native Title Act 1993*

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

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

Native title may exist in areas such as:

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

A search of the National Native Title Tribunal Register was carried out on 17 April 2019. 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.

4.3.3 Renewable Energy (Electricity) Act 2000

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

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

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

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

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

4.3.4 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 if required.

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 reversible 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 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 resulting from the proposed development have been assessed and would place the cost of remediation solely upon the proponent. The proposal, being a renewable energy project, is a financially viable alternative to pollution-generating developments including coal and gas. The economic assessment of the project has incorporated the decommissioning and full rehabilitation of the site, ensuring future generations are not left with pollution legacy issues.

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 State Significant Development 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 DPIE assesses 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 6 and 7), site suitability (Section 2.5), community and agency consultation (Section 5) and policy and framework requirements (Section 4).

4.4.3 NSW Riverina Murray Regional Plan 2036

The NSW Riverina Murray Regional Plan 2036 established a framework to grow the region's cities and local centres, support the protection of high-value environmental assets and make developing a strong, diverse and competitive economy central to building prosperity and resilience in the region (DPE 2019).

The plan guides the NSW Government's land use priorities over the next 20 years, providing an overarching framework to guide subsequent land use plans, development proposals and infrastructure funding decisions.

The plan is broken down into a number of goals and directions, which detail a number of actions to be considered during the planning process. The following goals are applicable to the proposal, and were considered as part of this EIS:

Table 4-5 Directions, actions and consideration of the NSW Riverina Murray Regional Plan 2036

Goal 1: Direction and Actions	EIS Consideration
Direction 1: Protect the region's diverse and productive agricultural land 1.1 Develop a regional agricultural development strategy that: • Maps important agricultural land • Identifies emerging opportunities for agriculture • Sets direction for local planning of agricultural development. 1.2 Protect important agricultural land identified in the regional agricultural development strategy from land use conflict and fragmentation and manage the interface between important agricultural lands and other land uses. 1.3 Minimise biosecurity risks by undertaking risk assessments, taking into account biosecurity plans and applying appropriate buffer areas.	The Department of Primary Industries (DPI) is conducting a 3-year program to map and recognise important agricultural land. The draft Riverina Murry Important Agricultural Land Mapping was on public exhibition through November and December 2018; however, the plan is no longer available for public viewing as it is being revised to take into consideration all public feedback. As such, important agricultural land from this draft plan cannot be considered in the EIS. The significance of the land has been assessed under the Primary Production SEPP 2019, the former Rural Lands SEPP 2008, the Mining SEPP 2007 and the Land and Soil Capability (LSC) Scheme. It has been determined that the land is not classified as significant under the relevant SEPPs, and as Class 3 under the LSC Scheme. Use of the subject land for the proposal will not cause conflict or fragment the landscape, given that agricultural activities in the form of grazing can continue on the site. The proposal also provides additional agricultural and economic opportunities for the relevant landowners and broader community.
Direction 2: Promote and grow the agribusiness sector 2.1 Encourage agribusiness diversification by reviewing local plans and removing restrictive land use zonings and outdated land use definitions. 2.2 Provide opportunities to improve support to agriculture through better guidance on protecting agricultural land and managing the interface with other land uses. 2.3 Facilitate investment in the agricultural supply chain by protecting assets, including freight and logistics facilities, from land use conflict arising from the encroachment of incompatible land uses.	The current land use zoning is compatible with electricity generating works under the ISEPP. The proposal has the potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. As mentioned above, agricultural activities in the form of grazing can continue on the site. It is the intention of the proponent and the relevant landowners to continue low density, strategic grazing on the site. Strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.
Direction 11: Promote the diversification of energy supplies through renewable energy generation 11.1 Encourage renewable energy projects by identifying locations with renewable energy potential and ready access to connect with the electricity network.	The proponent reviewed the solar generation potential of many areas in NSW. The proposed site was selected because it provides the optimal combination of low environmental constraints, level terrain, high quality solar resources, compatible land zoning, capacity in the grid transmission system and onsite access to connect to the network.

Goal 1: Direction and Actions	EIS Consideration
11.2 Promote best practice community engagement and maximise community benefits from all utility-scale renewable energy projects. 11.3 Promote appropriate smaller-scale renewable energy projects using bioenergy, solar, wind, small-scale hydro, geothermal or other innovative storage technologies.	The community has been engaged throughout the development process, with local benefits including direct and indirect employment, providing significant participation opportunities for local businesses, direct business volume for local services, materials and contracting, increased spending in the community and Council rates revenue.

4.4.4 2018 Draft Riverina Murry Important Agricultural Land Mapping

As detailed above, the draft Riverina Murry Important Agricultural Land Mapping was on public exhibition through November and December 2018; however, the plan is no longer available for public viewing as it is being revised to take into consideration all public feedback. As such, important agricultural land from this draft plan cannot be considered in the EIS.

4.5 SUMMARY OF LICENCES

Table 4-6 lists licences that have been identified as relevant to the proposal.

Table 4-6 Summary of licences 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 DPIE.
Roads Act, section 138	Any works to public or classified roads requires consent under this act from the road authority. Greater Hume Shire Council is the roads authority for public roads within the Jindera/Glenellen area.
Local Government Act 1993, Section 68	Approval is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Greater Hume 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.
Oversize Overmass Permit	An oversize overmass permit will be required from the relevant road authority (Council and/or RMS) for any oversized vehicles.

Note: if it is determined that additional licences 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 Greater Hume Shire Council.

The EIS must describe the consultation process and the issues raised, and identify how the design of the development has been amended in response to these issues. Where amendments 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 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

5.1.1 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 130 MW DC PV solar farm at Jindera. The development site has not changed but during further investigations as part of the EIS, and through improved efficiency of design and technological advances of available equipment, opportunities for additional yield have been identified. This EIS now describes a 150 MW DC facility.

The SEARs were issued by DPIE on 14 September 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
General Requirements – **The Environmental Impact Statement (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;**	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;**	Section 2.6 ,
• **a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);**	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 (including Glenellen Solar Farm), 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 6, Section 7
• **a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and**	Section 8.2, Section 4
• **the reasons why the development should be approved having regard to:** ○ **relevant matters for consideration under the *Environmental 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 2,

Issue summary	Addressed in EIS
o the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and **o feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.** **• a detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.** **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 – **• 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 6.2 Appendix D
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 5, Section 6.3, Section 7.8
Land – **• an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:** **o a consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights (including EL8467);** **o a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and** **o a cumulative impact assessment of nearby developments;**	Section 6.5

Issue summary	Addressed in EIS
• **an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:** o **consideration of the zoning provisions applying to the land, including subdivision, and;** o **completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and** • **a description of measures that would be implemented to remediate the land following decommissioning in accordance with *State Environmental Planning Policy No 55 - Remediation of Land*.**	
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 6.4, Appendix F
Noise – **Including an assessment of the construction noise impacts of the development in accordance with the Interim *Construction Noise Guideline (ICNG),* operational noise impacts in accordance with the *NSW Noise Policy for Industry 2017*, and cumulative noise impacts (considering other operations in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.**	Section 6.6
Transport – • **an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;** • **an assessment of the likely transport impacts to the site access route (including Urana Road, Walla Walla Jindera Road, Glenellen Road, Klinbergs Lane and Sparkes Road), site access point, rail safety issues, any Crown land, particularly in relation to the capacity and condition of the roads;** • **a cumulative impact assessment of traffic from nearby developments; a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);** • **a description of the measures that would be implemented to mitigate any transport impacts during construction; and** • **demonstration of consideration of potential cost-sharing of road upgrades with Glenellen Solar Farm.**	Section 7.3
Water – • **an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (Dead Horse Creek and Kilnacroft Creek, drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;**	Section 7.2

Issue summary	Addressed in EIS
• **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).**	
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 7.5
Socio-Economic – **including an assessment of the likely impacts on the local community, provision of or increase the demand for public amenities and public services within the area and a consideration of the construction workforce accommodation.**	Section 7.6
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 (including Minerals Australia Pty Ltd), quarry operators and mineral title holders.** **In particular, you must undertake detailed consultation with affected landowners surrounding the development and Greater Hume 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 amendments 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 EARs, you must consult further with the Secretary in relation to the preparation of the EIS.**	Section 5

Greater Hume Shire

Issue summary	Addressed in this EIS
Detailed information concerning the proposed recycling of generated packaging waste.	Section 7.7
Traffic assessment to include cumulative impacts of the possibility of an adjacent large-scale solar development being constructed concurrently to this proposal.	Section 7.3, 7.9

Issue summary	Addressed in this EIS
Clarity concerning the numbers employed during the operational phase of the development. **Since the introduction of the Fixed Development Contributions Plans, all proponents of eligible development have had a condition of consent applied upon their development consents requiring payment of the contribution. In accordance with the requirements of Fixed Development Contribution Plans, payment is applicable irrespective of whether there is an impact from the development of local infrastructure.** **Should the Department of Planning be inclined to require the proponent to enter into a Voluntary Planning Agreement (VPA) with Council, then it is requested that negotiations and the VPA be finalised before determination of development consent for the approval of the project. It is expected that the terms of the VPA would be consistent with the payment that would be received by Council from its Fixed Development Contribution Plan.**	

The proponent held a meeting with the Greater Hume Shire Council on 19 December 2018, after the release of the SEARs and the Community Open Day sessions. The proponent discussed the results of the open day, outlining concerns that had been raised by the community, and provided feedback and updates to the proposal.

Council also discussed the minutes of their November and December Council Meeting, and their response to the draft Riverina Murray Important Agricultural Lands mapping provided by DPI.

NGH Environmental also sought permission for use of a nearby Council standpipe and provided information to Council about the proposed subdivision. Council has provided provisional consent for use of the standpipe, and has raised no objection to the proposed subdivision.

On 22 August 2019 Greater Hume Council provided land owner consent for the EIS to be lodged.

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.** • **Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the NRAR Guidelines for Controlled Activities on Waterfront Land**	Section 7.2

Issue summary	Addressed in this EIS
(2012) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).	

DPI – Agriculture
• The Class 3 land should be protected as much as possible. The proponent should consider moving as much of the development from the Class 3 land (as assessed under the Land and Soil Capability Assessment Scheme), to the Class 6 lands that surround the site. This land is considered as High Capability Land as outlined in the Preliminary Environmental Assessment, and aerial imagery shows that this land has been deep ripped in the past and therefore it has been actively used for cropping.
• The Draft SEARs provided by Department of Planning and Environment should be amended with the following changes:
  o General requirements – details of construction, operation and decommissioning, including rehabilitation objectives for agricultural land.
  o Land – a soil survey undertaken in accordance with the Guidelines listed in Attachment 1 (Appendix A).
• During the development of the EIS and the rehabilitation strategy, the proponent should consider the removal of all underground infrastructure as part of the decommissioning of the solar farm at the end of life to ensure all previously cropped lands are returned to their predevelopment state.
	Section 6.5

DOI Lands – Should any of the Crown Public Roads within the proximity of the proposal be required for the development they are either to be closed and purchased or transferred to Council as a Council Public Road.	Section 4.2.12

DPE (Resources and Geoscience)

Issue summary	Addressed in this EIS
According to departmental records, there is a current mineral title – Exploration Licence (EL) 8467 (held by Minerals Australia Pty Ltd) overlapping the north-western boundary of the project area. The division has identified that there are no coal or petroleum titles or applications or operating mines or quarries over the site of adjacent lands. To fulfil the SEARS: • The proponent should undertake a dated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date referenced map. It should also be noted in the EIS there are no operating quarries in the vicinity. Current mining and exploration titles and applications can be viewed through the Division's Minview map viewer at: http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/geoscienceinformation/services/online-services/minview • Make contact with the titleholder to determine their level of interest and provide authentic consultation to the Division. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including associated electricity transmission	Section 6.5

Issue summary	Addressed in this EIS
infrastructure) in relation to the exploration title boundaries, and a letter of response from the title holder to the proponent. If responses are not received from the titleholder, the Proponent is to contact the Division. • Consultation with the Division in relation to the proposed location of any off-site 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 or extractive resources.	

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 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.	Section 7.5

Office of Environment and Heritage

Issue summary	Addressed in this EIS
OEH recommends that the EIS appropriately address the following • Biodiversity and offsetting	Section 6.2, Section 6.3,

Issue summary	Addressed in this EIS
• **Aboriginal cultural heritage** • **Flooding** **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. 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. The assessment must include all ancillary infrastructure associated with the project and Rural Fire Service requirements for asset protection.** **The site for the proposed development contains many patches of vegetation as well as paddock trees. Landscape connectivity is also an important value in the local context and the EIS should demonstrate how the principle of avoid, minimise and offset is used to limit impacts on these values. In this site where there is a matrix of vegetation and paddock trees, the EIS will need to clearly explain the method used to map trees as paddock trees rather than components of vegetation patches, which will affect the assessment of the site using the Biodiversity Assessment Method under the *Biodiversity Conservation Act 2016*. If paddock trees are to be impacted, the EIS should detail the value of paddock tree habitat to all threatened species known or likely to occur in the area and an assessment of the impacts of clearing those trees.** **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.** **An Aboriginal Cultural Heritage Assessment Report (ACHAR) will be required as part of the EIS. The ACHAR must demonstrate consultation in accordance with the 'Aboriginal cultural heritage consultation requirements for proponents 2010' (DECCW). Aboriginal cultural heritage values that exist across the whole area that will be affected by the development must be identified and documented in the ACHAR. 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*.**	Section 7.2
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.**	Section 6.2, Appendix D

Issue summary	Addressed in this EIS
• **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.**	
Aboriginal cultural heritage – • **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**	Section 6.3, Appendix E

Issue summary	Addressed in this EIS
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 materials are 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 and trees. 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.**	Section 7.8
Flooding – **The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:** • **Flood prone land.** • **Flood planning area, the area below the flood planning level.** • **Hydraulic categorisation (floodways and flood storage areas).** • **Flood hazard.** **The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.**	Section 7.2

Issue summary	Addressed in this EIS
The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: • **Current flood behaviour for a range of design events as identified in 11 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.** **Modelling in the EIS must consider and document:** • **Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.** • **The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.** • **Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.** • **Relevant provisions of the NSW Floodplain Development Manual 2005.** **The EIS must assess the impacts of the proposed development on flood behaviour, including:** • **Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.** • **Consistency with Council Floodplain Risk Management Plans.** • **Consistency with any Rural Floodplain Management Plans.** • **Compatibility with the flood hazard of the land.** • **Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.** • **Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.** • **Whether there will be direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.** • **Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.** • **Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.** • **Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.**	

Issue summary	Addressed in this EIS
• **Any impacts the development may have on the social and economic costs to the community as a consequence of flooding.**	

Additional correspondence received from OEH (dated 26/09/2018) confirmed that there was no major flooding issue on site and recommended using the standard DPIE SEARs as the scope for assessing flooding. The site is outside of the extent of the Jindera Floodplain Risk Management Study and Plan. The site is not subject to any mainstream flooding of any note, just overland ephemeral flow paths that activate during local intense rainfall events.

As such, a simple flood model for the purpose of identifying the major flow paths that activate during intense rainfall events has been adopted for this EIS, as a means to appropriately locating major and sensitive infrastructure away from these areas and for assessing impacts external to the site post development.

SES have advised they will not make comment in regard to flood risk and emergency management, evacuation and access, and contingency measures prior to the submission of the EIS. Emergency mitigation measures have been included in the EIS for SES consideration.

Refer to Appendix C.1 for full details of correspondence with OEH regarding flooding and SES requirements.

Roads and Maritime Services (RMS)

Issue summary	Addressed in this EIS
The subject site is located to the north of Jindera with frontage to Urana Road (MR125) and the Walla Wall Jindera Road (MR547) which are both classified roads and to several other public roads such as Klinbergs Lane, Sparkes Road and Glenellen Road which are classed as local roads under the provisions of the Roads Act. **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.** **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. This is referred to in the submitted Preliminary Environmental Assessment Report. Details for deliveries of ancillary materials, such as gravel and concrete, should also be addressed 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**	Section 7.3

Issue summary	Addressed in this EIS
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. **The submitted plans indicate that access is proposed to Urana Road (MR125) and the Walla Walla Jindera Road (MR547) as the primary access rather than to the local road network, therefore the provisions of State Environmental Planning Policy (Infrastructure), particularly Clause 101, need to be addressed as part of the supporting documentation to be submitted with the application for the proposed development.** **Further to the above it is understood that a development proposal for the Glenellen solar farm project (SSD 9550) is being prepared for a nearby site. The potential for both projects being constructed at the same time needs to be considered. Therefore, unless it is guaranteed that the construction of these 2 projects will not coincide the cumulative traffic impacts of the simultaneous construction of both of these projects needs to be addressed as part of the TIA.** **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.**	

TransGrid

Issue summary	Addressed in this EIS
The preliminary assessment does not effectively cover the connection to the substation, which would likely require a new transmission line and easement and vegetation clearance on the substation site. **The project scope description in the EIS should include all ancillary electricity transmission works (all works associated with connection to the National Electricity Market, such as ancillary substation works, transmission line works (direct and upstream), and telecommunications works) that would be necessary for the construction and operation of the Project.** **The EIS should identify all land parcels affected by these works and include them within the project boundary, to ensure that the full impact of the project is assessed.** **The proponent has contacted TransGrid as the Transmission Network Service Provider for connection of their proposed project. As part of their project development, the proponent will need to follow the connection**	Section 2.6

Issue summary	Addressed in this EIS
process, in accordance with the National Electricity Rules and TransGrid's requirements in order to connect.	

A formal Preliminary Connection Enquiry to TransGrid was made by the proponent on 20 October 2017, with a formal response received on 20 December 2017. From mid-2018 through to the present, informal discussions and emails with TransGrid to develop the connection strategy and updates have been provided by the proponent.

5.2 ABORIGINAL COMMUNITY CONSULTATION

5.2.1 *Local Aboriginal Land Council and Registered Aboriginal Parties*

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 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 Aboriginal Cultural Heritage Assessment Report (ACHAR) (Appendix E). A summary of actions carried out in following these stages are as follows:

Stage 1. Letters outlining the development proposal and the need to carry out an ACHA were sent to the Albury LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspapers, the *Eastern Riverina Chronicle* on the 8th of August 2018 seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by OEH in correspondence to NGH Environmental. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, two Aboriginal groups registered their interest in the proposal. No other party registered their interest. In keeping with best practice, it was decided to engage directly with both parties.

Stage 2. On the 21st of September 2018, an Assessment Methodology document for the Jindera Solar Farm survey was sent to the two registered Aboriginal parties. This document provided details of the background to the proposal, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the proposal. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties, however all expressed an interest in participating in fieldwork.

The field survey of the Jindera Solar Farm proposal area in November 2018 in conjunction with an assessment of contour data, archaeological modelling and consideration of the comments from the Registered Aboriginal Parties resulted in the identification of four areas considered to have potential for *in situ* subsurface deposits that required further assessment. Given this, a Subsurface Testing Methodology document for the Jindera Solar Farm was sent to the two registered Aboriginal parties on the 19th of

December 2018. This document provided details of the proposed subsurface testing methodology. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties, however all expressed an interest in participating in fieldwork.

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

The initial survey fieldwork was organised, and the two registered groups were asked to participate in the fieldwork. The initial survey fieldwork was carried out in early November 2018 by two archaeologists from NGH Environmental with local Aboriginal representatives.

Additional survey fieldwork was conducted in January 2019 following the harvesting of a crop that had previously hampered the ground survey visibility in a paddock. The two registered groups were asked to participate in the additional survey fieldwork in January 2019. The additional survey fieldwork was carried out on the 21st of January 2019 by two archaeologists from NGH Environmental with three local Aboriginal representatives.

The subsurface testing fieldwork was organised for February 2019 and the two registered groups were asked to participate in the fieldwork. Additional survey work was also conducted during this fieldwork to cover a small area previously not surveyed. The subsurface testing and additional survey fieldwork were carried out between 25th February and the 8th March 2019 by two archaeologists from NGH Environmental with local Aboriginal representatives.

Stage 4 In April 2019 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal (this document) was forwarded to the RAPs inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days has been allowed for responses to the document, with all responses received by May 2019.

5.2.2 Fieldwork feedback

Aboriginal community consultation occurred throughout the project. Following the completion of the survey fieldwork in November 2018 Mark Saddler provided a report on his participation in the survey which included a list of the sites he recorded and additional comments on the proposal. Details of correspondence and NGH Environmental responses can be seen in Appendix E.

5.3 BROADER COMMUNITY CONSULTATION

The proponent and NGH Environmental have undertaken extensive and meaningful consultation with the local community in addition to any requirements of the SEARs in line with:

- DPE's *Guidelines for Major Project Community Consultation* (October 2007), Community and Stakeholder Engagement: Draft Environmental Impact Assessment Guidance Series June 2017.
- Guideline 6, NSW Large-scale Solar Energy Guideline for State Significant Development December 2018.

- 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. Consultation activities were informed by Beyond Public Meetings: Connecting community engagement with decision making, Twyford Consulting (2007).

5.3.1 Community consultation activities to date

A range of community engagement tools have been used with regards to the proposal. These include:

- Development of a project website to provide information and updates http://www.jinderasolarfarm.com.au/. The website went live in November 2018 and is updated regularly. Feedback about the proposal can also be submitted on-line.
- Establishment of a dedicated email address and phone number for feedback.
- A meeting was held with representatives of Greater Hume Shire Council on 25 January and 1 August 2018 to discuss proposal information, community concerns and engagement, and Council engagement.
- A subsequent meeting was held with Council on 19 December 2018.
- A pre-SEARs meeting was undertaken with the Department of Planning and Environment on 2 August 2018.
- Direct engagement with neighbours through phone calls, letters, emails, face to face meeting and community open day events:
  - On 31 June 2018, the proponent and representatives from NGH Environmental visited all receivers within 1 km of the proposal and left a flyer with information about the proposal with all residences. For those that were home, discussions and initial concerns about the proposal were undertaken. For those that were not home, a flyer was left with details on how to make contact with the proponent. Follow up meetings were organised with the proponent on request.
  - On 11 October 2018, the proponent further extended door knocking and face-to-face consultation with all residences within a 1 to 2 km radius of the proposal. For those that were home, discussions and initial concerns about the proposal were undertaken. For those that were not home, a flyer was left with details on how to make contact with the proponent. Follow up meetings were organised with the proponent on request.
  - In November 2018, a visual architect visited homes of residences with visual concerns to undertake photo montages, with montages provided to relevant residences in December 2018.
  - In November 2018, a flyer detailing the dates and location for the Open Day was emailed to all interested parties that provided an email address, posted to all residences within a 2 km radius of the proposal, placed in every Post Office Box (estimated to be 800) at the Jindera Post Office, advertised at the local IGA and community bulletin board, and advertised twice in the Eastern Riverina Chronicle newspaper.
  - On December 5 and 7, two Open Day sessions were held at the Jindera Community Hub. One was conducted during the day, and one outside of business hours to allow the community ample opportunity to attend. Information poster, flyers and visual montages were provided and on display to the public, with a feedback form provided

to all attendees (Appendix C.2). Refer to Appendix C.3 for information provided to residences and at the Open Day sessions.

- Continued correspondence between the proponent and landowners has been undertaken via face-to-face meetings, phone calls, return emails and letters, and responding to the Jindera Solar Farm website.
- A general information flyer was either posted or emailed to all residences and properties within 2 km of the proposal, people who registered their attendance at the Open Day and those that provided feedback via the Jindera Solar Farm website on 19 June 2019 (Appendix C.3). The flyer and attached letter outlined the frequently asked questions, and approximate dates and location for exhibition of the EIS.
- An individual response was either emailed or posted to community members that provided feedback at the Open Day on 19 June 2019. The response included estimated exhibition times for the proposal, and a copy of the general information flyer detailed above.
- When DPIE provide the proponent with a date of exhibition, all landowners who have provided an email address will be notified of the exhibition date, period and location for accessing the Development Application.

5.3.2 Results of community consultation

The 48 households and 9 additional landowners classified as sensitive receivers (within a 2 km radius of the proposal) were initially engaged through door knocking consultation and phone calls by the proponent. They also received a minimum of two consultation letters with details of the proposed project and details for direct methods of communication. Feedback was received from the households during the door knocking consultation or in reply to the letters. Points raised were followed up via email, mail or direct call and either amended in the EIS or by further individual engagement.

The community information sessions attracted about 40 individuals who registered their details on a community attendance register that was provided. Most of the registered individuals had already been consulted (i.e. live within 2 km of the proposal). Many of those who provided their details would like to be kept informed on the progress of the project. 12 individuals completed feedback forms (Appendix C.2). Details from respondents in regard to the local values and general attitude towards solar and the proposal include:

- Local values – Respondents value the views of the farmland, local heritage, investment in land values, lifestyle, and open spaces. The land is seen as highly productive and sustainable agricultural land.
- General attitudes towards solar – The general attitude towards solar was mixed, with the vast majority of respondents in favour of solar power. This was however dependent on the location, with the majority of respondents against solar farms on productive agricultural land.
- Attitude towards the proposal – The attitude towards the proposal was also mixed, with the majority of respondents against the proposal in its current location.

The key issues of the responses from the community consultation program are shown in Table 5-1, including where they have been addressed in the EIS or otherwise:

Table 5-1 Key issues raised from community consultation

Issue raised	Where feedback is addressed
Devaluation of land	Section 6.5
Reduction of productive agricultural land	Section 6.5
Increase in rainfall runoff downstream of the site and interruption to natural watercourses	Section 7.2
Heat island effect (increases in local temperature)	Section 7.4
Changes to microclimate	Section 7.4
Visual impacts (including glare)	Section 6.4
Noise	Section 6.6
Traffic increases	Section 7.3
Overloading the local grid	Section 2.4.5
Radiation and other health impacts	Section 7.5
Loss of native flora and fauna	Section 6.2
Fire risk and hazards	Section 7.5
Increase in pest species (including weeds and native species with pest potential).	Section 6.2
Reclassification of land	Section 6.5
Community benefit	Section 7.6

In addition, notes from door knocking, the Jindera website and one-on-one consultations were maintained. One-on-one consultation was undertaken with those who requested it. The key concerns raised include visual and noise impacts, dust generation during construction, glare from the panels, increases in water flow downstream of the site and the heat island effect. Through a consultative process, these concerns have been addressed by changes in design and have been incorporated into the project. Concerns and how they were addressed with potentially impacted individuals are detailed in Table 5-2.

Table 5-2 How individual concerns were addressed

Issue raised	How issue was addressed
Visual impacts and views of infrastructure	<u>Offset of infrastructure on Glenellen Road:</u> Solar panels and related infrastructure were initially proposed to be constructed to the subject land boundary on Glenellen Road. As a result of direct consultation and concern from local residences, infrastructure was offset a further 50 m from the subject land boundary. The 50 m buffer incorporates a larger vegetative screening effort, made up of a mixture of local and endemic plant species.
	<u>Locating transmission infrastructure underground:</u> It was initially proposed to have aboveground transmission lines connecting the eastern and western portions of the proposal to the onsite substation. As a result of visual concerns, the design has been revised to include underground transmission lines.

Issue raised	How issue was addressed
	<u>Incorporation of temporary and permanent screening:</u> The proponent has entered into a land use agreement with a number of adjacent landowners. Key areas of the subject land boundary have also been identified for vegetative screening, as a result of consultation with landowners and the Visual Impact Assessment.
Plant choice and screening effectiveness	<u>Incorporation of particular plant species:</u> A section of planting on Glenellen Road has been reserved for plantings suitable for honey production. A local Registered Aboriginal Party has also requested that species that would benefit threatened bird species, such as the Glossy Black Cockatoo, also be incorporated into the final landscape plan. Nominated species are outside of the PCT but identified as local to the area by a professional local landscaper. As such, the proposed species have been incorporated into the landscape plan.
	<u>Effectiveness of screen and growth rates:</u> Concern has been raised over the growth rates and effectiveness of some species to act as a visual barrier to the site. Plant species selection was undertaken by a professional local landscaper, which incorporated a number of fast growing, dispersive tree species that are local to the area.
Increase in water flow downstream	A number of residences downstream of the site expressed concern at increased runoff and the potential for flooding downstream due to solar infrastructure. A runoff model was commissioned by the proponent, incorporating the proposed infrastructure into a runoff model to show the difference in runoff pre and post-construction in a 1-in-10 and 1-in-100 year rainfall event. The result show negligible runoff impact, with no nuisance caused to landowners downstream.
Heat island effect (increases in local temperature)	Studies into the heat island effect show negligible temperature increases outside the boundary of the proposed solar farm. A recommendation of 30m between infrastructure and the boundary of adjacent properties is, however, recommended. The final design of the proposal mostly adheres to the recommendation, with the boundary of two properties being less than 20 m from proposed infrastructure. However, one property consists of a vacant block, and the other has a residence more than 100 m from infrastructure.
Traffic and use of local roads	A number of adjacent residences raised concern over the use of minor local roads, and dust creation. The proponent has assured these residences that the haulage route consists of Urana Road and Walla Walla Jindera Road. No construction access is permitted off minor roads such as Nation Road, Klinberg Road and Ortlipp Road. Emergency and maintenance access will be permitted on these roads only.

Residual concerns of the community have been documented and assessed in this EIS and communicated to the community through the feedback process. Ongoing consultation will occur with these and others who request it during the construction and operation stages.

Details of all consultation conducted to date have been provided to Department of Planning in the form of a log. The log and specific details of the consultation are not made publicly available along with other parts of the EIS. This is to protect personal contact information that is contained within the log.

5.3.3 Continued engagement

Engagement activities would continue throughout the EIS determination period.

5.3.4 Minerals Australia Pty Ltd (Hancock Prospecting Pty Ltd)

An email was sent to Minerals Australia Pty Ltd (a subsidiary of Hancock Prospecting Pty Ltd) on 11 December 2018 seeking details on their interest on the proposal site and use of their Exploration Licence EL8467.

A response from Peter Collings from Hancock Prospecting Pty Ltd was received on 15 January 2019 expressing concern over the proposed development over EL8467, as any development would potentially limit future open cut mining operations if exploration proves the existence of an economic resource. It was also noted that the proponent/operator for the solar farm would also likely object to any open cut mining operations due to potential impacts to infrastructure such as dust and vibrations.

It is, however, important to note that the proposal will potentially impact a maximum 9 ha of the 4-block exploration area of well over 1,000 ha licence area (less than 1%). In the event that any economic resource was found to be viable, the project would be subject to an impact assessment process during which issues can be investigated, including the interaction between the solar farm and a future mining operation. Given that there is currently no certainty around the existence of an economic resource, nor the approval of a future mining activity, this solar farm proposal will continue as planned.

5.3.5 Consultation with CWP Renewables

CWP is concurrently proposing to construct Glenellen Solar Farm; a 200MW solar farm, including battery facility, adjacent to the proposed Jindera Solar Farm. The proponent’s discussed the following matters on 2 August 2019 (participants: Ed Mounsey CWP, Symon Grasby Green Switch, Erwin Budde and Brooke Marshall NGH Environmental; minutes compiled by Brooke Marshall):The key items discussed during the meeting are summarised below:

- Background of Green Switch and CWP Renewables
    - The proponents discussed general pipeline of projects, funding arrangements of project’s, presence in Australian solar, likely involvement of partners into construction and operation.
- General project layout
    - CWP confirmed that the layout that will be presented in the Glen Ellen Solar Farm EIS will be generally as shown in the Scoping Report for this project.
    - This layout has been used by GreenSwich to consider potential for cumulative impacts within this EIS.
- Timing
    - The proponents discussed that both project EIS’s were nearly ready to be submitted and that, dependant on several factors, concurrent construction and commissioning timetables are a possibility, although not likely. At the earliest, this would be around Q3 2020. This has been considered in the cumulative traffic assessment within this EIS (7.3.5).
- Traffic routes

- o Key haulage routes were discussed. The key area of interaction was confirmed to be Walla Walla Jindera Road and the intersection with Glenellen Road. This has been considered in the cumulative traffic assessment within this EIS (7.3.5).
- Council consultation
    - The level of current Council consultation was discussed briefly for each project, including potential for impacts on Council roads, road reserves and road upgrades. The detail of road upgrades and cost sharing was agreed better dealt with at a later stage, when it was clear how the projects' actual construction timelines compared. CWP noted they had discussed in-principle terms for a VPA with Council and Council has proposed slightly different terms. Negotiations are not yet resolved.
- Issues of concern to the community
    - It was confirmed that the same general issues have been raised by the community for both projects. These centre on agricultural / land use interactions and visual and noise amenity.
    - Both projects have made layout changes to mitigate impacts on nearby receivers and to reduce biodiversity impacts.
- Consideration of project interactions
    - o In the meeting it was resolved that on issues such as landscape treatments for visual impact mitigation and traffic management in the event of concurrent construction timing, further consultation would be a commitment of each project (refer to project commitments 6.4.8 and 7.3.7 in this EIS). In these cases, project interactions warrant consideration of the other project in the development of the detailed management plans.
    - o Green Switch agreed to update CWP on two matters of interest to CWP, prior to the submission of the Jindera Solar Farm, as more details became available. These include the presence of potentially EPBC listed vegetation along Ortlip Road and use of Ortlip Road to connect to the existing substation (which CWP noted as having potential to impact visual screening of Glenellen).

6 ENVIRONMENTAL IMPACT ASSESSMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *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 (including Glenellen Solar Farm), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes or practice;*
  - *A description of the measures that would be implemented to monitor and report on the environmental performance of the development.*

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

OEH recommends that the EIS needs to appropriately address the following:

1. *Biodiversity and offsetting*
2. *Aboriginal cultural heritage*
3. *Cumulative impact.*

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	Likely	Moderate	Very High
Aboriginal heritage	Likely	Moderate	Very High
Visual	Possible	Moderate	High
Noise	Possible	Moderate	High
Land use	Likely	Moderate	Very High
Soils and water	Possible	Minor	Medium
Transport	Unlikely	Moderate	Medium
Hazards	Unlikely	Moderate	Medium
Resource Use and Waste Generation	Possible	Minor	Medium
Historic Heritage	Unlikely	Minor	Low
Climate	Unlikely	Minor	Low
Socioeconomic	Possible	Minor	Medium
Cumulative impacts	Possible	Minor	Medium

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

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

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

6.2 BIODIVERSITY (FLORA AND FAUNA)

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Biodiversity – including

- *Including 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

The site for the proposed development contains many patches of vegetation as well as paddock trees. Landscape connectivity is also an important value in the local context and the EIS should demonstrate how the principle of avoid, minimise and offset is used to limit impacts on these values. In this site where there is a matrix of vegetation and paddock trees, the EIS will need to clearly explain the method used to map trees as paddock trees rather than components of vegetation patches, which will affect the assessment of the site using the Biodiversity Assessment Method under the Biodiversity Conservation Act 2016*. If paddock trees are to be impacted, the EIS should detail the value of paddock tree habitat to all threatened species known or likely to occur in the area and an assessment of the impacts of clearing those trees.*

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.*

Biodiversity –

1. *Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the* Biodiversity Conservation Act 2016 *using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the* Biodiversity Conservation Act 2016 *(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.*
2. *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.*
3. *The BDAR must include details of the measures proposed to address the offset obligation as follows:*
    a. *The total number and classes of biodiversity credits required to be retired for the development/project;*
    b. *The number and classes of like-for-like biodiversity credits proposed to be retired;*
    c. *The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;*
    d. *Any proposal to fund a biodiversity conservation action;*
    e. *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.
4. *The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM.*

> 5. *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 s.6.10 of the* Biodiversity Conservation Act 2016.

6.2.1 Approach

A specialist Biodiversity Development Assessment Report (BDAR) was prepared by NGH Environmental to investigate and assess the potential impacts of the proposal on biodiversity. The 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 geology of the Glenellen/Jindera region is comprised of Ordovician to Devonian folded and faulted sedimentary sequences with inter-bedded volcanic rocks and large areas of intrusive granites, and large areas of Tertiary and Quaternary alluvium. Some scattered outcropping of Jindera Granite occurs (eSpade v.02).

The general topography includes undulating and hilly ranges and isolated peaks set in wide valleys at the apices of the Riverina alluvial fans.

Shallow stony soils on steep slopes, texture contrast soils grading from extensive red-brown earths on undulating plains, and extensive grey clays on alluvium.

Four soil landscapes occur within the project area: Yarra Yarra, Kindra, Cookardinia and Doodle Comer Swamp (eSpade v.02). The area in general is characterised by grey cracking clay soils with mud, silt and sand occurring in lake and swamp deposits. Residual deposits consist of alluvial and colluvial boulders, gravel and sand. The area sits on the Shepparton Formation, comprising unconsolidated to poorly consolidated mottled variegated clay, silty clay and coarse to fine sand and gravel. Each of these is described in detail below.

Yarra Yarra

Gently inclined footslopes of almost totally cleared grassy woodland, ranging from 2-8%. Local relief varies between 10–30 m and elevation between 200–300 m. The soils are comprised of very deep low to moderately drained red, brown and yellow podzolics located on upper and midslopes. Well drained earthy sands are found on fans and parallel drainage lines.

Kindra

Broad gently sloping plains of extensively cleared box woodlands, formed on colluvium below sedimentary hills. Slopes range from 1-3%, local relief is less than 5 m and elevation varies from 130-200 m. Soils include red-brown earths, brown and occasionally red podzolics. These have formed on slopewash and include gravel, sand, silt and clays.

Cookardinia

Undulating low hills and rises of granite outcropping. Slopes range from 3-10%, local relief is between 10-40 m and elevation varies from 180-320 m. Hardsetting localised soils occur throughout the residual landscape, including red podzolics on the upper crests and ridges, yellow podzolics on the midslopes and yellow and brown sodsolics in drainage depressions. Moderate gully erosion also occurs in drainage depressions.

Doodle Comer Swamp

Partially cleared river red gum landscape, consisting of localised swampy depressions with broad to extensive low plains, receiving run-off from adjacent hilly areas. Slopes are <1% with local relief less than 5 m and elevations varying from 160-210 m. Soils consist of up to 1.5 m of grey clay across swamp regions. Alluvial soils of sand and silt are found on swamp margins where prior or current stream channels occur.

Groundwater and Surface Water

Two hydrogeological landscapes (HGL) occur within the project area: Walla Walla and Burrumbuttock. These are described in more detail below.

Walla Walla HGL

The region covered by the Walla Walla HGL experiences between 500-700 mm of annual rainfall across extensive and broad, gently sloping plains.

Semi-confined or unconfined aquifers dominate the region, allowing groundwater to flow through alluvial sediments. Water quality is fresh to marginal, with soils overlying a shallow to intermediate watertable, which pools above clay soils in wet conditions.

Burrumbuttock HGL

The Burrumbuttock HGL region covers Gerogery West and parts of Jindera and receives between 550 and 700mm of annual rainfall over rolling to steep hills, undulating low hills and rises, long colluvial slopes and gently inkling footslopes and fans. Localised swamp depressions and low-lying plains are also present across the wider region.

Approximately 26 man-made dams and two watercourses occur within the project area. The watercourses include Dead Horse Creek and Kilnacroft Creek, which bisect the site boundary and run east to west through the project area.

All watercourses on the site are classified as ephemeral with no flowing water. Water flows through watercourses within the site would generally be broad and shallow as they are typically characterised by broad deep depressions without a defined low flow channel.

Native vegetation

Most of the native vegetation has been cleared in the Walla Walla HGL. Extant native vegetation on the flats and gentle rises tends to be white box woodland but grey box and yellow box woodland may also occur on the flats and low country, and Blakely's red gum woodland may occur with river red gum around the creeks.

Tree species on the gentle slopes include *Eucalyptus albens* (white box) on fertile sites, *E. blakelyi* (Blakely's red gum) on loamy soils and *E. dwyeri* (Dwyer's red gum) on well drained sites, *Callitris glaucophylla* (white cypress pine), *Acacia implexa* (hickory wattle), *Brachychiton populneus* (kurrajong) and *Pittosporum angustifolium* (butterbush). Understorey species include *Acacia rubida* (red-stemmed wattle), *Hakea* *tephrosperma* (hooked needlewood), *Indigofera australis* (austral indigo), *Bursaria spinosa* (sweet bursaria), *Eutaxia microphylla* (mallee bush pea) and *A. montana* (mallee wattle).

Around the alluvial channels, tree species can be *E. camaldulensis* (river red gum) with *Callistemon sieberi* (river bottlebrush) in the understorey.

Vegetation on the upper and lower slopes of the Burrumbuttock HGL tends to be white box and grey box woodland dominant, with some Blakely's red gum woodland. White box woodland also occurs on the flats and gentle rises. Vegetation on the rocky outcrops tends to be Dwyer's red gum woodland with currawang and long-leaf box, as well as red stringybark dry forest on the drier slopes with a south-easterly aspect.

Tree species in the rocky outcrops include *Acacia doratoxylon* (currawang), *A. implexa* (hickory wattle), *Allocasuarina verticillata* (drooping she-oak) on dry ridges, *Eucalyptus goniocalyx* (long-leaf box) on dry rocky slopes, *Brachychiton populneus* (kurrajong), *E. polyanthemos* (red box) and *E. dwyeri* (Dwyer's red gum) on well drained sites, *E. albens* (white box) on more fertile slopes and ridges, *E. blakelyi* (Blakely's red gum) on loamy soils, *Callitris glaucophylla* (white cypress pine), and *C. endlicheri* (black cypress pine). Understorey species include *Acacia rubida* (red-stemmed wattle), *A. verniciflua* (varnish wattle), *Dillwynia spp.* (parrot pea), *Dodonaea viscosa* ssp. *angustissima* (narrow-leaf hop-bush), *Indigofera australis* (austral indigo) and *Pultenaea cunninghamii* (grey bush-pea).

61.11 ha of native vegetation occurs within the development site. This is comprised of:

- 12.3 ha of River Red Gum – wallaby grass tall woodland wetland on the outer River Red Gum zone, mainly in the Riverina Bioregion.
- 42.8 ha of Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.
- 1.3 ha of Gilgai wetland mosaic in the southern NSW South Western Slopes Bioregion.

40 paddock trees also occur within the development site (Figure 6-1). These trees are a mix of Yellow Box and Blakely's Red Gum.

Three plant community types (PCTs) were identified within the development site (Figure 6-2). These are:

- PCT 9 – River Red Gum – wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion;
- PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion; and
- PCT 360 – Gilgai wetland mosaic in the southern NSW South Western Slopes Bioregion.

PCT 277 Forms part of the Threatened Ecological Community White Box - Yellow Box - Blakely's Red Gum Woodland listed as endangered under the BC Act (Figure 6-2).

Cleared areas (Non-indigenous vegetation)

About 255 ha occurs as non-native vegetation. This vegetation is comprised of sown exotic pastures, farm tracks and broadacre crops including Canola *(*Brassica sp.),* Wheat (**Triticum aestivum*) and Lupins (**Lupinus*).

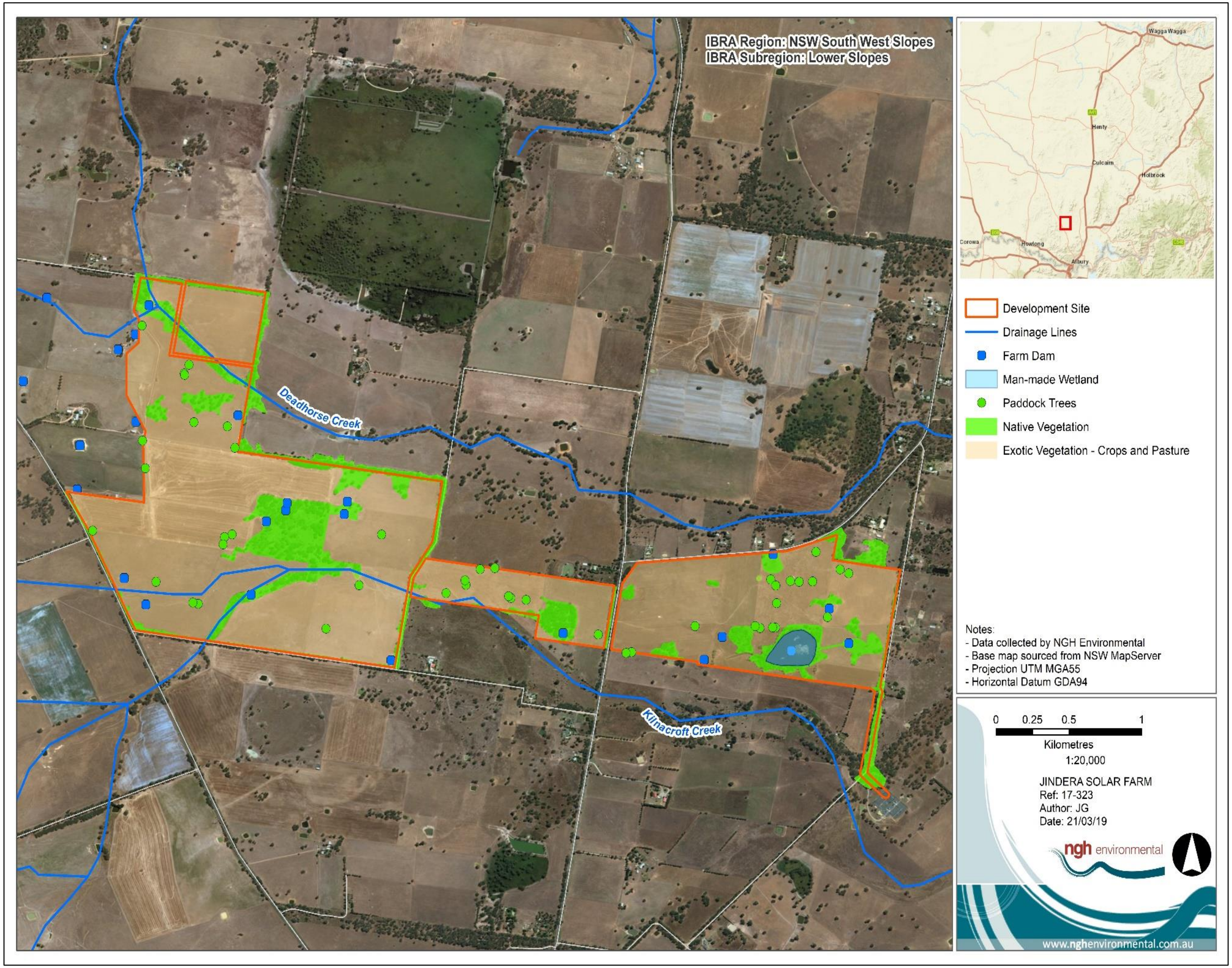

Figure 6-1 Native vegetation extent within the development site

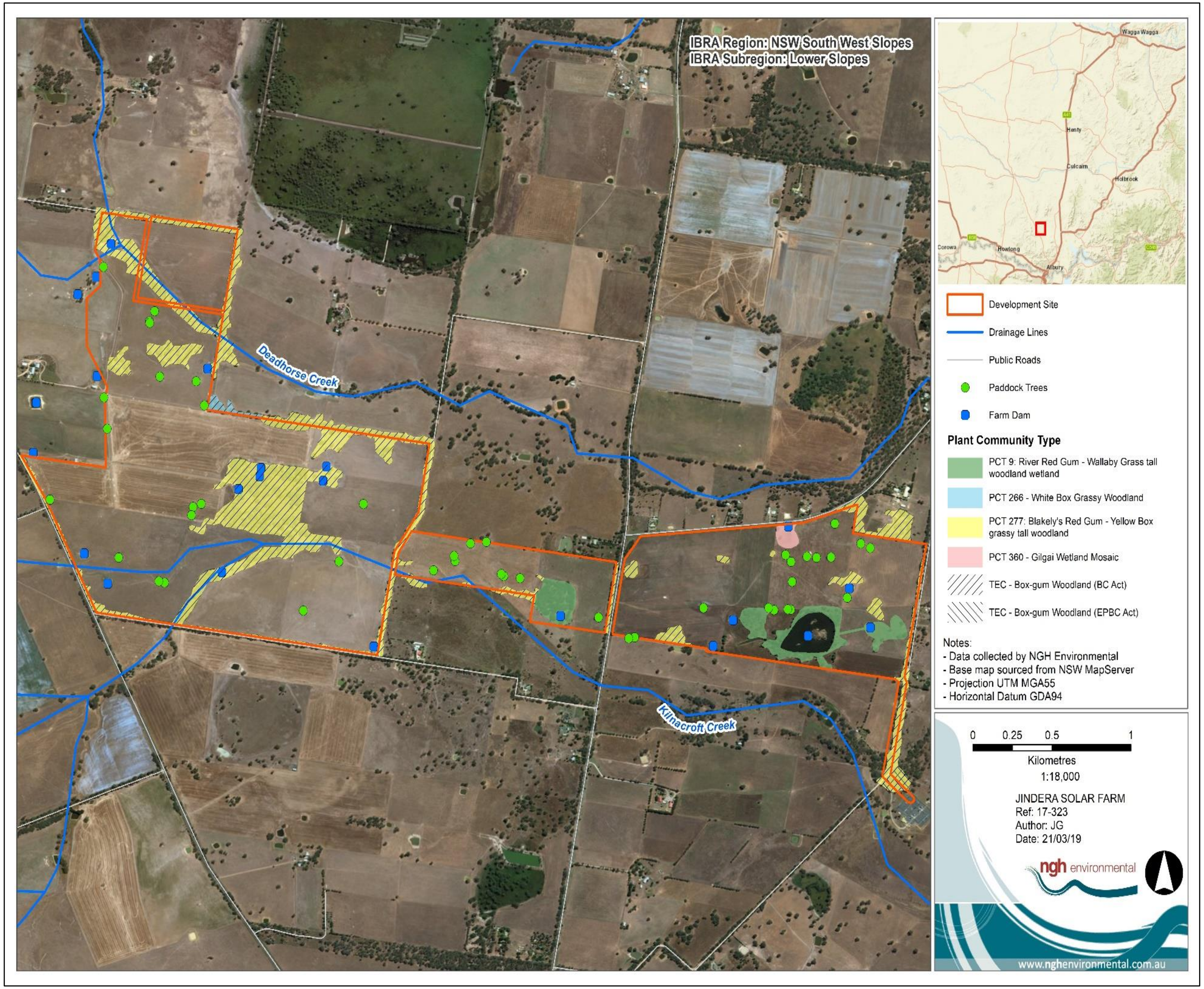

Figure 6-2 PCT's and Threatened Ecological Communities at the development site

Threatened species

The following ecosystem credit species were returned by the BAM calculator as being associated with the PCTs present on the development site (Table 6-3). These species are assumed to occur on site and contribute to ecosystem credits. No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits. Of these 23 species, the Flame Robin was observed on site during the field surveys.

Table 6-3 Threatened species returned from the BCC as assumed to occur on site

Ecosystem credit species	Associated PCT	NSW listing status	National listing status
Australian Painted Snipe *Rostratula australis*	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Vulnerable
Barking Owl *Ninox connivens*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Not listed	Not listed
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Corben's Long-eared Bat *Nyctophilus corbeni*	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Vulnerable
Diamond Firetail *Stagonopleura guttata*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed

Ecosystem credit species	Associated PCT	NSW listing status	National listing status
Flame Robin _Petroica phoenicea_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Not listed	Not listed
Gang-gang Cockatoo _Callocephalon fimbriatum_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Grey-crowned Babbler (eastern subspecies) _Pomatostomus temporalis_ _temporalis_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Grey-headed Flying fox _Pteropus poliocephalus_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Vulnerable
Hooded Robin (south-eastern form) _Melanodryas cucullata cucullata_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Koala _Phascolarctos cinereus_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Vulnerable
Little Eagle _Hieraaetus morphnoides_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Little Lorikeet _Glossopsitta pusilla_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Little Pied Bat _Chalinolobus picatus_	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed

Ecosystem credit species	Associated PCT	NSW listing status	National listing status
Major Mitchell's Cockatoo _Lophochroa leadbeateri_	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Masked Owl _Tyto novaehollandiae_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Purple-crowned Lorikeet _Glossopsitta porphyrocephala_	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Regent Honeyeater _Anthochaera phrygia_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Critically Endangered	Critically Endangered
Scarlet Robin _Petroica boodang_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Speckled Warbler _Chthonicola sagittata_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Spotted Harrier _Circus assimilis_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Not listed	Not listed
Spotted-tailed Quoll _Dasyurus maculatus_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Endangered (SE mainland population)
Square-tailed Kite _Lophoictinia isura_	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed

Ecosystem credit species	Associated PCT	NSW listing status	National listing status
	9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion		
Superb Parrot *Polytelis swainsonii*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Vulnerable
Swift Parrot *Lathamus discolor*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Endangered	Critically Endangered
Turquoise Parrot *Neophema pulchella*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Vulnerable	Not listed
Varied Sittella *Daphoenositta chrysoptera*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Not listed	Not listed
White-bellied Sea-Eagle *Haliaeetus leucogaster*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Not listed	Not listed
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Not listed
Painted Honeyeater *Grantiella picta*	277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion 9 – River Red Gum - wallaby grass tall woodland wetland on the outer River Red Gum zone mainly in the Riverina Bioregion	Vulnerable	Vulnerable

The BAM calculator predicted the following species credit species (Table 6-4) for the development site. Those highlighted in grey were excluded from the assessment based on unsuitable habitat requirements.

Twenty-three species were therefore required to be targeted by surveys or would be assumed to occur onsite and would generate an offset requirement.

Table 6-4 Summary of species credits

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
FAUNA							
Barking Owl ***Ninox connivens*** **(Breeding)**	Woodland and open forest, including fragmented remnants and partly cleared farmland. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	High	Vulnerable	Not listed	Hollow bearing trees present in development site.	Included	Habitat components on site
Bush Stone-curlew ***Burhinus grallarius***	Open forests and woodlands with a sparse, grassy ground layer and fallen timber.	High	Endangered	Not listed	Woodland with fallen timber in development site	Included	Habitat components on site
Eastern Pygmy Possum ***Cercartetus nanus***	Broad range of habitat from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath preferred. Known in subregion.	High	Vulnerable	Not listed	Woodland areas present in development site.	Included	Habitat components on site
Gang-gang Cockatoo ***Callocephalon fimbriatum*** **(Breeding)**	In spring and summer, tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages. Known in subregion.	High (breeding)	Vulnerable	Not listed	Hollow bearing trees present in development site.	Included	Habitat components on site
Grey-headed Flying-fox ***Pteropus Poliocephalus***	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water,	High	Vulnerable	Vulnerable	Woodland areas in development site.	Included	Habitat components on site

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
(Breeding)	including lakes, rivers, and coastlines. Known to roost in locality.						
Koala ***Phascolarctos cinereus***	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species that are particularly abundant on fertile clay soils. Known in subregion.	High	Vulnerable	Vulnerable	Woodland areas in development site.	Included	Habitat components on site
Large-eared Pied Bat ***Chalinolobus dwyeri***	Cliffs, or within 2km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices or within 2km of old mines or tunnels.	Very high	Vulnerable	Vulnerable	No cliffs, or within 2km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices.	Excluded	No suitable habitat
Little Eagle ***Hieraaetus morphnoides*** **(Breeding)**	Open eucalypt forest, woodland, or open woodland, and She-oak or Acacia woodlands and riparian woodlands in interior NSW, where they nest in tall living trees within a remnant patch. Nest trees - live (occasionally dead) large old trees within vegetation.	Moderate	Vulnerable	Not listed	Large old trees present in development site	Included	Habitat components on site
Major Mitchell's Cockatoo ***Lophochroa leadbeateri*** **(Breeding)**	Living or dead tree with hollows greater than 10cm diameter	High (breeding)	Vulnerable	Not listed	Hollow bearing trees present in development site.	Included	Habitat components on site

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Masked Owl ***Tyto novaehollandiae*** **(Breeding)**	Living or dead trees with hollows greater than 20cm diameter.	High	Vulnerable	Not listed	Hollow bearing trees present in development site.	Included	Habitat components on site
Pink-tailed Legless Lizard ***Aprasia parapulchella***	Rocky Areas or within 50m of rocky areas.	High	Vulnerable	Vulnerable	No rocky areas in development site.	Excluded	No suitable habitat
Regent Honeyeater ***Anthochaera phrygia***	Mapped important areas	High	Critically Endangered	Critically Endangered	Not within mapped important areas	Excluded	Not within mapped important areas.
Southern Myotis ***Myotis macropus***	Dependent on waterways with pools of 3m wide or greater. Hollow Bearing trees within 200m of riparian zone. Bridges, caves or artificial structures within 200m of riparian zone.	High	Vulnerable	Not listed	Manmade wetland providing permanent water present in development site.	Included	Habitat components on site.
Square-tailed Kite ***Lophoictinia isura*** **(Breeding)**	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. Nest Trees.	Moderate	Vulnerable	Not listed	Woodland areas present in development site.	Included	Habitat components on site
Squirrel Glider ***Petaurus norfolcensis***	Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely connected (i.e. no more than 50 m apart).	High	Vulnerable	Not listed	Woodland and Hollow bearing trees present in development site. Known records within development site.	Included	Habitat components on site.

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Superb Parrot ***Polytelis swainsonii*** **(Breeding)**	Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5cm diameter; greater than 4m above ground or trees with a DBH of greater than 30cm.	High (breeding)	Vulnerable	Vulnerable	Hollow bearing trees present in development site.	Included	Habitat components on site
Swift Parrot ***Lathamus discolor***	Mapped Important Areas	Moderate	Endangered	Critically Endangered	Development site not within mapped important areas.	Excluded	Not within mapped important areas
White-bellied Sea-eagle ***Haliaeetus leucogaster*** **(Breeding)**	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	High	Vulnerable	Not listed	Within 1km of wetlands. Large mature trees present in development site.	Included	Habitat components on site.
FLORA							
Ausfeld's Wattle ***Acacia ausfeldii***	Footslopes and low rises on sandstone. Associated species include *Eucalyptus albens*, *E. blakelyi* and *Callitris* spp., with an understorey dominated by *Cassinia* spp. and grasses.	High	Vulnerable	Not listed	Blakely's Red Gum present in development site.	Included	Within geographic distribution.
Austral Pillwort ***Pilularia novae-hollandiae***	Semi-permanent/ephemeral wet areas Periodically waterlogged sites (including table drains and farms dams)	High	Endangered	Not listed	Wetlands present in development site.	Included	Habitat components on site.

Species credit species	Habitat components and geographic restrictions	Sensitivity to gain class	NSW Listing Status	National Listing Status	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Silky Swainson-pea ***Swainsona sericea***	Box-gum woodland in southern tablelands and South West Slopes. Sometimes in association with cypress pines. Known in subregion.	High	Vulnerable	Not listed	Box-gum Woodland present in development site.	Included	Within geographic distribution.
Small Purple-pea ***Swainsona recta***	Predominantly grassy woodlands, but sometimes extends into grassy open forest, usually with tree cover including Blakely's Red Gum, Yellow Box, and White Box. Known in subregion.	Moderate	Not listed	Endangered	Box-gum Woodland present in development site.	Included	Within geographic distribution.
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 between 450 and 700 mm. Known in subregion.	High	Endangered	Not listed	Box-gum Woodland and River Red Gum present in development site.	Included	Within geographic distribution.

6.2.3 Site surveys

A general biodiversity survey was undertaken on 29 and 30 November 2017. Additional areas that were considered for the development footprint were undertaken on the 30th August 2018 and 6th March 2019. Targeted threatened fauna diurnal and nocturnal surveys were undertaken on 29th and 30th November 2017, and 22nd, 23rd and 24th August 2018. Targeted threatened flora surveys were undertaken on 29th and 30th November 2017.

Diurnal birds

- A woodland bird survey was completed over two survey times (the 29th - 30th November 2017 and 22nd, 23rd and 24th August 2018). A total of 10 x 20-minute point surveys were carried out across the development footprint. Twenty-four opportunistic surveys were also undertaken by car and foot.

Nocturnal Birds

- A nocturnal bird survey was completed on the nights of 22nd and 23rd August 2018 for a total of approximately 8 person hours.

Nocturnal mammals

- A targeted survey for nocturnal mammals was completed on the nights of 22nd and 23rd August 2018 for a total of approximately 8 person hours.
- Targeted survey for Koalas was undertaken during the day on the 29th and 30th November 2017. All mature feed trees were inspected for scats and scratches. A targeted spotlight survey was also completed on the evenings of 22nd and 23rd August 2018 for a total of approximately 12-person hours.

Southern Myotis

- Targeted bat surveys were completed on the 22nd and 23rd August 2018. Two Anabat Swifts were put out for three nights at suitable locations within the development footprint.

Sloane's Froglet

- A targeted frog survey was completed at farm dams on 22nd and 23rd August 2018. Point call surveys including call playback were used at 12 farm dams within the development footprint.

Threatened flora

- Targeted survey for Ausfelds Wattle was undertaken on the 29th and 30th November 2017. The understorey of all vegetation zones within the development area and roads were inspected.
- Targeted survey for the Small Purple Pea, Silky Swainson-pea and Small Scurf Pea was undertaken on the 29th - 30th November 2017 in areas of suitable habitat for approximately 2 hours.

Note: Spring survey for listed threatened grasses and forbs was unable to be taken during the specified time period.

All survey effort was conducted to the BAM Calculator requirements, BDAR requirements and OEH guidelines and recommendations.

6.2.4 Survey results

Table 6-5 summarises all species found on-site. Of these, only the Flame Robin is a threatened species. No threatened flora was identified.

No karsts, caves, crevices or cliffs occur within the development site. No surface rocks or rocky outcrops occur within the development site. No human made structures that could be used by threatened species occur within the development site. Non-native vegetation within the development site is predominantly crops. No threatened species are considered to rely on the non-native vegetation within the development site.

The development site is located on flat, low-lying land. Two ephemeral creeks run through the development site. These are Dead Horse Creek which runs through the north western corner of the development site, and Kilnacroft Creek which transects the southern western section of the development site. The two creeks run into Bowna Creek, which feeds into Lake Hume, upstream of the Murray River. No water was present in the creeks for the duration of the field surveys which were undertaken between November 2017 and January 2019. Two wetlands also occur within the development site. One large man-made wetland is present in the south-east corner of the development site and a smaller ephemeral wetland occurs in the north eastern corner.

19 farm dams occur within the development site that provide catchment for drainage (26 dams in the subject land). These dams provide limited habitat values as they are heavily utilised by stock and most lack fringing vegetation.

Table 6-5 Fauna identified on-site through survey effort

Species	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Op.
BIRDS																						
Australasian Darter *Anhinga novaehollandiae*				X																		
Australasian Grebe *Tachybaptus novaehollandiae*				X															X	X		
Australian Magpie *Cracticus tibicen*	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X		X	
Australian Raven *Corvus coronoides*		X	X	X				X									X	X	X			
Australian Shoveler *Spatula rhynchotis*				X																		
Black Swan *Cygnus atratus*				X																X		
Black-fronted Dotterel *Elseyornis melanops*				X																		
Black-tailed Native-hen *Tribonyx ventralis*				X																		
*Common Starling *Sturnus vulgaris*			X													X						
Crested Pigeon *Ocyphaps lophotes*	X		X	X		X						X	X	X				X				
Dusky Moorhen *Gallinula tenebrosa*				X																		
Eastern Rosella *Platycercus eximius*	X	X	X	X	X	X	X	X	X	X	X		X		X	X				X	X	
Eurasian Coot *Fulica atra*				X																X		
Flame Robin *Petroica phoenicea*							X															
Fork-tailed Kite *Milvus migrans*								X												X		
Galah *Eolophus roseicapillus*	X		X	X	X	X	X		X	X	X	X	X	X	X		X	X				

Species	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Op.
Golden Whistler *Pachycephala pectoralis*			X																			
Great Cormorant *Phalacrocorax carbo*				X																		
Grey Butcherbird *Cracticus torquatus*	X							X				X										
Grey Shrike-thrush *Colluricincla harmonica*		X	X	X	X		X			X		X				X			X		X	
Grey Teal *Anas gracilis*				X											X			X		X		
Laughing Kookaburra *Dacelo novaeguineae*	X	X	X		X			X											X			
Little Black Cormorant *Phalacrocorax sulcirostris*									X													
Little Corella *Cacatua sanguinea*				X																		
Little Pied Cormorant *Microcarbo melanoleucos*				X										X								
Little Raven *Corvus mellori*		X	X											X				X				
Noisy Friarbird *Philemon corniculatus*				X																		
Noisy Miner *Manorina melanocephala*	X			X	X			X	X		X	X			X				X			
Pacific Black Duck *Anas superciliosa*									X				X									
Peewee *Grallina cyanoleuca*	X	X		X	X	X		X					X	X		X	X	X	X			
Pied Butcherbird *Cracticus nigrogularis*						X								X								
Red Wattlebird *Anthochaera carunculata*	X	X		X									X						X		X	
Red-capped Robin *Petroica goodenovii*						X																

Species	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Op.
Red-kneed Dotterel *Erythrogonys cinctus*				X																X		
Red-rumped Parrot *Psephotus haematonotus*				X		X										X	X					
Restless Flycatcher *Myiagra inquieta*				X												X		X	X			
Rufous Whistler *Pachycephala rufiventris*			X																			
Spur-winged Plover *Vanellus miles*				X		X			X						X	X			X	X		
Straw-necked Ibis *Threskiornis spinicollis*																						X
Striated Pardalote *Pardalotus striatus*	X			X	X			X		X		X	X		X	X	X		X			
Sulphur-crested Cockatoo *Cacatua galerita*		X		X												X		X	X			
Superb Blue Wren *Malurus cyaneus*		X			X	X		X													X	
Tawny Frogmouth *Podargus strigoides*																						X
Tree Martin *Petrochelidon nigricans*				X																		
Weebill *Smicrornis brevirostris*							X															
Welcome Swallow *Hirundo neoxena*		X		X	X											X			X			
Whistling Kite *Haliastur sphenurus*																					X	
White-eyed Duck *Aythya australis*				X																X		
White-faced Heron *Egretta novaehollandiae*													X									
White-plumed Honeyeater *Lichenostomus penicillatus*		X		X											X							
White-winged Chough	X	X							X													

Species	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	Op.
Corcorax melanocephalus																						
Willy Wagtail *Rhipidura leucophrys*			X		X	X					X			X		X				X		
Wood Duck *Chenonetta jubata*				X		X			X	X	X	X	X		X	X	X			X		
Yellow Thornbill *Acanthiza nana*			X																			
Yellow-billed Spoonbill *Platalea flavipes*				X		X						X										
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*			X			X								X								
Mammals																						
Common Brushtail Possum *Trichosurus vulpecula*																						X
Common Ringtail Possum *Pseudocheirus peregrinus*																						
*Feral Cat *Felis catus*																						X
Amphibians																						
Plains Froglet *Crinia parinsignifera*																			X	X	X	
Molluscs																						
Flood Plain Mussel *Velesunio ambiguus*									X		X	X										

6.2.5 Potential impacts

Direct impacts

The construction and operational phases of the proposal have the potential to impact biodiversity values at the site. These cannot be entirely avoided. This would occur through direct impacts such as habitat clearance and installation and operational effects of installed infrastructure as detailed in Table 6-6.

Table 6-6 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)	17.41 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	>11 HBTs	Regular	Construction	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	80 ha (19% of 404 ha development site at horizontal)	Regular	Operational Phase: Long-term	• Modification of modified fauna habitat • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure (Fencing, array infrastructure).	80 ha	Regular	Operational Phase: long-term	• Modification of habitat beneath array (mostly non-native) • Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats (fencing).

Loss in native vegetation

About 17.41 ha of native vegetation would be removed by the proposal. The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 6-7 below. Note, while shading and microclimate effects are unlikely to remove all vegetation beneath the array, a future integrity score of zero is entered as a worst case.

Table 6-7 Table of current and future vegetation integrity scores for each vegetation zone within the development site.

Zone ID	PCT	TEC and/or threatened species habitat?	Impact Area (ha)	Current vegetation integrity score	Future vegetation integrity score
1	PCT277_Grazed understorey	Box-Gum Woodland EEC Squirrel Glider	12.47	**22.0**	**0**
2	PCT277_Roadside	Box-Gum Woodland EEC Eastern Pygmy Possum (Assumed) *Cullen parvum* (assumed) *Swainsona sericea* (assumed) *Swainsona recta* (assumed)	1.38	**48.4**	**0**
3	PCT277_Creekline	Box-Gum Woodland EEC Squirrel Glider Eastern Pygmy Possum (Assumed)	0.49	**40.0**	**0**
6	PCT9_Woodland	Southern Myotis (Assumed) *Cullen parvum* (assumed)	1.57	**19.8**	**0**
7	PCT9_Derived Grassland	*Cullen parvum* (Assumed)	1.10	**24.7**	**0**
9	PCT277_Benchmark	Box-Gum Woodland EEC Eastern Pygmy Possum (Assumed) *Cullen parvum* (assumed) *Swainsona sericea* (assumed) *Swainsona recta* (assumed)	0.40	100	**0**
		Total	**17.41**		

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 6-8 below.

Table 6-8 Summary of species credit species loss at the development site

Species Credit Species	Biodiversity risk weighting	Area of habitat / count of individuals lost
Squirrel Glider (*Petaurus norfolcenisis*)	2.00	8.60 ha in Zone 1: 277_grazed 0.49 ha in Zone 3: 277_Creekline
Eastern Pygmy Possum (*Cercartetus nanus*) – assumed present	2.00	1.38 ha in Zone 2: 277_roadside 0.49 ha in Zone 3: 277_creekline 0.40 ha in Zone 9: 277_benchmark
Southern Myotis (*Myotis macropus*) – assumed present	2.00	woodland within 200m of wetland dam 0.44 ha in Zone 1: 277_grazed 0.21 in Zone 6: 9_woodland
Small Scurf Pea (*Cullen parvum*) – assumed present	2.00	0.90 ha in Zone 2: 277_roadside 0.49 ha in Zone 3: 277_creekline 1.57 ha in Zone 6: 9_woodland 1.10 ha in Zone 7: 9_derived grassland 0.40 ha in Zone 9: 277_benchmark
Silky Swainson-pea (*Swainsona sericea*) – assumed present	2.00	1.38 ha in Zone 2: 277_roadside 0.40ha in Zone 9: 277_benchmark
Small Purple-pea (*Swainsona recta*) – assumed present	1.00	0.90 ha in Zone 2: 277_roadside 0.40 ha in Zone 9: 277_benchmark

Loss of Paddock Trees

Forty paddock trees occur throughout the development site comprised of a mix of Yellow Box and Blakely's Red Gum. Thirty-three of these paddock trees would be impacted by the proposal.

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 6-9 below details the type, frequency, intensity, duration and consequence of the indirect impacts that may occur as a consequence of the proposal. Given the current land management practices and degraded nature of the development site, indirect impacts are unlikely to occur or be exacerbated as a result of the proposal.

Table 6-9 Potential impacts to biodiversity during the construction and operational 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 Phase: Short-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	• Injury and mortality of fauna during clearing of fauna habitat and habitat trees; • Disturbance to stags, fallen timber; and • Increased edge effects.
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. • Flame Robin • Squirrel Glider	• Loss of connectivity between remnant 277 within and around development footprint; and • Reduced genetic diversity within isolated populations
Reduced viability of adjacent habitat due to noise, dust, heat or light spill	Unknown	Rare	Operational Phase: Short-term	• Squirrel Glider • Southern Myotis • Flame Robin	• May alter fauna activities and/or movements; and • Loss of foraging or breeding habitat.
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction & Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	• Degradation of community biodiversity and integrity; and • Weed encroachment (remnant veg).
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction & Operational Phase: Long-term	• Squirrel Glider • Southern Myotis • Flame Robin	• Loss of foraging habitat; • Exposure to predators when moving between segmented patches of vegetation; and • Loss of access to water (loss of dams).
Loss of breeding habitats	12 HBT	Constant	Construction Phase: Long-Term	• Squirrel Glider • Southern Myotis	• Loss of potential breeding habitat including fallen and hollow logs at height;

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
					• Loss of vegetation close to water: and • Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna
Earthworks and mobilisation of sediments	Unknown	Regular	Construction	PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	• Erosion and sediment deposition pollution on downstream habitats; and • Alternation of surface watercourses (isolating high biodiversity value communities).

Prescribed impacts

The following prescribed biodiversity impacts are relevant to the proposal:

- Impacts of the development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range;
- Impacts of the development on movement of threatened species that maintains their life cycle;
- Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation;
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities; and
- Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC.

Impacts to matters of national environmental significance

Patches of Yellow Box and Blakely's Red Gum woodland were present in the development site, however these woodland areas did not meet the criteria for the federally listed Box-gum woodland ecological community.

The woodland vegetation around the Transgrid substation was unable to be surveyed due to site access restrictions. No floristic plots were able to be undertaken within this area to determine whether it met the criteria thus a precautionary approach was used. For the purposes of this assessment, the area of woodland around the TransGrid substation was considered to form part of the EPBC listed *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Box-gum Woodland). 0.4ha of this community would be impacted through the construction of the proposed transmission line.

An assessment of significance was undertaken for this community and concluded that a significant impact was unlikely, on the basis that:

1. The amount of habitat to be removed or disturbed by the proposal is minimal.
2. The proposal area occurs on land that has been previously cleared and modified from farming practices (cropping and grazing).
3. Mitigation measures would be implemented to prevent the introduction of pathogens or invasive weeds on site.

A referral to the Federal Department of Environment is not considered necessary for this community.

No EPBC listed species were recorded during the field surveys. Twenty-two threatened species and 13 migratory species were returned from the protected matters report. Of these, 4 threatened fauna species and 2 migratory species are considered to have the potential to utilise the habitats at the development site. Assessments of significance were undertaken for these species.

EPBC Assessments of Significance were completed for the threatened fauna: Swift Parrot, Superb Parrot, Grey-headed Flying-fox, Fork-tailed Swift and White-throated Needletail. 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 these species.
- Affect habitat or introduce disease such that these species would decline.
- Introduce invasive species harmful to the species.

- Interfere with the recovery of these species.

No referral is considered necessary to the Australian Government's Department of Environment and Energy for these species.

The EPBC Referral Guidelines for the Koala 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. The assessment resulted in a score of 3 and as such habitat within the study area is not considered to be critical to the survival of the Koala. An assessment of significant impact is not required.

6.2.6 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;
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 for the proposal are documented in Table 6-10.

Table 6-10 PCTs and vegetation zones that require offsets

Zone ID	PCT ID	Zone name	Impact area (ha)	Vegetation Integrity Score	Future Vegetation Score	Ecosystem credits required
1	277	Grazed understorey	12.47	22.0	0	138
2	277	Roadside	1.38	48.4	0	33
3	277	Creek line	0.49	40.0	0	10
6	9	Woodland	1.57	19.8	0	14
7	9	Derived Grassland	1.10	24.7	0	12
9	277	Benchmark	0.40	100*	0	20
					TOTAL:	**227**

*Benchmark Data for this PCT used

Paddock Tree Credits

Offsets are required for the clearing of Class 2 and Class 3 Paddock trees. Thirty-three class 3 and 2 class 2 paddock trees would be removed by the proposal. The paddock trees are considered to form part of PCT 277: Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. Ecosystem credits are calculated as per the streamlined assessment defined in the BAM. The ecosystem credits are documented in Table 6-11. 27 ecosystem credits are required for the clearing of paddock trees for the proposal.

Table 6-11 Paddock Tree offsets

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Credits generated per tree	Ecosystem credits required
Class 1 (<20cm DBH)	No	1	0	0
Class 2 (>20cm DBH and < 50cm DBH)	No	2	0.5	1
Class 2 (>20cm DBH and < 50cm DBH)	Yes	0	0.75	0
Class 3 >50cm DBH	No	21	0.75	16
Class 3 >50cm DBH	Yes	9	1	9
			TOTAL:	**26**

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 6-12. As mentioned above, these species were not able to be surveyed for, and presence is assumed.

Table 6-12 Species credit species that require offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost (ha)	Species credits required
Squirrel Glider (*Petaurus norfolcensis*)	2.0	9.09 ha	105
Southern Myotis (*Myotis macropus*)	2.0	0.65 ha	7
Eastern Pygmy Possum (*Cercartetus nanus*)	2.0	2.27 ha	63
Small Scurf Pea (*Cullen parvum*)	2.0	4.46 ha	93
Silky Swainson-pea (*Swainsona sericea*)	2.0	1.78 ha	53
Small Purple-pea (*Swainsona recta*)	1.0	1.78 ha	53
		TOTAL:	**374**

No species listed on 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.

6.2.7 Safeguards and mitigation measures

Table 6-13 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
BD1	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 on Superb Parrots, Major Mitchell Cockatoo and Corben's Long-eared Bat. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.	**C**		
BD2	Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events, including: • Pre-clearing checklist. • Tree clearing procedure.	**C**		
BD3	Relocate 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 and construction**		
BD4	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; • Access to the Box-Gum Woodland EEC would not be permitted via vehicles to reduce understorey impacts and clearing; and • Strict weed protocol must be observed at all times.	**C**		
BD5	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**	
BD6	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**

No.	Safeguards and mitigation measures	C	O	D
BD7	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		
BD8	Temporary fencing to protect significant environmental features such as riparian zones should be installed prior to construction commencing. Exclusion fencing, and signage would be installed around habitat to be retained	C		
BD9	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. A Weed Management Procedure would be developed 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 and after construction. • Weed hygiene protocol in relation to plant, machinery, and fill. Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported. The weed management procedure would be incorporated into the Biodiversity Management Plan.	C	O	
BD10	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; and • Site speed limits to be enforced to minimise fauna strike.	C	O	
BD11	Preparation of a vegetation management plan to regulate activity in vegetation and habitat adjacent to the proposed development. Preparation of a Biodiversity Management Plan that would include protocols for: • 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; • Unexpected threatened species finds; • Exclusion of vehicles through sensitive areas; • Best practice clearing of overstorey vegetation for construction of the transmission line to avoid understorey impacts; and • Rehabilitation of disturbed areas.	C		

No.	Safeguards and mitigation measures	C	O	D
BD12	Barbed wire would not be used on internal and external fences surrounding Sparkes Rd and retained native vegetation would be considered as an offset site	**Pre - construction and construction**		
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.		**O**	
BD15	Installation of Glider Poles to connect central woodland patch to Sparkes Road.	**C**		
BD16	Install hollows of felled trees onto younger trees or on ground in retained vegetation patches.	**C**		

6.3 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 adequate consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

An Aboriginal Cultural Heritage Assessment Report (ACHAR) will be required as part of the EIS. The ACHAR must demonstrate consultation in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). *Aboriginal cultural heritage values that exist across the whole area that will be affected by the development must be identified and documented in the ACHAR.*

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 would 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 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 materials are uncovered during construction to formulate appropriate measures to manage the impacts to these materials.*

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 E and is summarised below.

The ACHAR was prepared in line with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);

- _Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales_ (OEH 2010a); and
- _Aboriginal cultural heritage consultation requirements for proponents 2010_ (OEH 2010b).

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.

6.3.1 Background

The proposal is within an area identified as part of the Wiradjuri language group. This is an assemblage of many small clans and bands speaking a number of similar dialects.

The Wiradjuri language group was the largest in NSW prior to European settlement. The borders were, however, not static, and were most likely fluid, expanding and contracting over time to the movements of smaller family or clan groups. 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 a number of 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 a number of grinding implements and a larger range of stone tools and raw materials.

The proposal area is located within the Murray Catchment, about 15 km north of the Murray River. The two closest surface water drainage lines are ephemeral creeks; Dead Horse Creek and Kilnacroft Creek. Ten man-made dams also occur within the development footprint.

Most archaeological surveys are conducted in a situation where there is topographic variation, and this can lead to differences in the assessment of archaeological potential and site modelling for the location of Aboriginal archaeological sites. As already noted, the ephemeral creeks Dead Horse Creek and Kilnacroft Creek intersect the proposal area. Additionally, Gum Swamp is located within 200 m of the northern portion of the proposal area. The areas in close proximity to a water source on slightly raised flat areas and hill crests are likely to have been a focus for Aboriginal people in the area. However, prior to European land modifications, this area as a whole may have provided resources, shelter, water and food for Aboriginal people.

The proposal area is located just inside the barrier between the two subregions, lying within the Lower Slopes subregion and surrounded by the Upper Slopes subregion. Landscape mapping as part of the Mitchell landscapes system (2002) divides the proposal area into two differing landscape types. These landscapes are the Brokong Plains (Bro), and Murray Lakes, Swamps and Lunettes.

These different soils and Mitchell landscapes were not readily identifiable within the proposal area and were not used as a means of landscape differentiation. The landforms were instead determined based on topography identified during the visual inspection of the proposal area during field survey and from the review of detailed contour mapping. The four landforms identified within the proposal area are crests, spurs, slopes and low-lying flats and drainage lines.

Database searches and consultation

A search of the AHIMS database was conducted over an area approximately 5 km from the proposal area on the 2nd August 2018. The AHIMS Client Service Number was: 361593. The search area extended from Lat, Long: -35.9628, 146.8051 to Lat, Long: -35.8642, 146.9355 with a 50 m buffer zone. There were six Aboriginal sites and no declared Aboriginal Places recorded in the search area. Figure 6-3 shows the locations of the AHIMS sites in relation to the assessment area and Table 6-14 shows a breakdown of the site types. A subsequent search of the AHIMS database was conducted over an area approximately 22 km east-west x 22 km north-south centred on the proposal area, was undertaken on the 20th of September 2018 to provide a more detailed understanding of the archaeological setting of the proposal area. The AHIMS Client Service Number was: 371889. The search area extended from Lat, Long -35.9968, 146.7418 to Lat, Long -35.8302, 147.0059 with a buffer zone of 50 m. There were 50 Aboriginal sites and no declared Aboriginal Places recorded in the search area. Figure 6-4 shows the locations of the AHIMS sites within 5 km of the assessment area and Table 6-14 shows a breakdown the of all the site types.

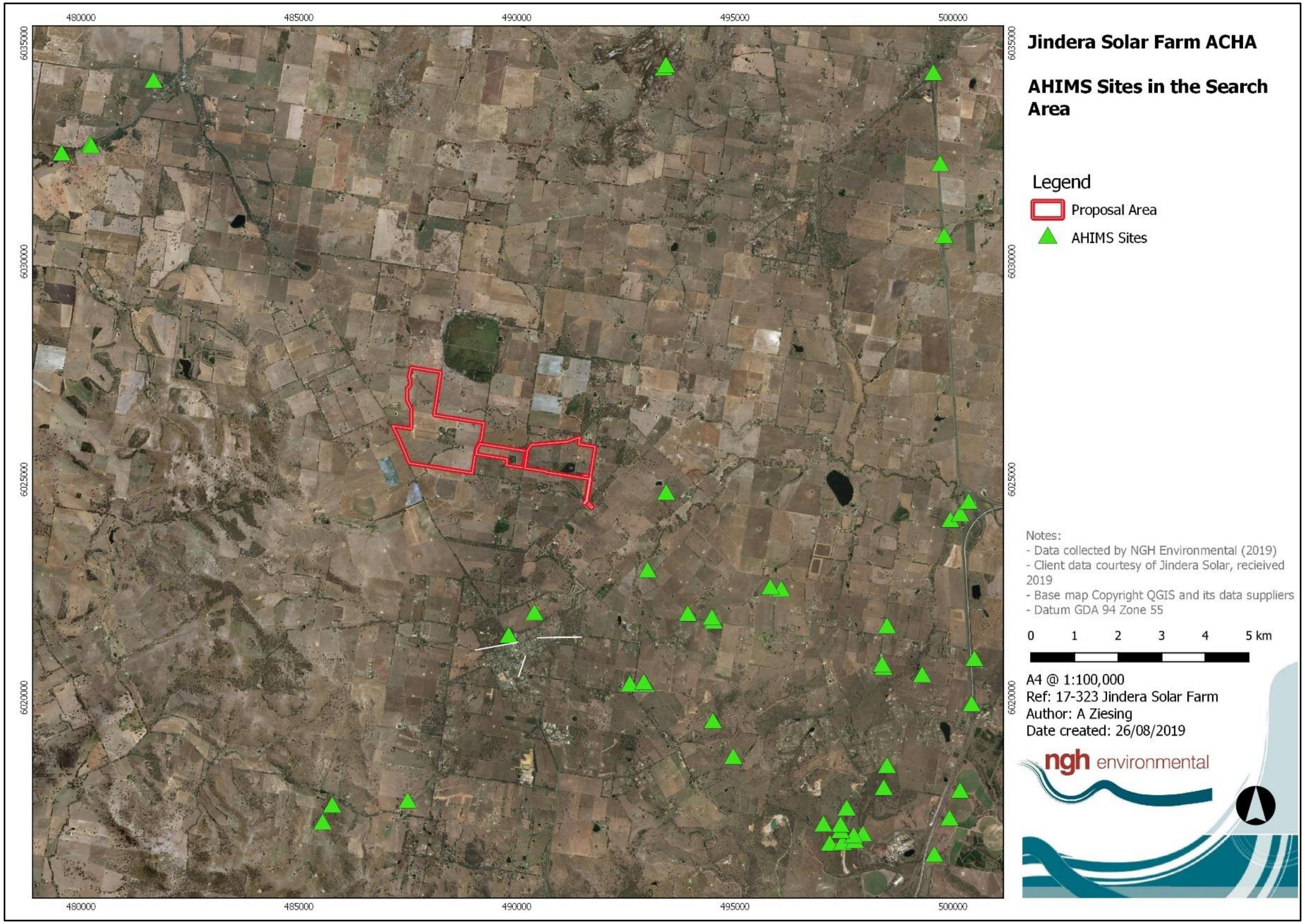

Figure 6-3 AHIMS Sites in the wider search area.

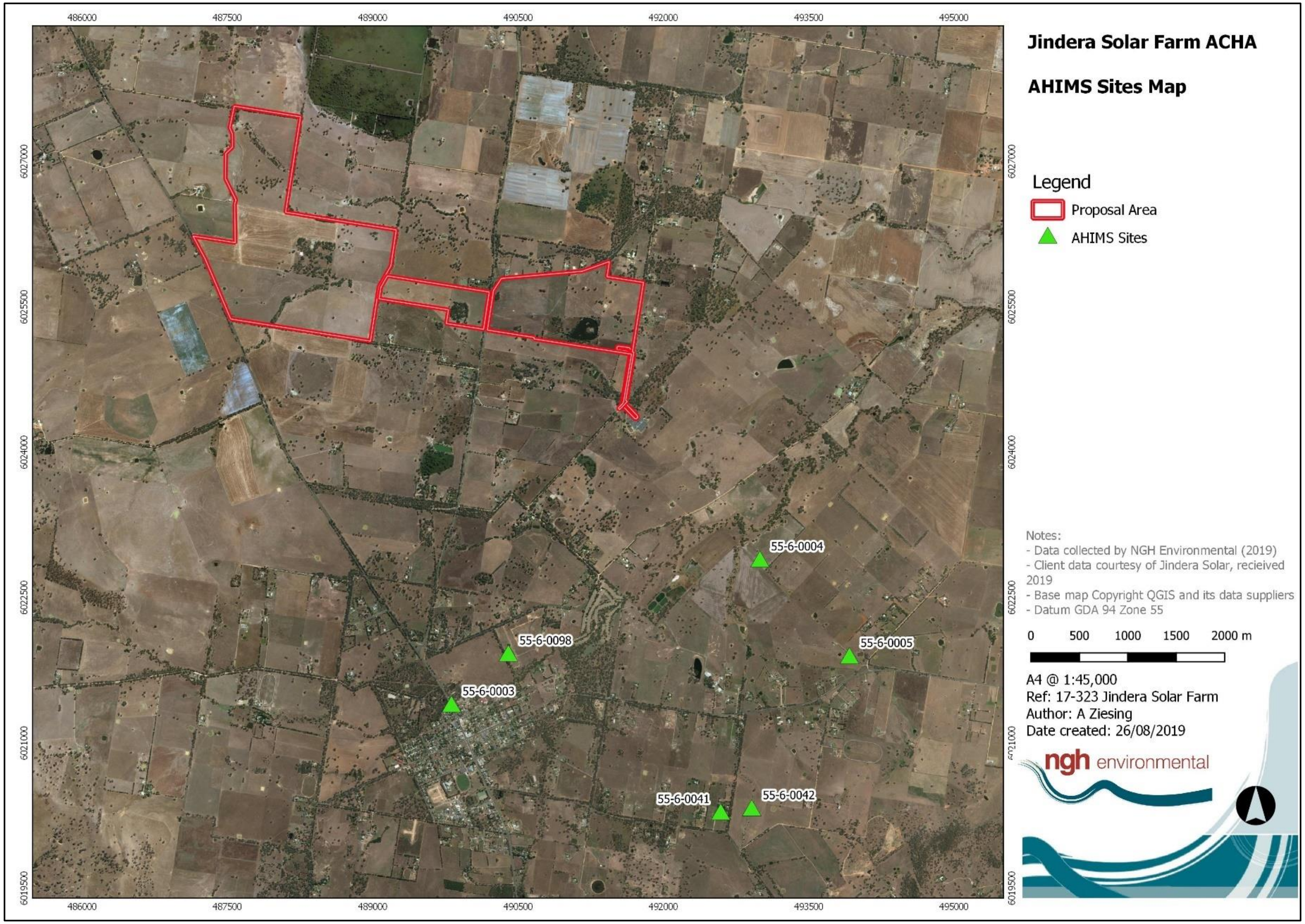

Figure 6-4 Location of AHIMS Sites within 5 km of the proposal area.

Table 6-14 Breakdown of previously recorded Aboriginal sites in the region.

Site Type	Number
Modified Tree (Carved or Scarred)	19
Artefact (1 or more)	30
Habitation structure	1
TOTAL	**50**

No sites are located within the proposed project boundary. Four sites lie within 3-4 km of the proposal area. These include three artefact sites (AHIMS# 55-6-0004, AHIMS# 55-6-0005 and AHIMS# 55-6-0098) and one culturally modified tree (AHIMS# 55-6-0003).

Two additional artefact sites are located within 5 km of the area under assessment and these are listed as one open artefact scatter (AHIMS# 55-6-0041) and one isolated find (AHIMS# 55-6-0042).

6.3.2 Site survey

Methodology

The intention for the field survey 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 was likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites.

The survey was undertaken by an archaeologist from NGH Environmental with representatives of the Aboriginal community. Initial surveys were conducted over a period of three days from the 6th to the 8th of November 2018 to identify areas that may have potential for *in situ* subsurface deposits. Additional survey fieldwork was carried out on the 21st of January 2019 and the 5th of March 2019 by an archaeologist from NGH Environmental with representatives of the Aboriginal community. The subsurface testing and additional survey fieldwork were carried out between 25th February and the 8th March 2019 by two archaeologists from NGH Environmental with local Aboriginal representatives. Over the course of the survey, notes were made about visibility, photos were taken and any possible Aboriginal features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

The survey method was to walk a series of transects across the landscape to achieve maximum coverage. Because the proposal site was generally cleared paddocks used for grazing livestock or recently harvested crop fields, transects were spaced evenly with the survey team spread apart at 30 m intervals, walking in parallel lines. The survey team consisted of a minimum of four people and a maximum of six people which allowed a 120 m to 180 m wide tract of the proposal area to be surveyed with each transect depending on the number of people present. 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.

Native vegetation remnants are considered to have high archaeological potential for mature trees and possible Aboriginal scarring. Such areas have been excluded from the development footprint where possible. Nevertheless, for completeness, these areas were inspected for any evidence of Aboriginal scarring. Native paddock trees were also inspected for any evidence of Aboriginal scarring (Long 2005).

The proposal site was divided into 4 landforms based on contour mapping and visual inspection during field survey. The landforms were crests, spurs, slopes and low-lying flats and drainage line as shown in Figure 6-7.

Over the course of the field survey, approximately 48 km of transects were walked across the proposal area by the participants. Allowing for an effective view width of 5 m for each person, a total surface area of 17.5 ha was examined. Visibility within the proposal area was variable, however as a whole it generally had poor visibility averaging 10% overall. The effective visibility in the paddocks ranged from 95% in exposures and in recently harvested paddocks to less than 5% in areas with a dense low grass cover.

Subsurface excavation of the 4 areas was required to investigate the presence and extent of archaeological material at 4 sites of Potential Archaeological Deposits (PADs) in the proposal area (Figure 6-5). The subsurface excavation was undertaken following the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. It was determined that the most effective way of testing the four PADs within the proposal area was through the hand excavation of a series of test pits. Test pits were placed to investigate the PADs at 20 m intervals along a baseline transect in each area to assess the presence or absence of archaeological material. A total of 52 pits were excavated across the proposal area.

It is considered 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.

Results and conclusions

Despite the variable visibility encountered during the survey a total of 10 artefact scatters and 15 isolated finds were recorded. Four areas of potential archaeological deposit were also identified that required subsurface testing. The Aboriginal community representatives identified 3 cultural trees. These locations are shown in Figure 6-6 and Figure 6-7. A total of 52 test pits were excavated across the 4 PAD sites (Figure 6-8 and Figure 6-9). Of the 52 test pits excavated, stone artefacts were recovered from 25 pits. In total there were 80 stone artefacts recovered.

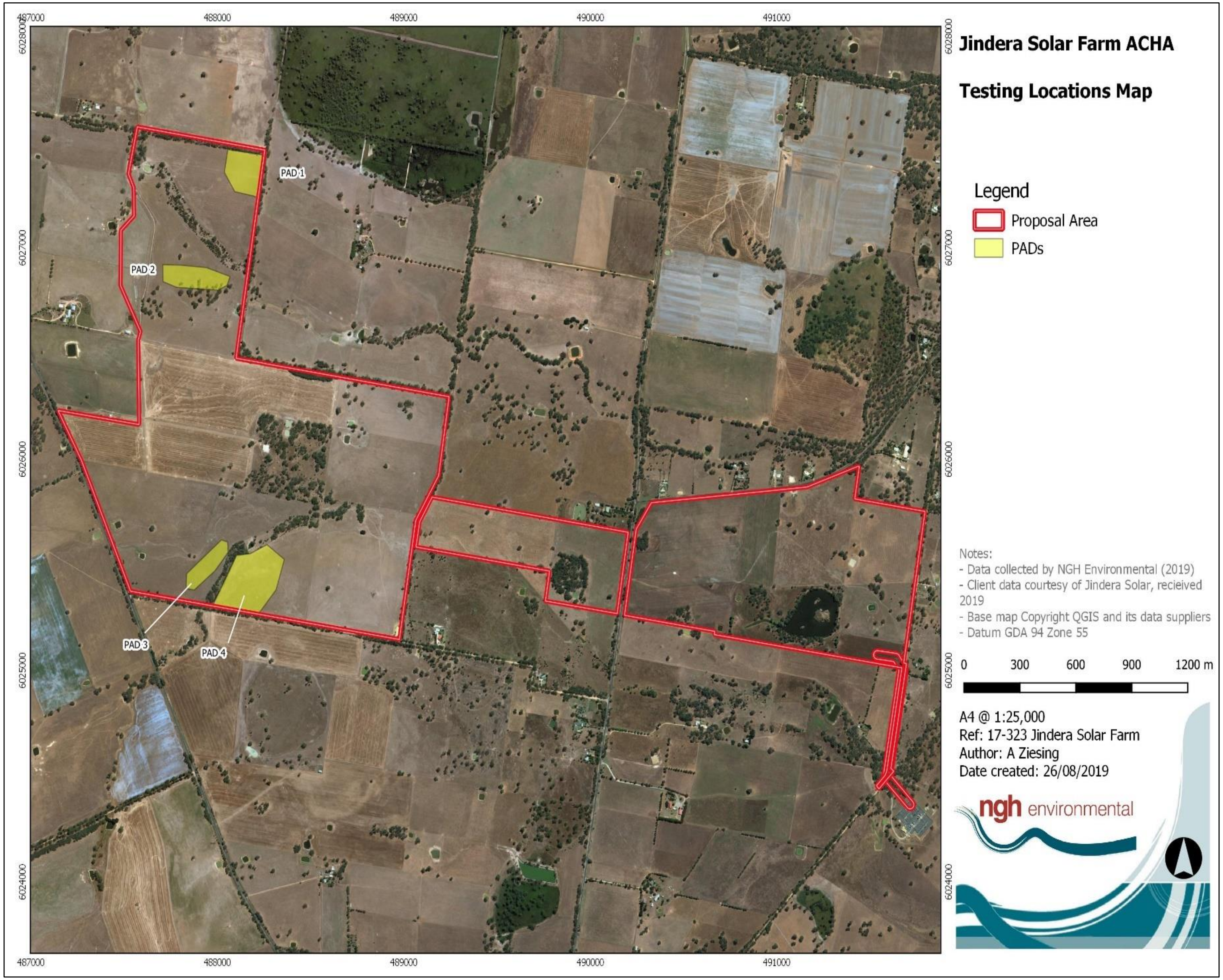

Figure 6-5 Overview of the 4 subsurface testing locations.

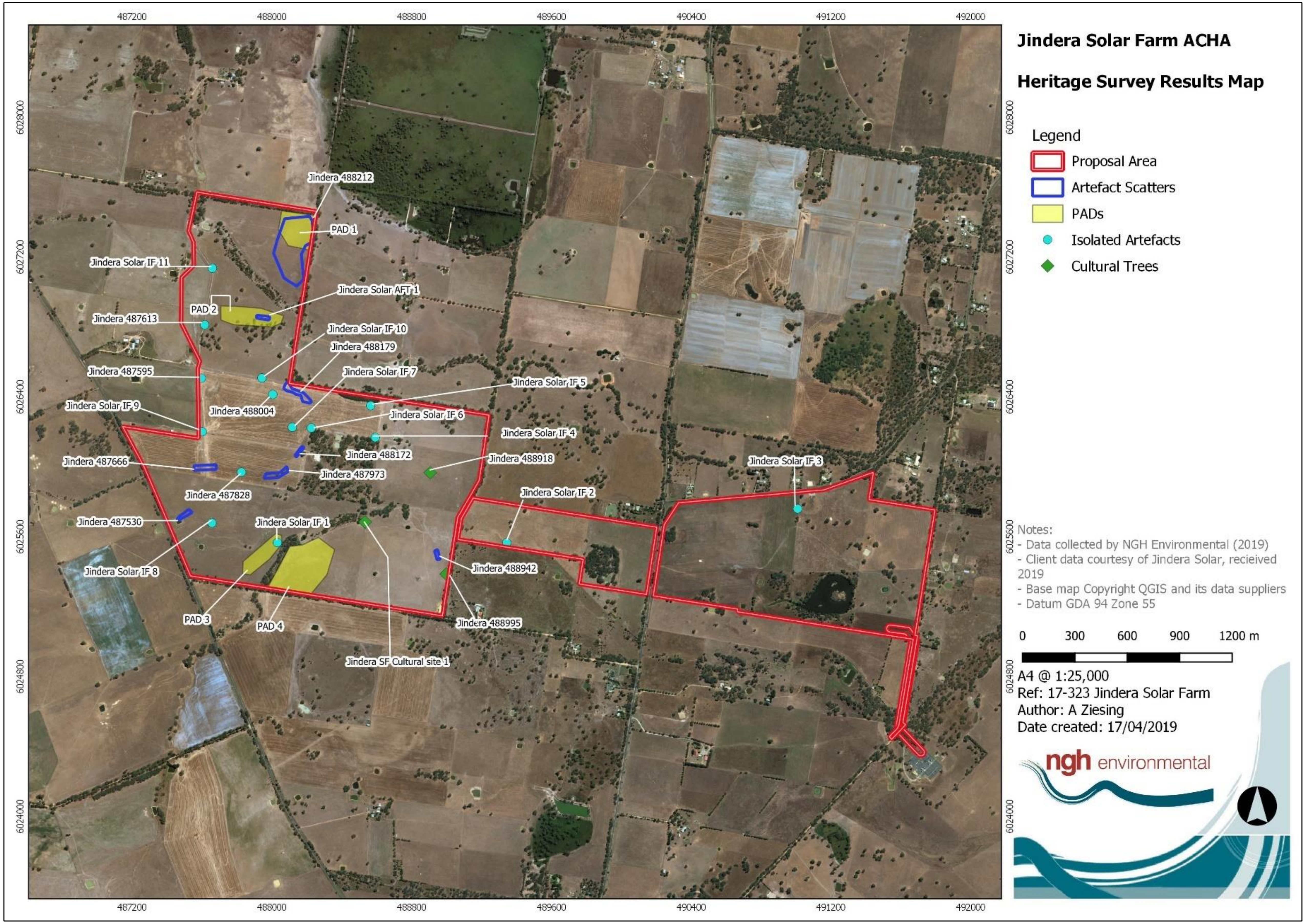

Figure 6-6 Location of recorded sites.

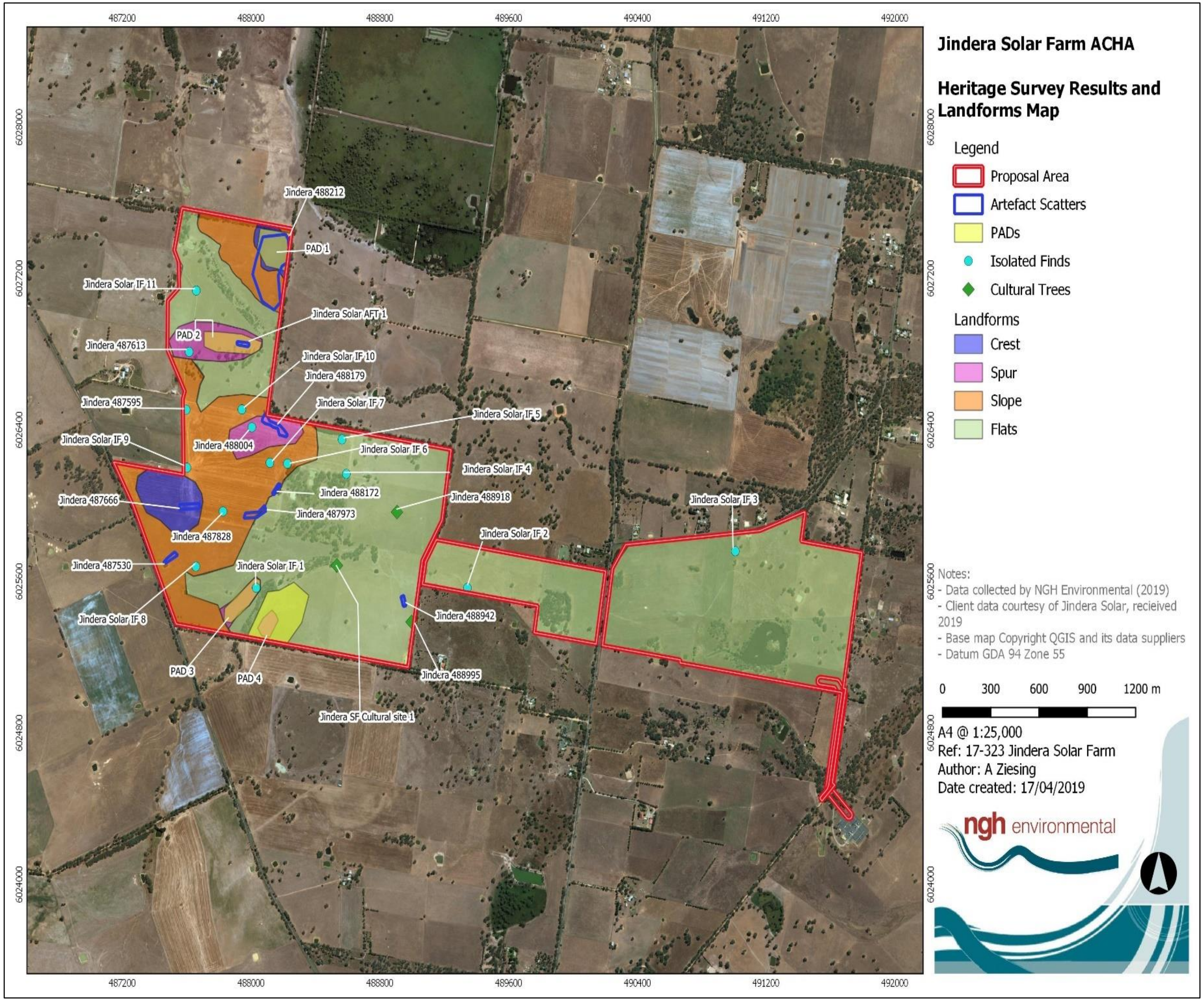

Figure 6-7 Overview of survey results and landforms.

Figure 6-8 Testing Locations at PAD 1 and PAD 2 showing pits where cultural material was recovered.

Figure 6-9 Testing Locations at PAD 3 and PAD 4 showing pits where cultural material was recovered.

Additionally, it should be noted that 12 sites were identified in the field and recorded independently by the Aboriginal representative Mark Saddler. Therefore, Mark Saddler independently assigned a naming convention to the sites he identified during the survey and submitted these sites to AHIMS.

Table 6-15 provides a summary of sites to be impacted and avoided while Table 6-16 details the degree of harm and the consequence of that harm upon the heritage value of each site resulting from the proposed works. Figure 6-10 also shows the location of the sites and the proposed development footprint.

There is Aboriginal archaeological and cultural material present within the solar farm proposal area and the assessment is that there are likely to be other stone artefacts present as well, although in similar low densities. The proposed level of disturbance for the construction of the solar farm could impact the stone artefacts recorded during the field survey and others that may be present within the areas subject to the subsurface testing program and across other areas of the development site.

The impact to the sites with stone artefacts is likely to be most extensive where earthworks occur, such as the installation of cabling, which may involve the removal, breakage or displacement of artefacts. This is considered a direct impact on the sites and the Aboriginal objects by the development in its present form.

The proposed construction methodology for the project will however result in only small areas of disturbance. The construction of access and maintenance tracks may involve some grading but given the nature of the majority of the terrain, this is likely to be minimal. The installation of the solar arrays involves drilling or screwing the piles into the ground and no widespread ground disturbance work such as grading is required to accomplish this. The major ground disturbance will be the trenching for cables and vehicle movement during construction.

The assessment of harm overall for the project is therefore assessed as moderate.

Table 6-15 Summary of sites to be impacted and avoided by the proposed development.

Sites impacted	Sites avoided
1. Jindera Solar AFT1 (artefact scatter) 2. Jindera Solar AFT2 (artefact scatter) 3. Jindera Solar AFT3 (artefact scatter) 4. Jindera 488942 (artefact scatter) 5. Jindera 487530 (artefact scatter) 6. Jindera 488212 (artefact scatter) 7. Jindera 488172 (artefact scatter) 8. Jindera 488179 (artefact scatter) 9. Jindera 487973 (artefact scatter) 10. Jindera 487666 (artefact scatter) 11. Jindera Solar IF 1 (isolated artefact) 12. Jindera Solar IF 3 (isolated artefact) 13. Jindera Solar IF 4 (isolated artefact) 14. Jindera Solar IF 5 (isolated artefact) 15. Jindera Solar IF 6 (isolated artefact) 16. Jindera Solar IF 7 (isolated artefact) 17. Jindera Solar IF 8 (isolated artefact) 18. Jindera Solar IF 9 (isolated artefact) 19. Jindera Solar IF 10 (isolated artefact)	1. Jindera Solar IF 2 (isolated stone artefact) 2. Jindera 488918 (cultural tree) 3. Jindera 488995 (cultural tree) 4. Jindera SF Cultural Site 1 (cultural tree)

Sites impacted	Sites avoided
20. Jindera Solar IF 11 (isolated artefact) 21. Jindera 487595 (isolated artefact) 22. Jindera 487613 (isolated artefact) 23. Jindera 487828 (isolated artefact) 24. Jindera 488004 (isolated artefact)	

Table 6-16 Summary of the degree of harm and the consequence of that harm upon site types.

Site Type	Type of Harm	Degree of Harm	Consequence of harm	No. of Sites	% of site type
Isolated Finds	Direct	Complete	Total loss of value	14	93.3
	Nil	Nil	Not Applicable	1	6.7
Artefact Scatters	Direct	Complete	Total loss of value	10	100
Cultural site	Nil	Nil	Not Applicable	3	100

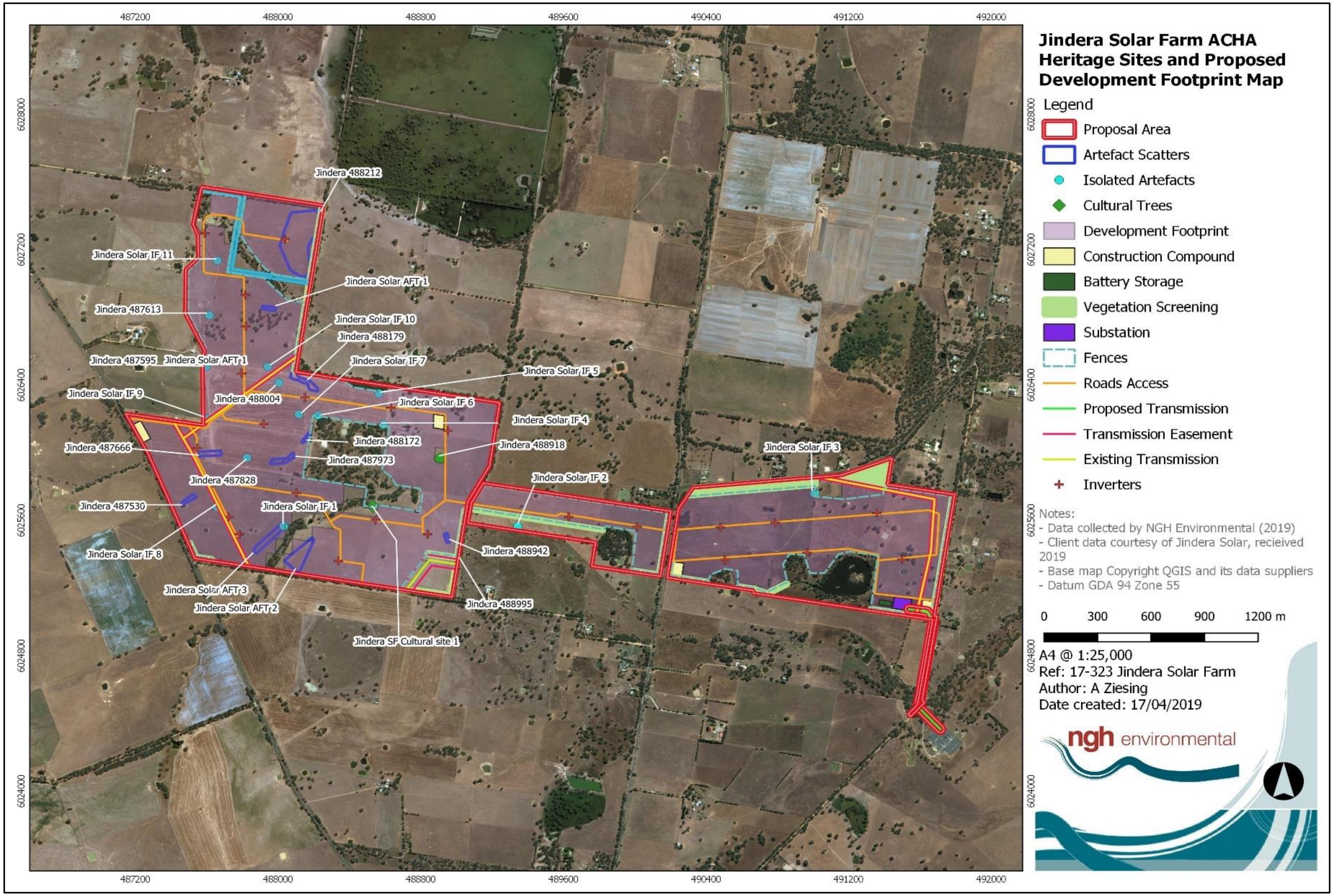

Figure 6-10 Heritage Sites and the proposed development footprint.

Table 6-17 Identified risk to known sites and recommendations.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0162	Jindera Solar AFT1	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	No further salvage/ excavation is required.
55-6-0160	Jindera Solar AFT2	Poor – 100+ year history of agricultural and pastoral use. Disturbed by extensive earth works.	Low	Direct	Partial	Partial loss of value	No further salvage/ excavation is required.
55-6-0161	Jindera Solar AFT3	Poor – 100+ year history of agricultural and pastoral use Disturbed by extensive earth works.	Low	Direct	Total	Total loss of value	No further salvage/ excavation is required.
55-6-0117	Jindera 488942	Poor – 100+ year history of agricultural and pastoral use. Disturbed by extensive earth works.	Low to moderate	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0114	Jindera 487530	Poor – 100+ year history of agricultural and pastoral use. Disturbed by extensive earth works.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0125	Jindera 488212	Poor – 100+ year history of agricultural and pastoral use. Disturbed by	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		extensive earth works.					
55-6-0121	Jindera 488172	Poor – 100+ year history of agricultural and pastoral use. Disturbed by extensive earth works.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0122	Jindera 488179	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0120	Jindera 487973	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0118	Jindera 487666	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0149	Jindera Solar IF 1	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0150	Jindera Solar IF 2	Poor – 100+ year history of agricultural and pastoral use	Low	None – outside of development footprint	None – outside of development footprint	No loss of value	Ensure avoidance with 5 m buffer around site
55-6-0151	Jindera Solar IF 3	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0152	Jindera Solar IF 4	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0153	Jindera Solar IF 5	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0154	Jindera Solar IF 6	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0155	Jindera Solar IF 7	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0156	Jindera Solar IF 8	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0157	Jindera Solar IF 9	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0158	Jindera Solar IF 10	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0159	Jindera Solar IF 11	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0124	Jindera 487595	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0129	Jindera 487613	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0119	Jindera 487828	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0123	Jindera 488004	Poor – 100+ year history of agricultural and pastoral use	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
55-6-0115	Jindera 488918	Poor – 100+ year history of agricultural and pastoral use	Low	None – outside of development footprint	None – outside of development footprint	No loss of value	Ensure avoidance with 20 m buffer around site
55-6-0116	Jindera 488995	Poor – 100+ year history of agricultural and pastoral use	Low	None – outside of development footprint	None – outside of development footprint	No loss of value	Ensure avoidance with 20 m buffer around site
N/A	Jindera Solar Cultural Tree 1	Poor – 100+ year history of agricultural and pastoral use	Low	None – outside of development footprint	None – outside of development footprint	No loss of value	Ensure avoidance with 20 m buffer around site

6.3.3 Potential impacts

Construction

The assessment of harm and impact to Aboriginal Heritage values for the development is assessed as moderate. However, it is likely that other artefacts and cultural material may be present in similar low densities to that recorded on-site.

The proposed level of disturbance for the construction of the solar farm could impact 24 sites with stone artefacts recorded during the field survey and others that may be present within other areas of the development site. The impact to the sites with stone artefacts is likely to be most extensive where earthworks occur, such as the installation of cabling, which may involve the removal, breakage or displacement of artefacts. A mitigation strategy has been developed for each site recorded (Table 6-17 above) and forms a commitment of the project (included in Table 6-18 below).

To date TransGrid have not been able to define the scope of any required works within the Jindera Substation lot. As such, the proposed 40 m wide transmission line easement could not be assessed: However, a commitment is made to ensure Aboriginal heritage is appropriately assessed and mitigated, once the scope of work is clarified. If any sites of Aboriginal cultural heritage are identified in the 40 m wide easement, they would be salvaged along with other impacted surface artefacts and would not preclude a connection to the substation in this area.

Operation

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

6.3.4 Safeguards and mitigation measures

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

Table 6-18 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	The development avoids the three cultural tree sites Jindera 488918, Jindera 488995 and Jindera SF Cultural Site 1. A minimum 20 m buffer should be in place around each cultural tree to prevent any inadvertent impacts to the canopy and root system.	C		
AH2	To ensure no inadvertent impacts occur to the three cultural tree sites no plantings for the vegetation screening or any form of ground disturbance during fencing activities can occur within the 20 m buffer zone. Any fencing wire installed will be a minimum of 1 m from physical contact with any part of the tree.	C		
AH4	If complete avoidance of the 15 isolated find sites and 10 artefact scatters recorded within the proposal area is not possible the surface stone artefacts within the development footprint must be salvaged. The salvage of these objects must occur prior to the proposed work commencing. Until salvage has occurred a minimum 5 m buffer must be observed around all stone artefact sites.	C		

No.	Safeguards and mitigation measures	C	O	D
AH5	The collection and relocation of the surface 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 any works commencing.	**C**		
AH6	A minimum 5 m buffer should be observed around all sites with stone artefacts that are being avoided by the proposed development.	**C**		
AH7	Subject to TransGrid defining the scope of any works within the Jindera Substation lot, further assessment of this area will be required. If Aboriginal cultural heritage sites are identified, they must also be subject to salvage collection and reburial as outlined in Recommendation 3 and 6 above.	**C**		
AH8	Jindera Solar Pty Ltd 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**		
AH9	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**		
AH10	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed 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

6.4 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 issues relating to potential for 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.

NGH Environmental completed a Visual Impact Assessment (VIA) of the proposal. It provides a full assessment of the visual impacts associated with the proposal, including:

- Landscape character and scenic vistas.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints.
- Addressing requirements of the SEARs.

The VIA includes a strategy to address identified impacts, including onsite vegetation screening, general design measures and a process to verify the actual visual impacts of the proposal. This improves the reliability of the measures and provides a trigger to undertake additional mitigation if required.

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

6.4.1 Approach

The VIA has been completed in the following stages:

1. Background investigations and mapping.
2. Field survey including reconnaissance, ground truthing and photography.
3. Consultation.
4. Impact assessment.
5. Development of a visual impact mitigation strategy.

The impact assessment methodology adopted by NGH Environmental, approved previously by the NSW Department of Planning and Environment, and used in this VIA for operational impacts is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d.). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project.

Key steps undertaken to assess the visual impact are as follows:

- Define Land Management Zones (LMZs) for the representative viewpoints, based on:
  - The scenic quality of the study area's LCUs.
  - The expected sensitivity at representative viewpoints.
  - The proximity of each representative viewpoint.

- Evaluate the degree of contrast the solar farm would generate at representative viewpoints in consideration of the management objectives of the relevant LMZ.
- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

Mitigation measures are considered to be required for high impact receivers, where unmitigated impacts are deemed greater than what is acceptable. For medium impact receivers, the contrast is considered acceptable and mitigation may be recommended. For low impact receivers, the contrast is deemed unlikely to be perceived and therefore acceptable with no mitigation required.

For the purpose of the assessment, a height of 3.5 m was used to model onsite infrastructure (which includes the maximum height of inverters, on-site substation, operations and maintenance building and security fencing). However, the posts for any overhead transmission lines would exceed 3.5 m in height. Specific assessment of impacts to sensitive receivers from the transmission line has been conducted. The model does not take into account screening such as vegetation or infrastructure. On this basis it is considered a 'worst case' model.

6.4.2 Photomontages

Photomontages were prepared for selected viewpoints to provide a realistic impression of the operational solar farm. The viewpoints for the photomontages were selected based on distance to the development site, frequency of view from a public place, and the location of the nearest sensitive receiver. These are considered to be either the most potentially sensitive viewpoints, or representative of a range of similar viewpoints.

A number of photomontages were also prepared for selected residences that have specific visual concerns about the proposal. Four premises were visited, and montages were produced. These were R09, R22, R23 and R25. Two are within close proximity of the proposed solar farm (R23 and R09), and two have more elevated views (R22 and R25). The montages are shown Table 6-23.

Each montage shows a specific view from a particular residence and has been provided to the relevant resident. The photomontages were produced to facilitate discussion between the affected resident and the proponent. Evidence of consultation has been recorded in a confidential log, provided to DPIE.

6.4.3 Community Values

Community consultation specific to the assessment of visual impacts for the proposal was conducted for near neighbours and the broader community. 48 households within 2 km and 9 additional adjacent landowners were directly consulted as part of the process (Figure 3-8).

Nearest neighbours

- During June 2018, a letter was hand delivered to every residence within a 1 km radius of the proposal
- In October 2018, another letter was extended to all residences within a 1 km to 2 km radius of the proposal.
- In November 2018, Urbaine Architecture visited the homes of residents that through the consultation exercise had requested a visual montage. Montages of what the proposal may look like, including rendered images of solar panels, were created and provided to the relevant landowners in December 2018.
- Also, in November 2018, a flyer with details of the Community Information Sessions was posted to all residents within 2km of the proposal, placed within every post office box at

the Jindera Post Office and advertised in the local newspaper, the Eastern Riverina Chronicle. This was also followed up with an email detailing the Open Day to anyone who had provided an email address.

- All residents within a 2 km radius that requested follow up with the proponent during the consultation period were contacted as per their requested contact method. This included face-to-face meetings, phone calls, emails and letters.

Broader community

A project website was developed to provide information and updates. The website went live in November 2018 and is updated regularly. An online comments section was also made available for the public to leave feedback or comments.

Community Open Days were held on 5 and 7 December 2018, inviting all interested parties to query and comment on the proposal. The open day was advertised through the local paper, and via posters hung at the IGA grocery store and the bulletin board near the Jindera Post office. A flyer was also distributed by Australia Post into every post office box at the Jindera Post Office. Details of the open day were also provided on the website.

Feedback forms

A feedback form was prepared to better understand the community's values and concerns regarding the proposal. Forms were distributed at the community open days, with the public encouraged to return the forms.

Results and visual concerns

A number of visual concerns were raised by near neighbours and the general public. This includes devaluation of properties and homes that are reliant on their visual aspect (not productivity of land), glare, removal of vegetation and change in land use.

A number of adjacent landowners agreed that vegetation planting would assist in breaking up the views, but also requested temporary fencing and/or earthen bunds for a more immediate solution:

- Temporary screening has been considered for properties affected by 270-degree views in consultation with affected landowners. Screening will be in the form of green shade cloth placed on the solar farm's security fences to screen view of infrastructure until proposed planted vegetation has established an effective screen.
- In specific circumstances, to deal with particular constraints, 1.5 m to 2 m high earthen bunds/mounds have been proposed to visually screen gaps in existing native vegetation until the proposed planted vegetation has established an effective screen. This technique is not proposed where these bunds could change the flow patch of drainage lines or affect flood storage.

Proposed vegetative screening locations and earthen bunds based on initial consultation and visual concern can be seen below in Figure 6-11.

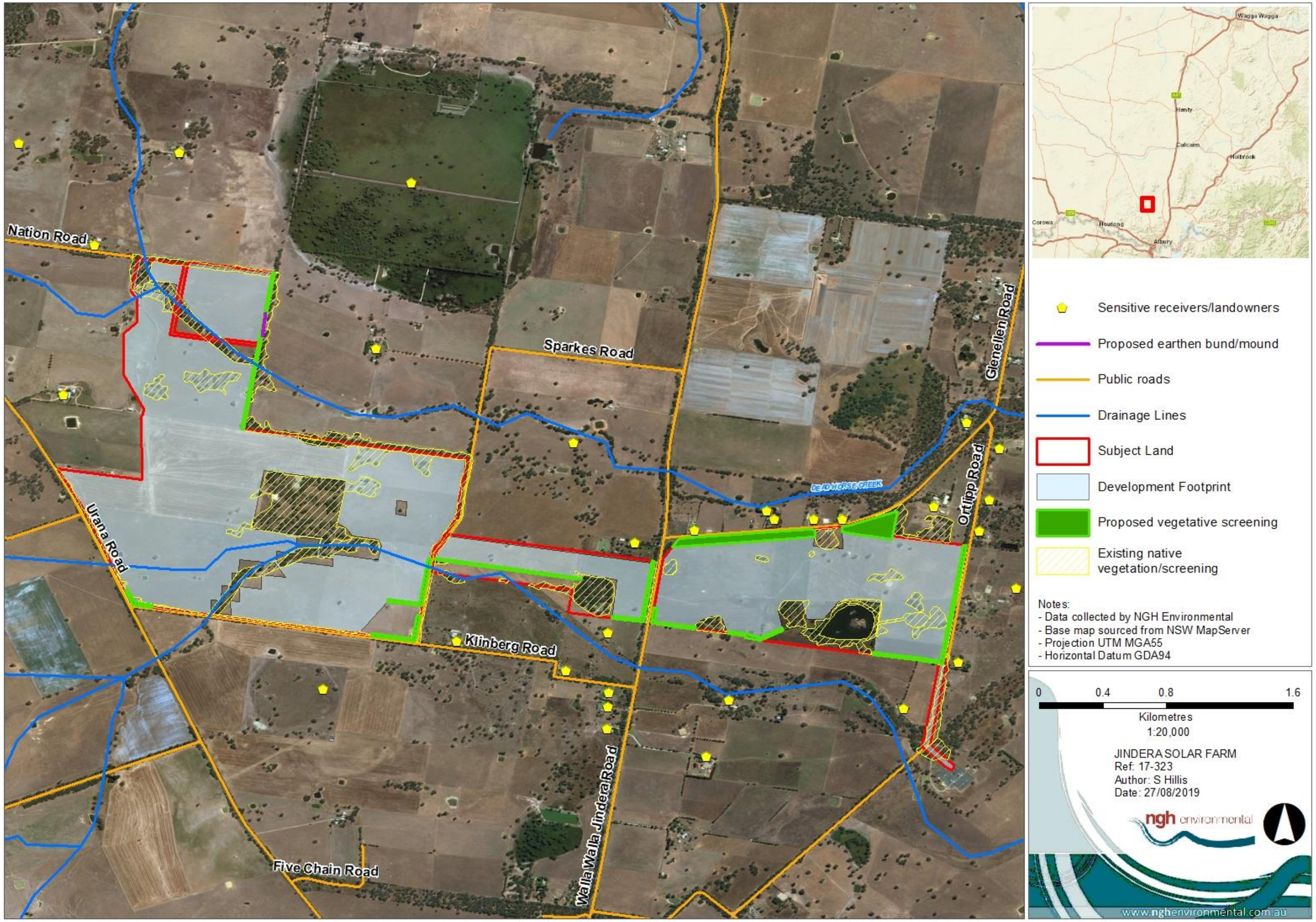

Figure 6-11 Proposed landscaping

6.4.4 Landscape Character

Four LCUs were identified within Jindera and surrounding areas:

- Rural (including agricultural lands).
- Residential (viewpoints near rural residence/homes).
- Industrial (major roads, electrical and other built infrastructure).
- Commercial (businesses, town centre).

The scenic quality was rated in each LCU as follows:

- A high scenic quality rating describes areas with outstanding, unusual or diverse features.
- A moderate scenic quality rating applies to areas with the features and variety normally present in the character type.
- A low scenic quality rating is given to areas lacking features and variety.

The four LCUs identified are characterised in Table 6-19 in terms of their scenic quality.

Table 6-19 Key features of LCUs within Jindera and surrounds

Rural LCU
Rural and agricultural lands within the study area are used predominantly for agriculture, grazing and rotational cropping of grains, cereals and pulses. The site is relatively flat to undulating. Expansive views within this LCU are generally limited given the undulating relief and screening provided by vegetation. Limited relief and elevation can be seen from properties on Urana Road. Secondary sealed roads such as Urana Road, Walla Walla Jindera Road and Glenellen Road are the main vantage points from which to view agricultural areas. From the road corridors, agricultural and grazing land can be viewed openly. Patches of native and planted vegetation screen views of agricultural land from roadways. In addition to sections of road, overhead transmission lines are visible that reinforce rectilinear shapes and are common in rural landscapes. Surrounding blocks are made up of primary production and hobby farms, with residences within this landscape being a mix of broadly and relatively closely distributed houses. Residences are commonly associated with some additional vegetation plantings; that is to say, residential boundary planting. Other infrastructure includes agricultural sheds, buildings and low open fences. **Scenic quality is moderate. Built elements are production related and include linear fences, powerlines, roads, agricultural buildings and rural homes. Forms are typically uniform, of undulating elevation and linear. This LCU is common and the dominant LCU in the study area. The proposed solar farm is located within this LCU.**
Residential LCU
Residential areas of Jindera and surrounds include Jindera township, the new Pomegranate Estate and viewpoints from the road near residents' homes. However, the Jindera township does not have a view of the proposal. As such, it is excluded from this assessment.

Much like the Rural LCU, the area is relatively flat to undulating with expansive views generally limited given the undulating relief and screening provided by vegetation. Residences are broadly and unevenly distributed over the landscape, with properties commonly associated with additional vegetation planting and screening (boundary planting, fences etc.). Residences are located on Urana Road, Nation Road, Sparkes Road, Klinberg Road, Walla Walla Jindera Road, Glenellen Road and Ortlipp Road. **Scenic quality is considered moderate. These areas have variety in colour and form normal in this character type. Elements include linear fences, powerlines, roads, agricultural buildings and rural homes. This LCU is common in the study area.**
Industrial LCU
Industrial areas within Jindera and surrounds include the major Urana Road, Walla Walla Jindera Road, the Jindera Substation and powerlines, and the Jindera industrial area. Common features in the LCU include two-way sealed roads, road reserve, fencing, powerlines, a substation, industrial buildings and regular small and large vehicles. The Jindera industrial area does not have a view of the proposal, as such is excluded from this assessment. **Scenic quality is considered low, with features matching the land use. Screening is present for the majority of surrounding roads, with broken views of surrounding rural land visible through existing native vegetation. The undulating landform also breaks up expansive views of surrounding rural and residential land. This LCU is common in the study area, with the development site located along major roads and adjacent to the Jindera substation and major overhead transmission lines.**
Commercial LCU
Commercial lands within the study area include the Jindera central business district, made up of local shops, eateries, supermarket and post office. Commercial areas of Jindera do not have a view of the proposal, and as such are excluded from the assessment.

The BLM methodology requires identification of representative viewpoints in the study area. These may be travel routes such as roads, waterways and recreational tracks, residential areas, tourist facilities, houses and farmland.

14 representative viewpoints were identified using topographic information and the BLM methodology, and are mapped in Figure 6-12.

The predicted sensitivity of each viewpoint can be determined considering its proximity to the development site and factors such as use, scenic quality and regional significance.

Considering the sensitivity of local viewpoints, the following assessments were made:

- **Rural viewpoints** were assessed as generally having a moderate to low scenic quality given the surrounding agricultural and industrial activities. Rural views are located on moderate to low routes, or areas only accessed by local traffic. As motorists use local roads, views increase as vehicles approach the development site. View durations are generally short as vehicle speeds are up to 100 km/hr, and the expected number of vehicles on these local roads is considered to be low to moderate. Regional and local significance is low, with scenic quality being moderate.
- **Residential viewpoints** were assessed as generally having a moderate to high sensitivity. If there was a view to the solar farm, the view duration could be expected to be high for a receiver.

- **Industrial viewpoints** were assessed as having low sensitivity. Any views from these areas would be fleeting due to vehicle speed, hard to discern, and fragmented by existing roadside vegetation and overhead transmission lines. Built structure is more commonly functional than aesthetic in these settings.

The sensitivity of each viewpoint is provided in Table 6-20.

Table 6-20 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	Distance to site	Scenic quality	Sensitivity
1	Industrial	Foreground	Moderate	Low
2	Rural	Foreground	Moderate	Moderate
3	Rural/Residential	Foreground	Moderate	Moderate
4	Rural	Foreground	Moderate	Moderate
5	Rural	Foreground	Moderate	Moderate
6	Industrial	Middle ground	Moderate	Low
7	Industrial	Middle ground	Moderate	Low
8	Residential	Foreground	Moderate	**High**
9	Residential	Foreground	Moderate	**High**
10	Residential	Foreground	Moderate	Moderate
11	Residential	Foreground	Moderate	Moderate
12	Residential	Foreground	Moderate	**High**
13	Industrial	Foreground	Moderate	Low
14	Residential	Foreground	Moderate	Moderate

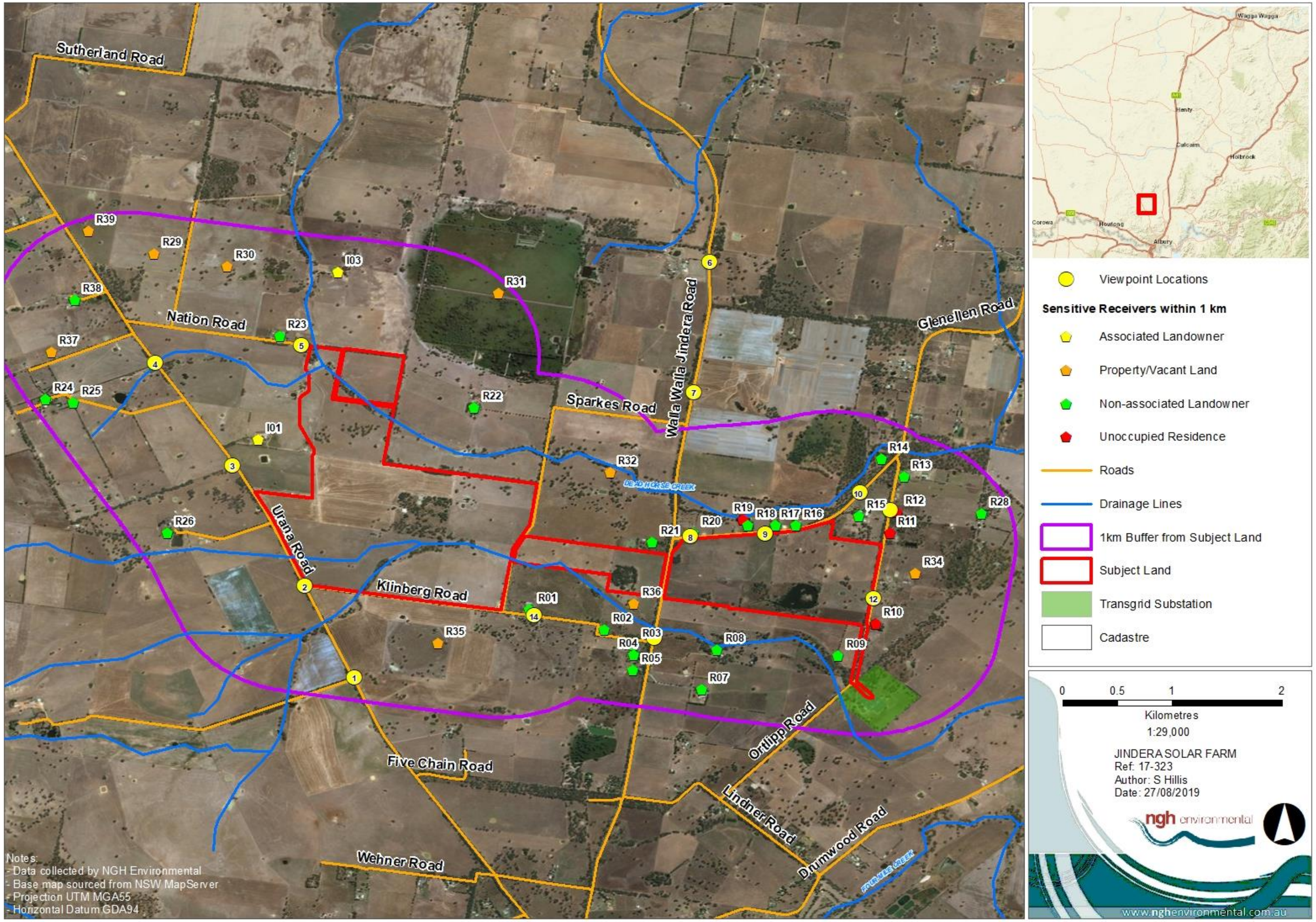

Figure 6-12 Location of representative viewpoints

6.4.5 Potential impacts

An operational visual impact assessment has been conducted considering:

- The proposed solar farm components.
- The potential for the proposed solar farm to be viewed from representative viewpoints.
- The degree of contrast the proposed solar farm would have within the identified LMZ. LMZs were assigned to viewpoints based on the results of the field work, and the contrast at that viewpoint was evaluated, as described below.
- Concerns raised by residents and the community.
- The potential impact from glare.

Evaluation criteria

The ratings for the degree of contrast created by the proposed solar farm at each viewpoint have the following definitions (BLM n.d.):

- High contrast: the proposed activity would be dominant within the landscape and generally not overlooked by the observer; the visual change would not be absorbed.
- Medium contrast: the proposed activity would be moderately dominant and noticed; the visual change would be partially absorbed.
- Low contrast: the proposed activity would be seen but would not attract attention; the visual change would be well absorbed.
- Indistinct: contrast would not be seen or would not attract attention; the visual change would be imperceptible.

To determine if the objectives for the VLM zone are met, the contrast rating for the viewpoint is compared with the relevant management objectives to give a visual impact level. The visual impact level is consequently defined as:

- High impact: contrast is greater than what is acceptable.
- Medium impact: contrast is acceptable.
- Low impact: visual contrast is little or not perceived and is acceptable.

For high impact viewpoints, mitigation must be considered.

Photo Montages

Photomontages of the project shown within the existing context were prepared by Urbaine Architecture to assist in the impact assessment of the proposal. Seven viewpoints were selected for the production of photomontages as they were determined to have the greatest potential for visual impact and best represent a range of distances and locations with differing views. Photomontages are based on a worst-case scenario of the project without the inclusion of proposed mitigation measures (i.e. vegetative screening). Where infrastructure is discernible in the landscape, rendered images in red have been included to provide clarity.

Evaluation Results

Table 6-21 evaluates the expected level of visual impact from the representative viewpoints, while Table 6-22 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures (i.e. vegetative screening), except Viewpoint 9. Photomontages from the selected residences (R09, R22, R23 and R25) are shown Table 6-23. A summary of the potential visual impact, proposed mitigation measures and residual visual impact following mitigation for potentially affected adjacent residences is detailed within Table 6-24. The viewpoint that best represents each potentially impacted receiver is shown in Table 6-25.

Viewpoint 9 includes an indicative view of the proposal with established vegetative screening, as indicated in the proposed Landscape Plan. It is important to note that overstorey vegetation is likely to take some years to mature as an effective vegetative screen, but the chosen species within the midstorey and shrubs are fast growing and dispersive/spreading species, capable of fast establishment and screening. The majority of these midstorey species (7 to 10m) and shrubs (2.5m) have a short lifespan and will be replaced as required. However, it is also likely that the overstorey vegetation will have established enough as an effective vegetative screen by this time.

Table 6-21 Visual impact at representative viewpoints with reference to the proposal

VIEWPOINT 1		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Industrial	Taken from Urana Road facing north-east towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Urana Road. Dominant features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not likely to be discernible by residences or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 2		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Rural	Taken from the intersection of Urana Road and Klinberg Road facing north-east towards the proposed solar farm. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominant features include the tree lined, sealed and unsealed roads, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominantly cleared and flat. The location represents the first point where motorists will gain a view of the proposal as they drive north on the high to moderately used Urana Road. Broken views of the proposed infrastructure through vegetative screening will be noticeable and may cause initial distraction to motorists at an intersection. Views would however be fleeting due to speed of travel. **Refer to Photo Montage 1** **Mitigation recommended** A 15 m wide vegetative buffer is recommended on the intersection of Urana and Klinberg Road to reduce any motorist distraction at the intersection. This will increase overall safety of the intersection by screening the view of infrastructure from road users.
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Medium	
Inherent Visual Impact	MEDIUM	
Residual Visual Impact	LOW	
VIEWPOINT 3		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Rural	

Scenic Quality	Moderate	Taken from Urana Road facing east towards the proposal. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominant features include the tree lined, sealed Urana Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominantly cleared and flat. Broken views of the proposal are likely through breaks in existing vegetation. However, proposed infrastructure is unlikely to be discernible by residences or motorists due to distance, vegetative screening and speed of travel. The form of the infrastructure, low (<4m) and in rectangular arrays, is also not incongruous with the existing low-lying rectangular forms in this agricultural area. **Refer to Photo Montage 2** **No mitigation is required**
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 4		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Rural	Taken from Urana Road facing east towards the proposal. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominant features include the tree lined, sealed Urana Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominantly cleared and flat. Views of the proposal are unlikely to be discernible by residences or motorists due to distance, vegetative screening and speed of travel. The form of the infrastructure, low (<4m) and in rectangular arrays, is also not incongruous with the existing low-lying rectangular forms in this agricultural area. **Refer to Photo Montage 3** **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 5		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Rural/Residential	Taken from Nation Road facing south towards the proposal. The viewpoint is representative of both the rural nature of the area and residential view of Landowner R23. Dominant features include the tree lined, unsealed Nation Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominantly cleared and flat. The viewpoint is directly adjacent the associated landowners retained property, where no development is proposed. Broken views of the proposal are likely through breaks in existing vegetation. However, proposed infrastructure is unlikely to be discernible by residences or motorists due to very low use of the road (private access) and vegetative screening. No views are affordable from the residence itself. **Refer to Photo Montage 4** **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 6		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Industrial	

Scenic Quality	Moderate	Taken from Walla Walla Jindera Road facing south towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Walla Walla Jindera Road. Dominant features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residences or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Proximity	Middle Ground (1 – 2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 7		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Industrial	Taken from Walla Walla Jindera Road facing south towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Walla Walla Jindera Road. Dominant features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residences or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Middle Ground (1 – 2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 8		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Residential	
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	High	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	

Residual Visual Impact	MEDIUM	Taken from Glenellen Road at its intersection with Walla Walla Jindera Road, facing south towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Glenellen Road that are directly adjacent the proposal boundary. Dominant features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. The land is predominantly cleared and flat with minimal vegetative screening. The location represents the first point where motorists will gain a view of the proposal as they drive south on the moderately used Walla Walla Jindera Road, and as they turn east onto Glenellen Road. Clear views of the proposed infrastructure will be noticeable and may cause initial distraction to motorists at an intersection due to limited existing vegetative screening. Views would however be fleeting due to speed of travel. It is important to note that the view does not take into consideration existing vegetative screening on the northern side of Glenellen Road within the boundary of the residences. **Mitigation recommended** A 50 m wide buffer incorporating vegetative screening (as per the Landscape Plan, Appendix B) is recommended for the length of Glenellen Road to screen views of the proposal. Existing vegetative screening on the Walla Walla Jindera Road intersection is to be retained. This will increase overall safety of the intersection by screening the view of infrastructure from turning vehicles and reduce any potential for collision. The buffer width will also maximise the screening potential for residences along Glenellen Road.
VIEWPOINT 9		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Residential	Taken from Glenellen Road facing south towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Glenellen Road that are directly adjacent to the proposal boundary. Dominant features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominantly cleared and flat with minimal vegetative screening. Clear views of the proposed infrastructure will be noticeable and may cause distraction to motorists due to limited existing vegetative screening. Views would however be fleeting due to speed of travel. It is important to note that the view does not take into consideration existing vegetative screening on the northern side of Glenellen Road within the boundary of the residences. **Refer to Photo Montage 5** **Mitigation recommended** A 50 m wide buffer incorporating vegetative screening (as per the Landscape Plan, Appendix B) is recommended for the length of Glenellen Road to screen views of the proposal. This will increase overall safety for motorists travelling along Glenellen Road by screening the view of infrastructure from turning vehicles and will reduce any potential for collision. The buffer
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	High	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	
Residual Visual Impact	MEDIUM	

		width will also maximise the screening potential for residences along Glenellen Road.
VIEWPOINT 10		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Residential	Taken from Glenellen Road facing south-west towards the proposal. The Viewpoint is representative of the residential views of residences north-east of the proposal. Dominant features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and dense vegetation. Proposed infrastructure is not discernible by residence or motorists due to dense existing vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 11		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Ortlipp Road facing south-west towards the proposal. The Viewpoint is representative of the residential views of residences along the northern end of Ortlipp Road. Dominant features include the tree lined, unsealed road, grazing and cropping paddocks, fencing, and dense vegetation. Proposed infrastructure is not discernible by residences or motorists due to dense existing vegetative screening. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 12		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Residential	Taken from Ortlipp Road facing west towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Ortlipp Road that are directly adjacent to the proposal boundary. Dominant features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. The Jindera substation is also located within 1 km of the viewpoint. Currently, the land is predominantly cleared and flat with low vegetative screening. Clear views of the proposed infrastructure will be noticeable and may cause distraction to motorists due to limited existing vegetative screening. The form of the infrastructure, low (<4m) and in rectangular arrays, is however not incongruous with the existing low-lying rectangular forms in this agricultural area, and infrastructure blends with the existing views of the industrial Jindera Substation and mass of overhead transmission lines. It is important to note that the view does not take into consideration existing vegetative screening on the eastern side of Ortlipp Road within the boundary of the residences and the current lack of occupied homes (homes are vacant and currently in disrepair/renovation.
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	High	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	
Residual Visual Impact	LOW	

		Refer to Photo Montage 6 (Table 6-22) **Mitigation recommended** A 15 m wide vegetative buffer and 50 m offset from the boundary of the proposal is recommended for the length of Ortlipp Road to screen views of the proposal. The current offset as per the design is 80 m from the edge of the subject land to the nearest panel array, incorporating the existing transmission line easement. This will increase overall safety for motorists travelling along Ortlipp Road by screening the view of infrastructure to reduce any potential for collision. The buffer width will also maximise the screening potential for future residences along Ortlipp Road.
VIEWPOINT 13		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Industrial	Taken from the intersection of Walla Walla Jindera Road and Klinberg Road facing north towards the proposal. The Viewpoint is representative of the industrial view of the moderately used Walla Walla Jindera Road. Dominant features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure barely discernible by motorists due to distance and existing dense vegetative screening. **Refer to Photo Montage 7** **No mitigation is required** Mitigation is however required where infrastructure is first viewed on Walla Walla Road. A 15 m wide vegetative buffer is recommended on both the east and western side of Walla Walla Jindera Road to reduce any motorist distraction. This will increase overall safety by screening the view of infrastructure from vehicles and reduce any potential for driver distraction.
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	
VIEWPOINT 14		
Summary of Viewpoint		**Viewpoint Description / Impact**
LCU	Residential	
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Medium	
Inherent Visual Impact	MEDIUM	

Residual Visual Impact	LOW	Taken from Klinberg Road facing north towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Klinberg Road. Dominant features include the tree lined, unsealed road, grazing and cropping paddocks, fencing, large overhead transmission lines and vegetation. Currently, the land is predominantly cleared and flat with moderate vegetative screening. Broken views of the proposed infrastructure will be noticeable by residences but are unlikely to cause distraction to motorists due to existing vegetative screening and distance from the proposal. The infrastructure blends with the existing views of the overhead transmission lines. **Mitigation recommended** A 15 m wide vegetative buffer is recommended to screen views of the proposal from residences. Screening should be on the subject land boundary for the full length of Klinberg Road, from its intersection with Walla Walla Jindera Road to the western boundary of the residence located on Klinberg Road. Proposed screening and distance from infrastructure will provide maximum screening potential for residences on Klinberg Road. Temporary fencing in the form of shade cloth may also assist screening until vegetation has established an effective screen.

Photomontages were taken at selected viewpoints (Figure 6-12).

Table 6-21 evaluates the expected level of visual impact from the representative viewpoints, while Table 6-22 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures (i.e. vegetative screening), except Viewpoint 9.

Table 6-22 Photomontages of representative viewpoints

PHOTOMONTAGE 1 (TAKEN FROM VIEWPOINT 2, refer to Figure 6-12)

PHOTOMONTAGE 2 (TAKEN FROM VIEWPOINT 3, refer to Figure 6-12)

PHOTOMONTAGE 3 (TAKEN FROM VIEWPOINT 4, refer to Figure 6-12)

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PHOTOMONTAGE 4 (TAKEN FROM VIEWPOINT 5, refer to Figure 6-12)

PHOTOMONTAGE 5 (TAKEN FROM VIEWPOINT 9, refer to Figure 6-12). Note the third image includes vegetative screening

PHOTOMONTAGE 6 (TAKEN FROM VIEWPOINT 12, refer to Figure 6-12)

PHOTOMONTAGE 7 (TAKEN FROM VIEWPOINT 13, refer to Figure 6-12)

Table 6-23 Photomontages of representative viewpoints from selected residences.

Photomontage taken from R09 (viewpoint 8c)

Photomontage taken from R22 (viewpoint 10c)

Photomontage taken from R22 (viewpoint 11c)

Photomontage taken from R23 (viewpoint 17c)

Photomontage taken from R25 (viewpoint 22c)

Table 6-24 Potentially affected residences adjacent to the proposal (including clearing for transmission line where relevant).

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
R01 Klinberg Road: The receiver will have solar infrastructure visible to the north and west of the residence. Views to the north-west and west will indistinct due to placement of panels and existing native vegetative screening. The closest panel infrastructure is located approximately 300 m to the north-east, and 500 m to the north of the residence. Existing large 330 kv transmission lines cross the property to the north and west, in front of proposed infrastructure. Refer to **Viewpoint 14** in Table 6-22	MEDIUM	• Ongoing consultation with the receiver. • A 15 m wide vegetative buffer would be established to the north and west of the residence within the project boundary to screen views of the proposal. Additional screening outside of the TransGrid transmission line easement would be implemented to fill gap in lieu of planting in the easement itself. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Temporary fencing in the form of shade cloth may also assist screening until vegetation has established as an effective screen.	LOW
R02 Klinberg Road: The receiver will have solar infrastructure partially visible to the north-east and north-west of the residence. Views will be broken due to existing native vegetation screening. The closest panel infrastructure is location approximately 500 m north-east of the residence. Existing large 330 kv transmission lines cross the adjacent property to the north, in front of proposed infrastructure.	LOW	• A 15 m wide vegetative buffer would be established to the north-east and north-west of the residence within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW
R03, R04, R05, R07 and R08 Walla Walla Jindera Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R08, is approximately 450 m from the closest panel infrastructure to the north-east. Refer to **Viewpoint 13** in and **Photomontage 7** in Table 6-22. None are likely to perceive any clearing required for Ortlipp Road, given intervening riparian	LOW	No mitigation is required. However, vegetation screening is proposed on the southern boundary of the proposal to fill in any gaps in existing native vegetation screening. This increases biodiversity connectivity to existing vegetation from the artificial wetland.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
vegetation and distance (greater than 1.5km for closest receiver).			
R09 Ortlipp Road: The receiver will have solar infrastructure visible to the north of the residence. Views will indistinct due to placement of panels and existing native vegetative screening. The closest panel infrastructure is located approximately 450 m to the north of the residence. If any clearing is required for Ortlipp Road it may be perceived (approximately 200m away from residence) however vegetation around the house lot is likely to screen this direction to a large extent (views to the north east are obscured).	MEDIUM	• Ongoing consultation with the receiver. • A 15 m wide vegetative buffer would be established to the north of the residence within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure.	LOW
R10, R11 and R12 Ortlipp Road: Face to face consultation with landowners was undertaken in July of 2018. Receivers 10, 11 and 12 on Ortlipp Road were visited, and the residences were considered unoccupied but were still assessed. The current offset as per the design is 80 m from the edge of the subject land to the nearest panel array, incorporating the existing transmission line easement. If any clearing is required for Ortlipp Road it may be perceived from R10 (less than 100m away from residence) however vegetation around the house lot is likely to screen this direction to a large extent (views to the south are obscured).	LOW	• While abandoned, if the landowners chose to develop the properties and inhabit the dwellings/residences in the future, a 15 m vegetative buffer for the full length of Ortlipp Road would be established to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW
R13 and R14 Ortlipp Road and Glenellen Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R13, is approximately 710 m from the	LOW	• No mitigation is required.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
closest panel infrastructure to the north-east.			
R15 Glenellen Road: The receiver will have solar infrastructure partially visible to the south of the residence. Views will be broken due to existing native vegetation screening. The closest panel infrastructure is location approximately 270 m south of the residence. Existing 30 kv transmission lines cross the subject land to the south of the residence, in front of proposed infrastructure.	LOW	• Up to 250 m of vegetative screening is proposed to the west of the residence. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW
R16, R17, R18, R19 and R20 Glenellen Road: All receivers will have solar infrastructure clearly visible to the south of the residence. The closest receiver residence, R20, is approximately 100 m from the closest panel. Refer to **Viewpoint 8** and **Viewpoint 9** and **Photomontage 5** in Table 6-22.	**HIGH**	• Ongoing consultation with the receivers. • A 50 m wide vegetative buffer would be established for the full length of Glenellen Road within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	MEDIUM
R21 Walla Walla Jindera Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening. The receiver is located approximately 110 m from the closest panel infrastructure to the south and 200 m to the direct east.	LOW	No mitigation is required.	LOW
R22 Sparkes Road: The receiver is elevated in the landscape, with partial views through existing native vegetation screening from the residence to the west and south. The residence is located approximately 630 m at it's closest point to panel infrastructure in both directions.	MEDIUM	• Ongoing consultation with the receiver. • A 15 m wide vegetative buffer would be established to the west of the residence within the project boundary to screen views of the proposal. • Additional earthen bund proposed in large gap in existing native vegetative screening to screen elevated views and for immediate effectiveness. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
R23 Nation Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening. The residence is located approximately 300 m from the closest panel infrastructure to the south-east. Refer to **Viewpoint 5** and **Photomontage 4** in Table 6-22	LOW	No mitigation is required.	LOW
R24 and R25 Urana Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The residences are located approximately 1.6 km from the closest panel infrastructure to the east. Refer to **Viewpoint 4** and **Photomontage 3** in Table 6-22	LOW	No mitigation is required.	LOW
R26 Urana Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The residence is located approximately 870 m from the closest panel infrastructure to the east. Refer to **Viewpoint 3** and **Photomontage 2** in Table 6-22	LOW	No mitigation is required.	LOW
R27 and R28 Ortlipp Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R28, is approximately 960 m from the closest panel infrastructure to the north-east.	LOW	No mitigation is required.	LOW
R38 and R61 Ortlipp Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R38, is	LOW	No mitigation is required.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
approximately 1890 m from the closest panel infrastructure to the north-west.			

Table 6-25 Representative viewpoints with reference to the receivers.

Receivers located within 1 km	Representative viewpoint
R1 (involved)	3
R1 (uninvolved)	14
R2 (involved)	6
R2 (uninvolved)	13
R3 (involved)	5
R3 (uninvolved)	13
R4 (uninvolved)	13
R5 (uninvolved)	13
R7 (uninvolved)	13
R8 (uninvolved)	13
R9 (uninvolved)	12 (montage also provided)
R10 (unoccupied)	12
R11 (unoccupied)	11
R12 (unoccupied)	11
R13 (uninvolved)	10 and 11
R14 (uninvolved)	10 and 11
R15 (uninvolved)	10 and 11
R16 (uninvolved)	9
R17 (uninvolved)	9
R18 (uninvolved)	9
R19 (unoccupied)	9

Receivers located within 1 km	Representative viewpoint
R20 (uninvolved)	8
R21 (uninvolved)	8
R22 (uninvolved)	Montage provided
R23 (uninvolved)	5 (montage also provided)
R24 (uninvolved)	4
R25 (uninvolved)	4 (montage also provided)
R26 (uninvolved)	2 and 3
R27 (uninvolved)	10 and 11
R28 (uninvolved)	10 and 11
R34 (uninvolved)	11 and12
R38 (uninvolved)	4 and 5
R61 (uninvolved)	4

6.4.6 Results summary

Glare

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, resulting in negligible glare or reflection. The panels will not generally create noticeable glare compared with an existing roof or building surface. 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 several airports around the world.

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

In addition to the above, Clean Technology Partners were commissioned by the proponent to prepare a Glare Study for the proposal (Appendix F). No glare risk was found to be present for any of the observation points for the flight path around the proposal. Existing and proposed vegetative screening was not included in the analysis of glare, further reducing any glare potential.

Night lighting

Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations) and will comply with the *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*. It would be directed away from roads and residences so as not to cause light spill that may be hazardous to motorists.

Lighting would be similar in scale and less frequent than lighting in adjacent residences. Night lighting is unlikely to present a hazard or impact to motorists or residences.

High impact – mitigation required

High impacts were assessed for three viewpoints. Screening as a mitigation strategy is recommended from these viewpoints.

Viewpoints 8, 9 and 12 are adjacent to the proposal boundary along Glenellen Road and Ortlipp Road. Glenellen road is of moderate use by the general public and by residences, while Ortlipp Road is of low use by local traffic and industry.

Views along Ortlipp Road do however present the most dominant view of the proposed infrastructure due to the closeness to the road and direction of the panel. Minor to moderate vegetative screening exists along the roadside and within the proposal boundary. It is however important to note that residences near these viewpoints either have vegetative screening on their properties, or the homes are vacant. The form of the infrastructure, low (<4m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area. Whilst not in direct contrast with the existing Jindera substation and overhead transmission lines, the solar farm will be visible to residences and motorists. Infrastructure will blend with the existing infrastructure in the area.

A 15 m vegetative buffer inside the subject land boundary has been proposed for the length of Ortlipp Road.

High impacts are expected for receivers 16 to 21 along Glenellen Road, represented by viewpoints 8 and 9. Receivers have been assessed as having a high impact due to closeness to the proposal, aspect of the property and visual concern from landowners.

Expected views will be long-term, however a 50 m buffer incorporating vegetative screening is proposed for the length of Glenellen Road to maximise vegetative screening of the proposal. The width and infrastructure buffer from Glenellen Road were the result of a decision made by the proponent based on the concerns of local residents that were received during the consultation process. On-site vegetative screening as a mitigation strategy has also been considered in consultation with the landowners, with minimal success.

Medium impact – mitigation considered

Medium impacts are seen for two viewpoints. Screening as a mitigation strategy has been considered for these viewpoints.

Viewpoint 14 is representative of receiver 1, a property which is adjacent to the southern side of the proposal along Klinberg Road. Minor vegetation screening exists in the form of roadside vegetation or boundary plantings, which provides minimal screening of the development site. Dominant views will be that of the solar farm and associated infrastructure. The form of the infrastructure, low (<4m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area. Infrastructure will however not be in direct contrast with the existing overhead transmission lines that run along the northern and western boundary of receiver 1. The solar farm will, however, be moderately visible to motorists and receivers.

Receiver 1 has been assessed as having a medium impact due to the closeness of the proposal and long-term expected views. On-site vegetative screening as a mitigation strategy has been considered in consultation with the landowner. Temporary fencing is also being considered to block views while the vegetation screening matures.

Viewpoint 2 is adjacent to the western boundary of the proposal site along Urana Road which is a road of high use. Viewpoint 2 has been assessed as having a medium impact due to the potential visual hazard for motorists at an intersection. On-site vegetation screening as a mitigation measure has been considered to break up any views of the proposal and remove distraction at the intersection.

Receiver R09 and R22 have also been assessed as having a medium impact due to topography, closeness to infrastructure and partial/broken views through existing native vegetative screening. On-site vegetative screening as a mitigation strategy has be considered in consultation with the landowners and is included in Figure 6-11. An earthen bund has also been proposed for immediate screening results for the elevated receiver R22.

Low impact – no mitigation

Low impacts are seen for roads and residences, where views of the solar farm infrastructure would be difficult to perceive or indistinct. Low impacts are expected for the majority of the study area and representative viewpoints due to existing vegetative screening, retained on-site vegetation and the overall undulating nature of the area. No mitigation is required for these locations.

6.4.7 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.

Glenellen Solar Farm

Due to the location of the proposed Glenellen Solar Farm cumulative visual impacts may occur where the proposed Glenellen Solar Farm site is adjacent to the Jindera Solar Farm for specific properties on Ortlipp Road (Receivers 9, 10, 11, 12 and 28) (Figure 6-12). It should be noted that three receivers along Ortlipp Road with potential for visual impact are currently unoccupied (R09, R10 and R11); these were still assessed. However, if the landowners choose to develop the properties and inhabit the dwellings/residences in the future, a 15 m vegetative buffer for the full length of Ortlipp Road is proposed to screen views of the Jindera Solar Farm. The proposed Glenellen Solar Farm would not be visible through existing native vegetative screening to the east of each residence. Each residence is also more than 250 m from the boundary of the proposed Glenellen Solar Farm, with distance also a screening buffer.

Receiver R09 is unlikely to have any view of the proposed Glenellen Solar Farm due to existing on-site native vegetation screening and views of the TransGrid Jindera Substation, and Receiver R28 is unlikely to have any views of the proposed Jindera Solar Farm due to distance from the residence to closest solar infrastructure (970 m approximately) and existing on-site native vegetation screening.

Other construction

During construction, the additional traffic and dust generation impacts have the greatest potential for cumulative visual impacts. The visual impact of increased traffic movements to the site would be predominantly limited to construction. A Traffic Management Plan (TMP) will be developed to minimise vehicle movements as much as practical for construction.

Additional cumulative traffic impacts during construction may occur if the adjacent Glenellen Solar Farm has a similar construction timeline. As part of the TMP, consideration of cumulative impacts with Glenellen Solar Farm will be detailed.

Other Operation

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 operational buildings.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles is all that will 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 undulating nature of the site that blocks out the majority of views. Specifically, screening to soften cumulative impacts has been recommended.

6.4.8 Safeguards and mitigation measures

Table 6-26 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 F): • Plantings would be more than one row deep and where practical, planted on the outside of the permitter fence, to break up views of infrastructure including the fencing. The majority of proposed visual screening is 15 m wide, with a 50 m buffer incorporating vegetative screening on the boundary of the proposal and Glenellen Road. • The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. They should be fast growing with mixed canopy height. Species selection could be undertaken in consultation with affected near neighbours and a botanist, horticulturalist or landscape architect. Suitable species are listed within the VIA Appendix F). • The timing is recommended to be chosen to ensure the best chance of survival and can commence during the construction of the proposal if timing suits. • 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	Prior to the commencement of construction, a detailed landscape plan will be prepared including: • Screening location. • Species type. • Planting density and spacing. • Method for planting. • Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method).	**Design Stage**		

No.	Safeguards and mitigation measures	C	O	D
	• A program to manage, monitor and report on the effectiveness of implemented measures.			
VA3	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.	**Design stage**		
VA4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	**C**		
VA5	Construction night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be directed away from roads and residents so as not to cause light spill that may be hazardous to drivers.	**C**	**O**	**D**
VA6	If construction of the Glenellen Solar Farm occurs, a 15 m vegetative buffer for the full length of Ortlipp Road would be required. This would occur in consultation with the developers of Glenellen Solar Farm.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

6.5 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Land – *Including:*

- *an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:*
  - *a consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights (including EL8467);*
  - *a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and*
  - *a cumulative impact assessment of nearby developments;*
- *an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:*
  - *consideration of the zoning provisions applying to the land, including subdivision, and;*
  - *completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and*
  - *completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and*
- *a description of measures that would be implemented to remediate the land following decommissioning in accordance with* State Environmental Planning Policy N. 55 – Remediation of Land.

DPE (RESOURCES AND GEOSCIENCE) REQUIREMENTS

To fulfil the Secretary's Requirements relating to the State's mineral resources and rights to assess and extract those resources, the Division requires the following project-specific requirements to be addressed in the EIS:

- *The proponent should undertake a dated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date-referenced map. It should also be noted in the EIS there are no operating quarries in the vicinity. Current mining and exploration titles and applications can be viewed through the Division's Minview map viewer.*
- *Make contact with the titleholders to determine their level of interest and provide evidence of authentic consultation to the Division. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including associated electricity transmission infrastructure) in relation to the exploration title boundaries, and a letter of response from the title holder to the proponent. If responses are not received from the titleholders, the Proponent is to contact the Division. The contact details the Department has on record for EL8467 are:*
  - *Agent: Tenement Administration Services Pty Ltd*
    Minerals Australia Pty Ltd
    Level 4, 345 Ann Street
    Brisbane QLD 4000
- *Consultation with the Division in relation to the proposed location of any off-site 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 or extractive resources.*

GREATER HUME SHIRE COUNCIL REQUIREMENTS

Specific Issues – Land – we are pleased that dust generation is being considered. This can have a significant impact on adjacent agricultural land and crops.

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, road and electricity networks and mining.

The proposal is consistent with the aims and planning principles of the Primary Production SEPP and the repealed Rural Lands SEPP. Given Schedule 1 of the Primary Production SEPP is blank, and the development site is not identified in Schedule 2 of the Rural Lands SEPP, it is inferred that the development site is not identified as state significant agricultural land and Part 2 of the Primary Production SEPP does not apply.

6.5.1 Existing environment

Agriculture and land capability

The rural land within the region is used primarily for agriculture including cropping and grazing. The development area comprises several large paddocks which have been deep ripped and largely cleared for pastures and grazing. Land and agricultural activities like those of the proposal area are widespread in the region. There is no evidence of horticulture or other intense farming activities within the proposal area.

The Mining, Petroleum, Production and Extractive Industries State Environmental Planning Policy 2007 (the Mining SEPP) extends across the proposal. The land is not classed as Biophysical Strategic Agricultural Land (BSAL) in the Mining SEPP Strategic Agricultural Land Map; BSAL has been described as land with high quality soil and water resources capable of sustaining high levels of productivity.

The land is classified as Class 3 and Class 6 under the Land and Soil Capability Assessment Scheme (OEH 2012) and is described as sloping land capable of sustaining cultivation on a rotational basis. The land is readily used for a range of crops and pastures. Class 3 land is considered High Capability Land: Land that has moderate limitations and can sustain 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.

There is 1 mineral title and no mineral applications relevant to the proposal area indicated in the Minview database (DPE 2018). A mineral exploration licence (Title EL8467) occurs within the subject land and intersects Lot 90 DP 753342 (Figure 6-15). A Clause 13 Compatibility Test was requested from Geological Survey NSW on 3 August 2018.

For the construction period, there would be a complete reduction in agricultural activities within the development footprint. During the operational phase, not all agricultural activities would be precluded, and it is highly likely that limited production such as occasional grazing could continue. As such, it can be expected that the nature of the agricultural activities would change from cropping and grazing to predominately grazing within the proposal area. This would be further explored in the EIS.

The solar farm would be decommissioned at the end of its operational life, removing all above-ground infrastructure. It is expected that the land would be returned to its prior production uses, as solar farms typically do not have significant permanent impacts to soil and landform.

Overall, the adverse impacts related to alienation of resources are expected to be low and restricted only to the period of operation.

Agriculture is the main employing industry in the Greater Hume LGA, providing work for 22% of the population (ABS 2019). The number of agricultural businesses has declined in recent years from 705 in 2012 to 695 in 2015 (ABS 2019).

Although agriculture is a key industry in the Greater Hume LGA (Greater Hume Shire 2012), the development site is not mapped as being **Biophysical Strategic Agricultural Land** (BSAL) (DPE 2017). BSAL is land that meets specific scientific criteria levels for soil fertility, land and soil capability classes and access to reliable water and rainfall levels. An amendment to the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 gave legal effect to the BSAL (NSW Government 2014).

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.

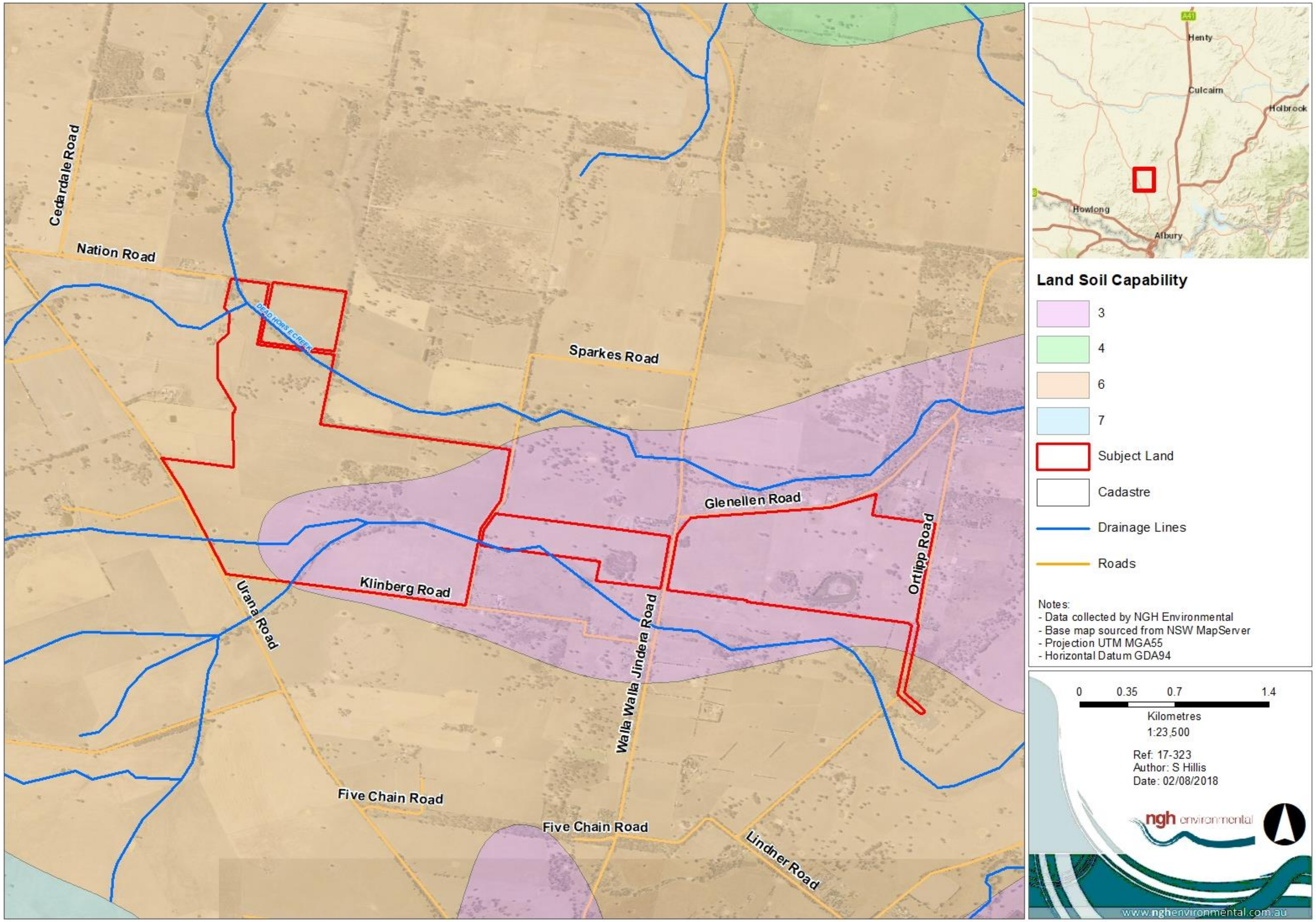

Figure 6-13 Land and soil capability mapping of the development site and surrounding area

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 6-14). Surrounding agricultural land generally consists of cropping and grazing. Other land uses in the locality include:

- Benambra National Park is located within 12 km of the development site. It was created in January 2001 and covers an area of 1400 ha (NSW NPWS 2018).
- Lake Hume is located within 13 km of the development site.
- Residential dwellings and associated dwellings.
- Public road network.
- Electricity connection and transmission infrastructure.
- Township of Jindera within 3.5 km of the site, comprising retail, health, accommodation and community services (refer to section 7.6).

One mining exploration lease exists within the development site (licence EL8467). The proposal will potentially impact a maximum 9 ha of the 4-block exploration area of well over 1,000 ha licence area (less than 1%). If any economic resource was found to be viable, the project would be subject to an impact assessment process during which issues can be investigated, including the interaction between the solar farm and a future mining operation. Given that there is currently no certainty around the existence of an economic resource, nor the approval of a future mining activity, this solar farm proposal will continue as planned.

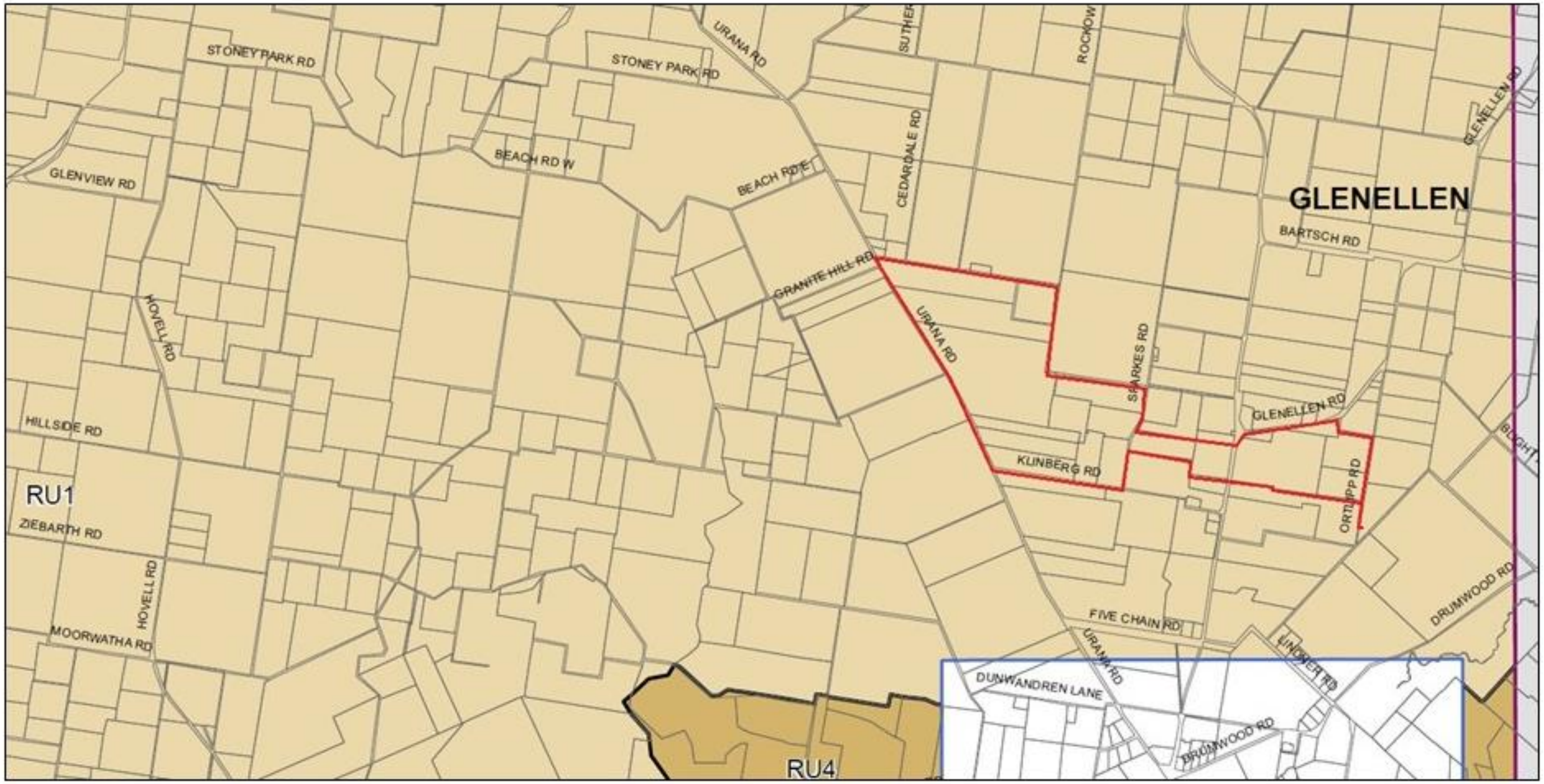

Figure 6-14 Planning zones surrounding the subject land (Greater Hume Shire Council 2010), indicated by the red polygon.

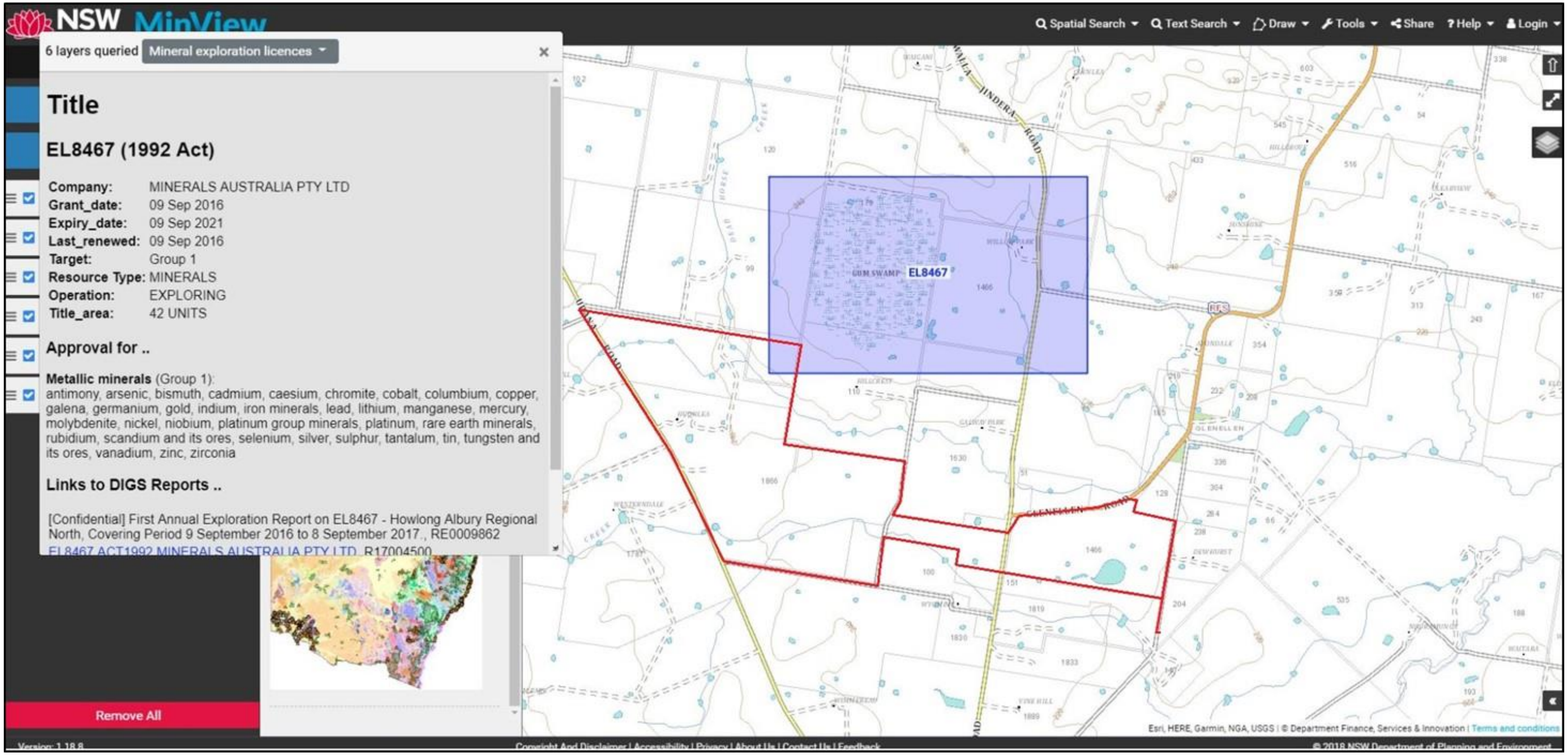

Figure 6-15 Exploration Licences for the development site and surrounding land (DPE 2018). *The subject land is outlined in red*.

6.5.2 Potential impacts

Land use conflict risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI 2011). Solar farming is not prohibited on rural land zonings in the Greater Hume LGA (eg RU1 zone) and is therefore considered compatible with agricultural land uses. Notwithstanding this, the proposed solar farm is different to the surrounding agricultural land use activities. Therefore, this assessment aims to identify and rank any 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 6-28 has been determined using the risk ranking matrix shown in Table 6-27, and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI 2011). The matrix ranks the risk of impacts according to the probability of occurrence and the consequence of the impact. Probability ‘A’ is described as ‘almost certain’ to probability ‘E’, which is described as ‘rare’. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk (DPI 2011).

Table 6-27 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 6-28 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	C5	4

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			managed using water carts when required. 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 6.4 would mitigate expected impact 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	D5	2

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			the site made available for alternate land uses including for mining purposes, if desirable.		

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. During the operational phase, not all agricultural activities would be precluded, and it is highly likely that limited production such as occasional grazing could continue. As such, it can be expected that the nature of the agricultural activities would change from cropping and grazing to predominately grazing within the proposal area.

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.

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

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

Land and Soil Capability

The proposal is not expected to adversely affect the biophysical nature of the land which determines its capacity. During any excavations at the site, topsoil would be removed, stockpiled separately and replaced to restore the original soil profile. Topsoil salvaged from the construction of the access tracks and other works would also be securely stored for use in site rehabilitation. Following construction, a perennial cover would be established to protect soils, enhance landscape function and prevent wind and water erosion. Some soil nutrients are expected to run down over time with the cessation of the crop fertiliser regime. Soil restoration and treatments would be guided by the findings of a pre-works soil survey conducted at the site (refer Section 7.1).

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

Agricultural Impacts

The development of a solar farm would potentially result in the following agricultural impacts:

- A reduction in the agricultural uses of the land. Specifically, broad-acre dry-land cropping would not be possible. This situation will affect land used principally for wheat and barley production. However, this opportunity to rest the land would provide a multitude of benefits including returning soil organisms, soil carbon, soil moisture and soil structure to the areas previously cropped and grazed. Diversity in groundcover and perennial species of grasses would be encouraged to increase soil stability, increase organic material and reduce evaporation losses.
- Other agricultural production, particularly sheep grazing, would continue albeit at a reduced capacity. Continuing grazing at a reduced rate would encourage grasses to continue growth, reduce the impact of soil compaction and maintain vegetation height below the panels and around the property.
- The farm is currently family-operated with assistance from neighbours. The fulltime equivalent (FTE) employment is estimated to be low, between 1 and 3. During specific times of the year, contractors are engaged to undertake tasks such as sowing and harvesting. These activities are short in duration and would typically employ several people. A small amount of additional employment is supported through local transportation services and processing (sheep and grain). In an employment context, the loss of jobs associated with the reduction of agricultural activities would be balanced by the creation of new jobs to support solar farm operations at the site. These new jobs would also create diversity in the local job market. The proposal would create ongoing employment for approximately 2-3 FTE staff, and up to 6 contractors annually.
- The property owner will be compensated by the proponent/operator for hosting the solar farm through regular lease payments over the life of the solar farm. When compared with agricultural production, this payment has positive cashflow benefits and creates a diversity of income sources for the property owner. It is not seasonal, nor climate dependent. Lease payments would increase in line with CPI over the agreement period.
- Upon decommissioning of the solar farm, the development site would require rehabilitation to restore it to its pre-existing agricultural condition.

Resource loss and fragmentation

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

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, only limited vehicles would be present at the site.

Changes in biosecurity risks – pest, diseases and weed risks

The proposal would result in the increased movement of vehicles and people to 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 the establishment and use of formed access tracks.

To assist in the management of weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on Greater Hume 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.

Mining Impacts

The proposed solar farm is located within an area that has been identified as a mining resource and there is currently one mineral exploration licence over the development site. Long term impacts on mining are likely to be negligible. In the long term (after decommissioning), the solar farm infrastructure would be removed, and the site made available for alternative land uses, including for mining purposes, if desirable.

Resource Impacts

The proposal would require approximately 7,000 m^3 of gravel to surface the access road and internal service track network and CPU and substation hardstand. Sand may be required for the bedding of underground cables, depending on the electrical design and ground conditions. Approximately 300 m^3 of concrete would be required to construct the inverter, substation, CCTV and BESS foundations. The availability of these resources is not declining or limited in the region.

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

In view of the nature of the resources, the limited quantities required and the opportunities for recycling, the proposal is unlikely to place significant pressure on the availability of local or regional resources for other land uses in the area. It is estimated that approximately 30 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 1.2ML) 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 the preserving agricultural capability of the development site.

Following decommissioning the rehabilitated site could be rehabilitated to restore 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.

6.5.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-29.

Table 6-29 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 Jindera 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 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.			**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**	

No.	Safeguards and mitigation measures	C	O	D
	with Greater Hume 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 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	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning.	**C**		
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

6.6 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), operational noise impacts in accordance with the NSW Industrial Noise Policy for Industry 2017, and cumulative noise impacts (considering other operations in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.

6.6.1 *Policy setting*

Construction noise

The NSW Interim Construction Noise Guideline DECC 2009 (ICNG) provides direction for the assessment and management of construction noise impacts. The guideline indicates that a quantitative assessment of noise impacts is warranted where works would impact an individual or sensitive land use for more than three weeks in total.

The ICNG provides direction on the calculation of 'noise management levels (NML)' for noise sensitive receivers. The NMLs are relative to the time of day. During standard construction hours construction noise levels measured at a receiver should comply with Table 6-30. Receivers are 'highly noise affected' when measured construction noise is above 75dB (A) at the receiver. Adhering to the levels described in the guidelines will minimise the impact of construction noise on adjacent receivers. The **rating background noise level** (RBL) is a single figure that represents background noise levels for noise assessment purposes. The noise descriptor L_{AF90} is the noise level that is exceeded for 90% of the time and is used to measure the RBL. Measurements of the RBL are made at likely noise receivers over seven days without rain, strong wind or extraneous noise.

Table 6-30 Construction Noise Levels.

Recommended Construction Hours	Noise Levels
Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	RBL + 10 dB
Justified work outside standard construction hours	RBL + 5 dB
Highly noise affected, likely strong community reaction	75 dB (A)

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

Operational Noise

The purpose of NSW Noise Policy for Industrial (NPI) (EPA 2017) is to ensure noise impacts associated with the operation of an industrial development are evaluated and managed consistently and transparently. The NPI specifies noise criteria to protect the community from excessive intrusive noise. The NPI provides guidance on the calculation of project noise trigger levels. Those trigger levels include:

- Intrusive noise levels.

- Amenity noise level.

The **L_{Aeq} descriptor** is used for measuring and describing both intrusive noise levels and amenity noise levels. The NPI describes a process for determining the intrusive noise levels (PINLs) for an industrial noise source. The NPI describes intrusiveness of a mechanical noise source. Generally, the noise level is acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the RBL by more than 5dB (A). The level for intrusive noise is described 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 (Monday to Friday 7 am to 6 pm, Saturday to Sunday and public holidays 8 am to 6pm)	35	= RBL + 5	40
Evening (6pm to 10pm)	30	= RBL + 5	35
Night (Monday to Friday 10pm to 7am, Saturday to Sunday and public holidays 10pm to 8am)	30	= RBL + 5	35

The acceptable intrusive noise level from an industrial noise source is the RBL + 5dB.

The NPI describes a process for determining the project amenity noise levels (PANLs). 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 PANL represents the objective for noise from a single industrial development at a receiver. The industrial noise during operation should not normally exceed the acceptable noise levels for rural residential properties as detailed in Table 6-32. The NPI calculates the PANLs for industrial developments as the recommended amenity noise level minus 5 dB (A) (Table 6-32).

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

Receiver type	Noise amenity area	Time of day	Noise Level L_{Aeq} dB (A)	
			Recommended amenity noise level	Project amenity noise levels
Residence	Rural	Day	50	45
		Evening	45	40
		Night	40	35

Comparing the amenity and intrusiveness criteria indicates that the intrusiveness criteria are more stringent for day. However, there is little difference for the evening and night periods. Compliance with the intrusiveness criteria would result in compliance with the amenity criteria. Therefore, the intrusiveness criteria would be assessed for from herein.

6.6.2 Background

Existing environment

The existing noise sources from land use adjacent to the development site generally consist of livestock grazing, cultivation management and harvesting of cereal crops, large lot residential activity and road traffic noise from Urana Road, Nation Road, Ortlipp Road, Walla Walla Jindera Road, Sparkes Road, Glenellen Road and Klinbergs Lane. 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.

Traffic volumes were obtained from RMS traffic volume viewer for Urana Road and Walla Walla Jindera Road, with the most recent volumes available being recorded in 2010. The volumes were recorded at Urana Road, between Hueske Road and Jelbart Road, and Walla Walla Jindera Road, between Wehner Road and Five Chain Road. The traffic volume viewer determined that an Average Daily Traffic (ADT) volume of 4,170 and 889 vehicles per day (vpd) travelled along Urana Road and Walla Walla Jindera Road respectively. Assuming an ADT growth rate of 1% per annum since 2010 given the rural nature of the road network, it is estimated that Urana Road and Walla Walla Jindera Road currently carry in the order of 4,600 vpd and 1,000 vpd respectively, which would result in approximate two-way peak hourly volumes of 740 and 160 vehicles per hour (vph) respectively.

Background noise levels

Background noise monitoring has not been conducted for the proposal hence, the minimum applicable RBL of 35 dB (A) for the daytime and 30 dB (a)A for the evening and night time periods was adopted for the noise assessment.

Sensitive receivers

Within 2 km of the proposed solar farm boundary there are 64 sensitive receivers (Figure 3-8). Of these, 3 are involved landowners, 4 are unoccupied residences (no current resident), 9 vacant properties (land without a residence) and 48 uninvolved residences. The nearest uninvolved residence is located about 105 m north of the proposal boundary. All residences have been included in this assessment.

Consultation

Consultation relating to general noise impacts has occurred throughout the project. Information presented at open days has included discussion of noise mitigation strategies. During door knocking and other one-on-one consultation activities, information on construction-related impacts has been provided and management strategies have been discussed.

The residences along Glenellen Road, which are likely to experience the highest levels of construction noise, have also been given opportunity to discuss mitigation strategies during the consultation program. This has included during door knocking and one-on-one meetings. Residents have also been provided a commitment, which has been included in the EIS, to undertake detailed consultation during the pre-construction phase to further identify strategies and mitigation measures to manage construction noise impacts.

6.6.3 Construction noise impact assessment

Noise management levels

Construction noise management levels (NMLs) at all residential receptors have been calculated for the project (Table 6-33). These NMLs will be used to manage impacts associated with noise sensitive receivers adjacent to the proposal. The NMLs for the project have been calculated based on the minimum applicable RBL and NSW ICNG (DECC 2009) criteria (Table 6-30). In addition, during standard construction hours sensitive receivers experiencing construction noise at or above 75 dB (A) would be deemed highly noise effected.

Table 6-33 Construction noise management levels

Location	Time of day	RBL dB (A) L_{A90}	NML dB (A) $L_{A90\ (15min)}$
All Residences	Day	35	45 (RBL + 10dB (A))
	Evening	30	35 (RBL + 5dB (A))
	Night	30	35 (RBL + 5dB (A))

Construction noise sources

Construction noise impacts would likely be from the operation of construction equipment. Several key activities on the site that are likely to produce the most noise include:

- Earth works for the construction of accesses roads, compounds and hard stands.
- Pile driving for solar panel frames and trenching for the installation of cabling.
- The delivery and movement of materials on site.

The proposed activities above use readily available construction equipment. As such, noise levels associated with that equipment (Table 6-34) and activity is well understood and able to be modelled. The construction activities selected above provide a worst-case scenario for noise generated from the site. It is common for the road work and compound construction activities to precede the construction of solar panel frames and cabling. The activities above rarely occur in the same location at the same time due to safety and logistics. As such, predictive modelling of the noise impacts during construction examines two scenarios, deemed to have the highest noise impact, that all of the plant listed in Table 6-34 would be operating simultaneously. Simultaneous operation is unlikely and as a result the noise predictions are conservative. Noise levels from works at the receivers are likely to be less than that predicted.

Table 6-34 Construction equipment sound power levels.

Scenario 1		Scenario 2	
Road work / compound construction equipment	Sound power level ((dB)A)) at 7m	Panel framing and cabling equipment	Sound power level ((dB)A)) at 7m
Water Cart	83	**Delivery Truck**	83
Front End Loader	66	**Mobile Crane**	88
Light vehicles (e.g. 4WD)	78	**Pile drilling rig**	87
Grader	85	**Backhoe**	85
Vibratory Roller	84	**Power Generator**	75
Delivery Truck	83	**Concrete Truck**	84

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 NGH database.

Construction noise assessment

Using construction equipment sound power levels and the RMS construction noise calculator, noise levels have been calculated for all involved, uninvolved an unoccupied residences. The construction noise predictions were calculated based on noise attenuation with distance from source. They do not take into account any obstacles between the source or weather conditions which can influence the level of noise perceived.

Scenario 1 – Road and compound construction

A detailed noise assessment of road work and compound construction for all sensitive receivers located within 2 km of the proposal has been completed (Appendix H). This assessment found that construction noise levels at 52 of the total 64 sensitive receivers were unlikely to exceed the NMLs.

Table 6-35 Predicted noise levels for Scenario 1.

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures*
20 (uninvolved)	105	63	Moderately Intrusive	N, V
21 (uninvolved)	115	62	Moderately Intrusive	N, V
17 (uninvolved)	130	60	Moderately Intrusive	N, V
18 (uninvolved)	135	60	Moderately Intrusive	N, V
19 (unoccupied)	190	55	Moderately Intrusive	N, V
16 (uninvolved)	200	54	Clearly audible	
10 (unoccupied)	220	53	Clearly audible	
9 (uninvolved)	260	51	Clearly audible	
15 (uninvolved)	270	50	Clearly audible	
11 (unoccupied)	280	50	Clearly audible	
23 (uninvolved)	315	48	Clearly audible	
1 (uninvolved)	330	48	Clearly audible	
1 (involved)	433	44	Not noticeable	

*Note: N = Notification, V = Verification.

Sensitive receivers located within 100m of the proposed works are predicted to experience a substantial exceedance above the NMLs during road and compound construction. These exceedances are likely to occur whilst construction activities take place intermittently in front of residences, over a total period of 2-3 weeks. These receivers are considered likely to be noise affected, consultation with these residences is recommended prior to the commencement of construction (refer to Section 6.6.7 and the draft Noise Management Plan, provided in Appendix H). A minor exceedance above the NMLs would occur for receivers within 330 m of the proposed works. These exceedances are likely to take place intermittently over 4-6 weeks.

The work would occur during normal working hours and, when audible, are not likely to cause a high level of impact at sensitive receivers. Construction of roads would move progressively across the site, meaning that at any one receiver, worst case construction noise typically last for several weeks only.

Scenario 2 – Driving of steel posts, erecting frames and installing panels

The erection of panel frames would include the delivery of framing components, the driving of steel posts and the fixing of frames. The cabling would involve trenching, cable laying and backfilling. The framing would precede the cable activities but may be concurrent in adjacent areas. The predicted noise impacts from these activities have been calculated as described above and are displayed below (Table 6-36).

The assessment found that construction noise levels at 49 of the total 64 sensitive receivers were unlikely to exceed the NMLs.

Table 6-36 Predicted noise levels for Scenario 2.

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures*
20 (uninvolved)	105	66	Moderately Intrusive	N, V
21 (uninvolved)	115	65	Moderately Intrusive	N, V
17 (uninvolved)	130	63	Moderately Intrusive	N, V
18 (uninvolved)	135	62	Moderately Intrusive	N, V
19 (Unoccupied)	190	58	Moderately Intrusive	N, V
16 (uninvolved)	200	57	Moderately Intrusive	N, V
10 (Unoccupied)	220	56	Moderately Intrusive	N, V
9 (uninvolved)	260	54	Clearly audible	
15 (uninvolved)	270	53	Clearly audible	
11 (Unoccupied)	280	53	Clearly audible	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures*
23 (uninvolved)	315	51	Clearly audible	
1 (uninvolved)	330	50	Clearly audible	
1 (involved)	433	47	Clearly audible	
8 (uninvolved)	440	47	Clearly audible	
12 (unoccupied)	460	46	Clearly audible	
13 (uninvolved)	480	45	Not noticeable	

*Note: N = Notification, V = Verification.

Sensitive receivers located within 220m of the proposed works are predicated to experience a moderate exceedance above the NMLs during installation of panel framing and cabling (Table 6-36). These exceedances are likely to occur whilst construction activities take place intermittently over 4-5 weeks. These receivers are considered likely to be noise affected, consultation with the residences prior to the commencement of construction is recommended (refer to Section 6.6.7 and Appendix H). A minor exceedance above the NMLs would occur for receivers within 460m of the proposed works. These exceedances are likely to take place intermittently over 4-6 weeks.

The construction works would occur in a rural environment with a low level of background noise. The works are likely to generate some moderate impact exceedances over a short-term from noise impacts from the use of machinery and plant. The work would occur during normal working hours and, when audible, are not likely to cause a high level of impact at sensitive receivers. The maximum duration that affected residents would be likely to experience worst case construction noise (e.g. from piling driving) is 8 hours in a day. Such activities would move progressively across the site, meaning that at any one receiver, worst case construction noise is intermittent, over 4-6 weeks.

Overall, construction noise impacts are unlikely to significantly affect nearby sensitive receivers with the implementation of the recommended mitigation measures.

6.6.4 Operation noise impact assessment

Operational noise sources

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

1. The onsite substation.
2. Maintenance activities such as visual inspections of panels and structures, general maintenance (e.g. replacing fuses, replacing panels), cleaning of panels and emergency repairs (e.g. replacing torsion bars).
3. Tracking motors and movement of the solar panels.
4. Inverter stations.

The proposed activities above use readily available equipment. As such, noise levels associated with that equipment (Table 6-37) and activity is well understood and able to be modelled. The 'null effect distance' was modelled for each piece of equipment (Table 6-37). This represents the distance at which each individual piece of equipment no longer exceeds the intrusive NML criteria for the project.

Table 6-37 Operational equipment sound levels.

Equipment	No.	Sound power level (dB (A)) at 7 m	Sound pressure level (dB) at 7 m	Null effect distance (m)
Internal substation - transformers	2	72	61	150
Light vehicle	1	78	77	240
Tractor – slashing grass	1	92	81	700
Tractor – washing panels	1	92	81	700
Truck	1	83	72	350
Telehandler	1	81	70	300
Tracking motor	10	60	49	50
Invertor station	1	70.4	59.4	130

Operational noise assessment

Using operational equipment sound power levels, noise levels have been calculated for four operational scenarios:

- Operation of tracking motors, internal substation and the inverter stations
- Maintenance vehicles accessing the site
- Grass slashing and panel cleaning
- Repairing faulty equipment

These scenarios are deemed to have the highest noise impact, that is all of the plant listed (refer to Table 6-41 Table 6-43, Table 6-45) would be operating simultaneously. The activities selected provide a worst-case scenario for noise generated from the site.

The operational noise predictions are based on noise attenuation with distance from source. They do not take into account any obstacles between the source or weather conditions which can influence the level of noise perceived.

Intrusiveness criteria is used in Table 6.31 was used to determine exceedances presented in Tables 6.39 – 6.40.

Scenario 1 – Operation of trackers, onsite substation and inverter stations

During operations, the internal substation and invertor stations would generate continuous noise. The tracking motors rotating the panels would generate intermittent noise during the day, operating every 15 minutes for about 0.5 minutes. This scenario considers the continuous operation of the internal substation, invertor substation and tracking motors, and predicts the typical noise levels that may be experienced during the operation of the solar farm infrastructure only (no maintenance activities occurring) (Table 6-38).

The internal substation would contain 1 or 2 transformers to transform 33 kV from the solar farm to 132 kV for transmission to the external substation. Australian Standard AS 60076 Part 10 2009 "Power Transformers – Determination of Sound Power Levels" specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the internal substation is not yet available, a conservative assumption is provided below based on two 150 MVA facilities. The specification for the 150 MVA transformers indicates that the sound power output from 2 transformers would be about 72dB (A) at 7 m.

Note, the upgrade on the existing substation does not involve the addition of any equipment that would increase the existing noise level of the substation. No further assessment of this component of the proposal has therefore been conducted.

During operation, there would be 25 inverter stations distributed across the development site. Due to their distribution across the site, for any one receiver, it is expected that only one invertor station would be close enough to affect the noise environment. Accordingly, only one inverter station has been used in the noise model below.

Table 6-38 Operational equipment for Scenario 1.

Equipment	Quantity	Sound power level (dB (A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	70.4

Table 6-39 Predicted noise levels for receivers during scenario 1 (during standard hours).

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[1]	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R20 (uninvolved)	105	300	45	Clearly Audible
R21 (uninvolved)	115	222	44	Clearly Audible
R17 (uninvolved)	130	406	42	Clearly Audible
R18 (uninvolved)	135	334	42	Clearly Audible

[1] Refer to compliance criteria Table 6.31.

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[1]	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R19 (unoccupied)	190	383	37	Not Noticeable
R16 (uninvolved)	200	336	37	Not Noticeable
R10 (unoccupied)	220	429	35	Not Noticeable
R9 (uninvolved)	260	641	33	Not Noticeable
R15 (uninvolved)	270	448	33	Not Noticeable
R11 (unoccupied)	280	546	32	Not Noticeable

Table 6-40 Predicted noise levels for receivers during Scenario 1 (during evening hours)

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R20 (uninvolved)	105	300	45	Clearly Audible
R21 (uninvolved)	115	222	44	Clearly Audible
R17 (uninvolved)	130	406	42	Clearly Audible
R18 (uninvolved)	135	334	42	Clearly Audible
R19 (unoccupied)	190	383	37	Clearly Audible
R16 (uninvolved)	200	336	37	Clearly Audible
R10 (unoccupied)	220	429	35	Not Noticeable
R9 (uninvolved)	260	641	33	Not Noticeable
R15 (uninvolved)	270	448	33	Not Noticeable
R11 (unoccupied)	280	546	32	Not Noticeable
R23 (uninvolved)	315	421	30	Not Noticeable

*Note additional mitigation measures required during evening hours. N = Notification, V = Verification.

Sensitive receivers located within 135m of the solar farm infrastructure are predicted to experience a minor noise exceedance of up to 5 dB (A)) above the intrusive daytime NML.

The solar farm would not normally be in operation during the evening and not in the night hours. The exception being summer with extended day lengths. This coincides with daylight savings (in NSW daylight savings begins on the first Sunday in October and ends on the first Sunday in April every year), where the invertor stations, tracking motors and on-site substation would still be operating until sunset.

Sensitive receivers located within 200 m of the solar farm infrastructure would experience a minor noise exceedance of up to 5 dB (A) above the evening NML when daylight savings is in effect.

Scenario 2 – Maintenance vehicle activity

During operations, two 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 activities would mostly be conducted inside a maintenance/control building located in the south-eastern corner of the development site. Noise from other maintenance works (replacing fuses, inspecting equipment) would be intermittent.

An operational maintenance scenario includes up to 2 maintenance vehicles across the project site replacing fuses or completing inspections. The scenario also includes the continuous noise generated by the internal substation and invertor stations, and intermittent noise associated with the tracking motors rotating the panels (Table 6-41).

Table 6-41 Operational equipment for Scenario 2.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	70.4
Light vehicle	2	81

Table 6-42 Predicted noise levels for Scenario 2.

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R20 (uninvolved)	105	300	52	Moderately Intrusive	N, V
R21 (uninvolved)	115	222	51	Moderately Intrusive	N, V
R17 (uninvolved)	130	406	49	Clearly audible	
R18 (uninvolved)	135	334	49	Clearly audible	
R19 (unoccupied)	190	383	44	Clearly audible	
R16 (uninvolved)	200	336	43	Clearly audible	
R10 (unoccupied)	220	429	42	Clearly audible	

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R9 (uninvolved)	260	641	40	Not Noticeable	
R15 (uninvolved)	270	448	39	Not Noticeable	
R11 (unoccupied)	280	546	39	Not Noticeable	
R23 (uninvolved)	315	421	37	Not Noticeable	
R1 (uninvolved)	330	510	37	Not Noticeable	
R1 (involved)	433	642	33	Not Noticeable	

Sensitive receivers located within 220 m of maintenance works are predicted to experience a minor exceedance (up to 9 dB (A)) above the NPI criteria. The detailed noise assessment indicated that 59 of the 64 sensitive receivers within 2 km of the proposal would not be adversely affected by the operational noise under scenario 2 (Appendix G).

During operation, maintenance works would be intermittent and occur at a variety of locations across the development footprint as required. These activities would be short-term lasting several minutes at most, and would occur during standard working hours. Sensitive receivers would not be 'highly noise affected' during general maintenance access.

Scenario 3 – Grass slashing and panel cleaning

During operations, grass slashing and panel cleaning would be required. Grass slashing would generally occur in spring after vegetation growth has occurred and may be required after sporadic summer rainfall. Panel cleaning would occur after dusty conditions like summer or as required.

An operational scenario includes one tractor with a slasher attached. Due to safety concerns both slashing and panel cleaning activities would be kept separate from other activities. As stated above it is unlikely and unsafe to run slashing and panel cleaning simultaneously. The scenario also includes the continuous noise generated by the internal substation and invertor stations, and intermittent noise associated with the tracking motors rotating the panels

Table 6-43 Operation equipment for Scenario 3.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Tractor – slashing grass or panel cleaning	1	92
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	70.4

Table 6-44 Predicted noise levels for scenario 3.

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Duration of exceedance	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R20 (uninvolved)	105	300	65	1- 2 hours, twice per year	Moderately Intrusive	N, V
R21 (uninvolved)	115	222	64	1- 2 hours, twice per year	Moderately Intrusive	N, V
R17 (uninvolved)	130	406	62	1- 2 hours, twice per year	Moderately Intrusive	N, V
R18 (uninvolved)	135	334	62	1- 2 hours, twice per year	Moderately Intrusive	N, V
R19 (unoccupied)	190	383	57	1- 2 hours, twice per year	Moderately Intrusive	N, V
R16 (uninvolved)	200	336	56	1- 2 hours, twice per year	Moderately Intrusive	N, V
R10 (unoccupied)	220	429	55	1- 2 hours, twice per year	Moderately Intrusive	N, V
R9 (uninvolved)	260	641	53	1- 2 hours, twice per year	Moderately Intrusive	
R15 (uninvolved)	270	448	52	1- 2 hours, twice per year	Moderately Intrusive	
R11 (unoccupied)	280	546	52	1- 2 hours, twice per year	Moderately Intrusive	
R23 (uninvolved)	315	421	50	1- 2 hours, twice per year	Clearly audible	
R1 (uninvolved)	330	510	50	1- 2 hours, twice per year	Clearly audible	
R1 (involved)	433	642	46	1- 2 hours, twice per year	Clearly audible	
R8 (uninvolved)	440	591	46	1- 2 hours, twice per year	Clearly audible	
R12 (unoccupied)	460	691	45	1- 2 hours, twice per year	Clearly audible	

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Duration of exceedance	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R13 (uninvolved)	480	940	45	1- 2 hours, twice per year	Clearly audible	
R2 (uninvolved)	500	652	44	1- 2 hours, twice per year	Clearly audible	
R3 (uninvolved)	555	735	43	1- 2 hours, twice per year	Clearly audible	
R4 (uninvolved)	640	823	41	1- 2 hours, twice per year	Not noticeable	
R22 (uninvolved)	640	736	41	1- 2 hours, twice per year	Not noticeable	

Sensitive receivers located within 280m of grass slashing are predicted to experience a substantial exceedance (up to 25 dB (A)) above the NPI criteria. The detailed noise assessment indicated that 54 of the 64 sensitive receivers within 2 km of the proposal would not be adversely affected by the operational noise under scenario 3 (Appendix G).

Grass slashing or panel cleaning would occur about twice a year. No sensitive receivers are considered to be 'highly noise affected' given that the work would occur during normal working hours, and the equipment would move progressively across the site, meaning that at any one receiver, worst case construction noise typically last for 1-2 hours only.

Scenario 4 – Repairing faulty equipment

During operations, repair and replacement of broken or faulty equipment would likely be required. A repair scenario considers the replacement of a torsion bar that operates the movement of the panels (Table 6-45). The scenario also includes the continuous noise generated by the internal substation and invertor stations, and intermittent noise associated with the tracking motors rotating the panels.

Table 6-45 Operation equipment for Scenario 4.

Equipment	No.	Sound power level (dB (A)) at 7 m
Truck	1	55
Telehandler	2	81
Light vehicle	1	78
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	70.4

Table 6-46 Predicted noise levels for scenario 4.

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R20 (uninvolved)	105	300	60	Moderately Intrusive	N, V
R21 (uninvolved)	115	222	59	Moderately Intrusive	N, V
R17 (uninvolved)	130	406	57	Moderately Intrusive	N, V
R18 (uninvolved)	135	334	57	Moderately Intrusive	N, V
R19 (unoccupied)	190	383	52	Moderately Intrusive	

Receiver	Distance (m) from development infrastructure	Distance (m) from Invertor station	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R16 (uninvolved)	200	336	52	Moderately Intrusive	
R10 (unoccupied)	220	429	50	Clearly audible	
R9 (uninvolved)	260	641	48	Clearly audible	
R15 (uninvolved)	270	448	48	Clearly audible	
R11 (unoccupied)	280	546	47	Clearly audible	
R23 (uninvolved)	315	421	45	Clearly audible	
R1 (uninvolved)	330	510	45	Clearly audible	
R1 (involved)	433	642	41	Not noticeable	
R8 (uninvolved)	440	591	41	Not noticeable	
R12 (unoccupied)	460	691	40	Not noticeable	
R13 (uninvolved)	480	940	40	Not noticeable	
R2 (uninvolved)	500	652	39	Not noticeable	
R3 (uninvolved)	555	735	38	Not noticeable	
R4 (uninvolved)	640	823	37	Not noticeable	

*Note additional mitigation measures required during standard daytime hours. N = Notification, V = Verification.

Sensitive receivers located within 200m of the solar farm infrastructure are predicted to experience a moderate noise exceedance of up to 17 dB (A)) above the intrusive daytime NML. The detailed noise assessment indicated that 60 of the 64 sensitive receivers within 2 km of the proposal would not be adversely affected by the operational noise under scenario 4.

Repair and replacement of broken or faulty equipment would occur infrequently. No sensitive receivers are considered to be 'highly noise affected' given that the work would occur during normal working hours and would be short-term.

Overall, operational noise impacts associated with the project are considered unlikely to significantly affect nearby sensitive receivers with the implementation of the recommended mitigation measures. However, it is recommended that a one-off noise validation monitoring assessment should be conducted during operation of the project to confirm the project meets the intrusive NML's (refer to Table 6-31).

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, no mechanical plant would be operating due to the lack of sunlight. During daylight saving period over summer some tracker noise emissions may occur between 6 am and 7 am. When the sun is not shining the invertors stations will not be operating. It is expected that noise levels at the closest receivers would be well below the sleep disturbance criteria.

Transmission line

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest sensitive receiver from the overhead power line and the TransGrid substation 100 m (R21) and 380m (R09) respectively, aeolian noise impacts are expected to be negligible.

SLR Consulting have previously measured corona noise (reference GEHA Report 045-109/2 dated 9 November 2004, pers. comm. I. Fricker December 2012) at a site near Officer in outer Melbourne, Victoria. SLR found it possible to measure corona noise at close distances, at high frequencies only, as other noise sources, namely traffic and birds, caused some interference at times. A 500-kV line was measured during damp foggy conditions.

At a distance of 30 m along the ground from the line, an L_{eq} noise level of about 44 dB (A) was measured. At a distance of 890 m the corona noise was calculated to be about 15 dB (A). The night-time intrusive criteria determined is 35 dB (A). The proposed transmission line would comply with the intrusive noise levels for the project.

6.6.5 Cumulative Impacts

There is potential for cumulative impacts associated with other known or foreseeable developments occurring in proximity to the proposal to impact upon sensitive receivers. There are currently 4 major solar farms developments within the Greater Hume LGA including Culcairn, Walla Walla, Glenellen and Jindera (see Section 7.9). Note, none of these solar farms have received development approval at this stage.

Glenellen Solar Farm is the closest major project, located approximately 300 m east of the proposed Jindera Solar Farm. The final infrastructure layout and any construction commencement date for Glenellen is unknown at this stage. However, due to the relative proximity of both proposals there is potential for cumulative noise impacts to occur during construction and operation.

Construction

Cumulative construction noise impacts may occur if the commencement of construction for the proposed Jindera and Glenellen solar farms overlap. However, these impacts would be restricted to receivers located within a 300 m buffer from both proposed solar farms (Figure 6-16). The only receiver located within 300 m is an unoccupied residence, receiver 10.

A construction noise assessment was conducted to provide a worst-case scenario for noise generated from both sites during the construction of both solar farms simultaneously.

Table 6-47 Construction equipment for panel framing and cabling scenario.

Equipment	No.	Sound power level (dB (A)) at 7 m per item
Delivery Truck	1	83
Mobile Crane	1	88
Pile drilling rig	1	87
Backhoe	1	85
Power Generator	1	75
Concrete Truck	1	84

Table 6-48 Predicted noise levels for receiver 10 during panel framing and cabling.

Receiver	Distance from Jindera Solar Farm infrastructure (m)	Distance from Glenellen Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Additional mitigation measures*
R10 (Unoccupied)	215	250	58	Moderately Intrusive	N, V

*Note: N = Notification, V = Verification.

A moderate exceedance (13 dB (A)) above the NML is predicted to occur during the panel framing and cabling construction at receiver 10. This assumes a worst-case scenario of both solar farms commencing construction at the same time and that the same work is concurrent at nearby locations.

The work would occur during normal working hours and, when audible, is not likely to be highly intrusive at sensitive receivers. Construction would move progressively across the site. These exceedances are likely to take place intermittently over 4-6 weeks. Therefore, any potential cumulative noise impacts during construction would be short-term. Consultation with the owners of this residence is recommended (refer draft Noise Management Plan, Appendix H).

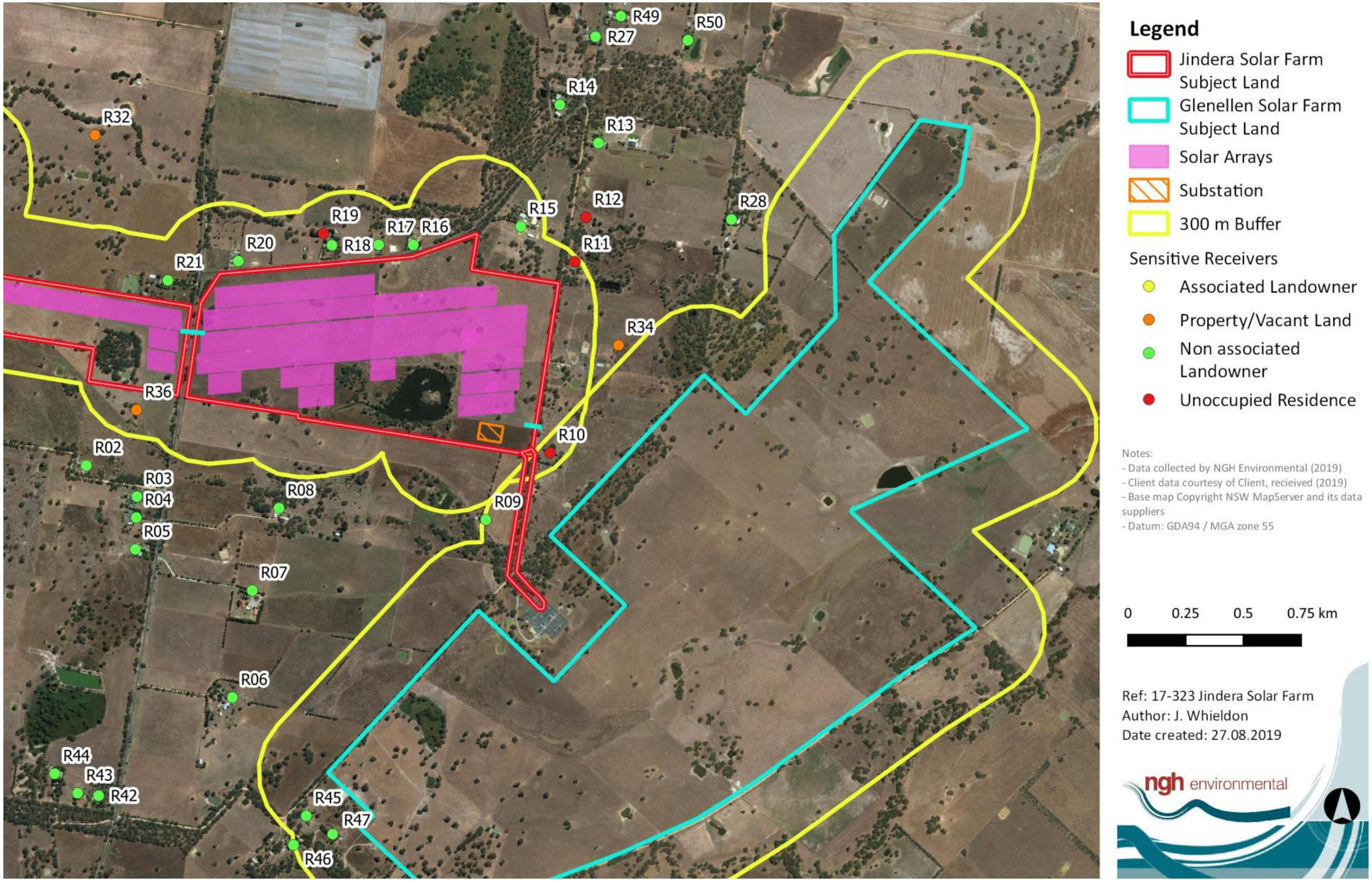

Figure 6-16 Sensitive receivers located within a 300m of proposed Jindera and Glenellen Solar Farms.

Operation

Scenario 1 - Operation of trackers, onsite substation and inverter stations

An operation noise assessment was conducted to provide a worst-case scenario for noise generated from the site during the operation of both solar farms simultaneously. The assessment considers receivers located within a 300 m buffer from both proposed solar farms (Figure 6-16).

This scenario considers the continuous operation of the internal substation, invertor station and tracking motors, and predicts the typical noise levels that may be experienced during the operation of the solar farm infrastructure only (no maintenance activities occurring). This scenario accounts for the actual distance between the receiver and the nearest invertor.

Table 6-49 Operational equipment for Scenario 1

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	70.4

Table 6-50 Predicted noise level for receivers located within 300m during operation of the solar farm.

Receiver	Distance from Jindera Solar Farm infrastructure (m)	Distance (m) from Invertor station	Distance from Glenellen Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R10 (Unoccupied)	215	433	250	39	Not noticeable

No exceedance above the NML is predicted to occur during the operation of the both solar farms at receiver 10 (Table 6-52).

Scenario 2 – Grass slashing and panel cleaning

The slashing of grass or panel cleaning using a tractor was adopted for this scenario, as this was identified as the noisiest operational activity. The scenario also includes the continuous noise generated by the internal substation and invertor station and intermittent noise associated with the tracking motors rotating the panels. The scenario also accounts for the actual distance between the receiver and the nearest invertor.

Table 6-51 Sound power level of a tractor grass slashing.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Tractor – slashing grass or panel cleaning	1	92
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station		70.4

Table 6-52 Predicted noise level for receivers located within 300m during grass slashing.

Receiver	Distance from Jindera Solar Farm infrastructure (m)	Distance (m) from Invertor station	Distance from Glenellen Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Additional Mitigation Measures
R10 (Unoccupied)	215	433	250	57	Moderately Intrusive	N, V

*Note: N = Notification, V = Verification.

A moderate exceedance (17 dB (A)) above the NML is predicted to occur during grass slashing at receiver 10 (Table 6-52). This assumes a worst-case scenario of grass slashing occurring simultaneously on both solar farms. Grass slashing would occur about twice a year, and the equipment would move progressively across the site. In the worst case slashing noise typically would last for 0.5 - 1 hour at receiver 10. Receiver 10 is not considered to be 'highly noise affected', however notification prior to grass slashing or panel cleaning occurring is recommended.

Given the proposal occurs in a rural environment surrounded by agricultural properties, tractors, headers, quad bikes, light vehicles and heavy vehicles are common noise generating activities. In comparison to the operation of a tractor grass slashing on a solar farm, a header operates at a sound power level 3 dB (A) higher (Table 6-53).

Table 6-53 Sound power level of a header.

Equipment	No.	Sound power level (dB (A)) at 7 m
Header	1	95

Table 6-54 Predicted noise levels for receivers located within 300 m of a header operating.

Receiver	Distance from Jindera Solar Farm infrastructure (m)	Distance from Glenellen Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Additional mitigation measures*
R10 (Unoccupied)	215	250	60	Moderately Intrusive	N, V

*Note: N = Notification, V = Verification.

A substantial exceedance (20 dB (A)) above the NML is predicted to occur during operation of a header at receiver 10 (Table 6-54). This assumes a worst-case scenario of 2 headers operating simultaneously within 300m of receiver 10. Given the operation of a header is a common noise generating activity typically experienced within the proposal area, a tractor grass slashing at 3 dB (A) lower is unlikely to significantly impact upon receiver 10.

Grass slashing would occur about twice a year or as required. The potential for both projects to conduct grass slashing within the same location at the same time is considered highly unlikely. Therefore, no operational cumulative noise impacts are considered likely to occur.

6.6.6 Vibration

The NSW guideline Assessing Vibration: A Technical Guideline (DEC 2006) is designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. Sources of vibration covered in this guideline include construction and excavation equipment, rail and road traffic, and industrial machinery.

Based on the proposed plant items listed in Table 6-34 vibration generated by construction plant was estimated and potential vibration impacts summarised in Table 6-55.

Table 6-55 Potential impact from vibration to the two closest sensitive receivers.

Receiver	Distance (m) from development infrastructure (Approximate)	Type of receiver	Level of risk for potential impact	Monitoring required
R20 (uninvolved)	105	Residential	Low	Not Required
R21 (uninvolved)	115	Residential	Low	Not Required

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at the nearest residential dwelling (105 m). Potential vibration impacts from operation are therefore not assessed any further.

6.6.7 Safeguards and mitigation measures

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 7am to 6pm. • Saturday 8am to 1pm. • No work on Sundays or public holidays.	**C**	**O**	**D**
NS2	A Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The CNVMP would generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The CNVMP would include the following: • Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Noise measurements would be consistent with the procedures documented in AS1055.1-1997 Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Vibration measurements would be undertaken in accordance with the procedures documented in the OEH's Assessing Vibration-a technical guideline (2006) and BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings. • valuation and measurement for vibration in buildings.	**Prior to construction**		**D**
NS3	Operate plant in a conservative manner, which includes: • Selection of the quietest suitable machinery. • Avoidance of noisy plant working simultaneously where practical. • Turning off plant and equipment that is not being used. • Utilise broadband reverse alarm in lieu of high frequency type.	**C**	**O**	**D**
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner. Provide toolbox meetings, training and education.	**C**	**O**	**D**
NS5	A letter box drop would be prepared and provided to residences in close proximity to the works (within 1 km). The letter would contain details of the proposed works including timing, duration, expected impacts and a contact person for any enquiries or complaints.	**Prior to and during construction**	**O**	**D**

No.	Mitigation strategies	C	O	D
NS6	For Sensitive Receiver 20, 21, 17, 18, 19, 16 and 10: • Specific consultation at least 2 weeks prior to the commencement of highly noise affecting works would be undertaken. This aim of this consultation is to identify any management measures required to minimise impact at this receiver. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities. • The residences would be provided a contact person for any enquiries or complaints. For other residences and other noise sensitive receptors likely to be noise affected (within 550 m) of the proposed work: • The residence would be provided a contact person for any enquiries or complaints. • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur at least two weeks prior to the commencement of construction works. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities.	**C**	**O**	**D**
NS7	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**
NS8	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	**C**	**O**	**D**
NS9	Scheduling of activities to minimise the number of work fronts and simultaneous activities occurring within 200m of the project boundary to minimise noise levels.	**C**	**O**	**D**
NS10	Where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver (within 200m) including areas in constant or regular use (e.g. unloading and laydown areas).	**C**		**D**
NS11	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for	**C**		**D**

No.	Mitigation strategies	C	O	D
	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.			
NS12	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**
NS13	Where noise level exceedances cannot be avoided during operation, sound barriers such as sound walls and acoustic fencing would be used to minimise noise levels.		**O**	
NS14	In the event the proposed Glenellen Solar Farm commences construction and operation, sensitive receiver 10 would receive: • Specific consultation at least 2 weeks prior to the commencement of highly noise affecting works would be undertaken. This aim of this consultation is to identify any management measures required to minimise impact at this receiver. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities. • Use of mobile screens or noise walls at the noise source (within 300 m of receiver 10) would be considered in consultation with receiver 10.	**C**	**O**	**D**
NS15	For receivers located within 300 m of development infrastructure during maintenance activities including grass slashing, panel cleaning or major works/repairs: • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur at least two weeks prior to the commencement of works. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of activities. • Consider the use of mobilised screening or noise walls around the invertors to reduce the level of noise at the source for noise affected receivers if verification of noise levels finds an exceedance above the NML occurs.		**O**	

C: Construction; O: Operation; D: Decommissioning

7 ASSESSMENT OF ADDITIONAL ISSUES

7.1 SOIL

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Land –

Including:

- *An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:*
  - *A consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights (including EL8467);*
  - *A soil survey to determine the soil characteristics and consider the potential for erosion to occur; and*
  - *A cumulative impact assessment of nearby developments;*
- *An assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:*
  - *Consideration of the zoning provisions applying to the land, including subdivision; and*
  - *Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's* Land Use Conflict Risk Assessment Guide*; and*
  - *A description of measures that would be implemented to remediate the land following decommissioning in accordance with* State Environmental Planning Policy No. 55 – Remediation of Land.

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).*

7.1.1 Approach

A desktop survey was undertaken of the development site by NGH Environmental.

At the request of NGH Environmental, a field survey was undertaken of 21 representative survey sites by DM McMahon Pty Ltd. The soil was analysed for topsoil and subsoil pH, electrical conductivity (EC), dispersion, nutrients and cations. The soil sampling sites are shown in Figure 7-1. The resultant Soil Survey Report for the proposed Jindera Solar Farm provides an analysis and evaluation of landforms and soil types as identified on the subject land. Limitations and management actions are provided for the soil landscapes that have been identified onsite.

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). Density of investigation boreholes was determined via the Guidelines for Surveying Soil and Land Resources (McKenzie *et al*. 2008), where selection of a 'Moderately High (Detailed)' intensity level was deemed appropriate for satisfying the objectives for detailed project planning.

The Soil Assessment is summarised below and provided in full in Appendix J.

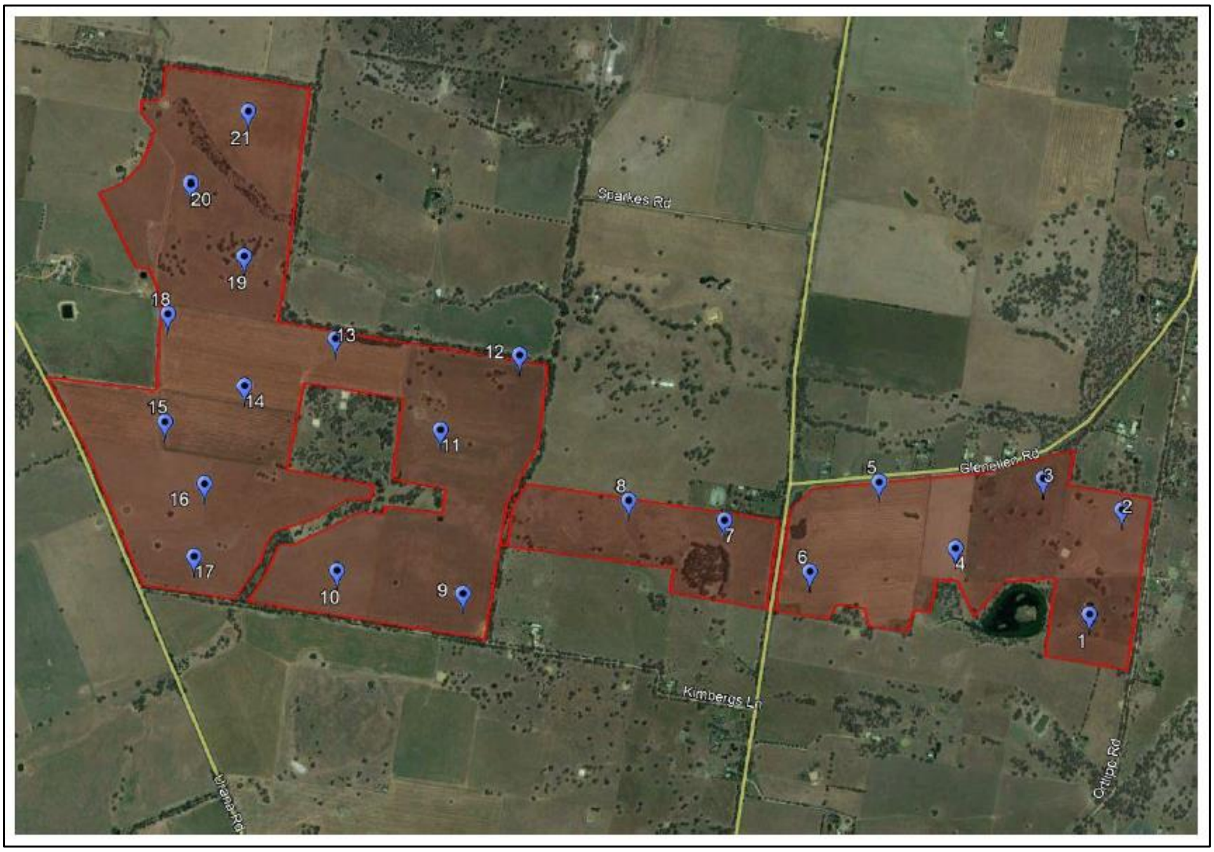

Figure 7-1 Soil survey investigation pit locations.

7.1.2 Existing environment

Topography and geology

The site is located at an elevation range of approximately 220 m – 265 m AHD. The landform of the site consists of low, gently to moderately undulating hills to the west running to level, to very gently inclined drainage plains to the east. Two widely spaced, shallow ephemeral drainages traverse the site, Kilnacroft Creek and Dead Horse Creek, that lie in the upper catchment of the Murray River associated with the Oak Hill range to the west.

The site geology is distributed over two units: Cainozoic alluvium and Granitoids. The lithology groups on the site are Cainozoic colluvial surfaces and Silurian – Devonian granites. The Cainozoic alluvium is associated with the drainage plains in the east of the site, while the granites lie in the west of the site on the low undulating hills.

Potential contamination

A search of the NSW EPA contaminated land public record (NSW Government 2019) was undertaken for contaminated sites in the Greater Hume Shire LGA on 19 February 2019. The search did not return any results for the LGA.

There is a risk that contamination associated with agricultural activities (such as use and storage of pesticides) could be present in the development site. However, no evidence of contamination was observed during the field work and this risk is considered very low.

Soil

Soils encountered are typical of the locale, generally falling into reconnaissance survey classes. Slight variations in profiles exist due to remnant parent formation, drainage plains and the complex soil sequences associated with them. Soil moisture contents varied between soil types but were generally found to be dry in the topsoil and at depth. Free groundwater was not encountered at the investigated depths.

The Soil Assessment shows that the site lies within the mapping units **Va14** from the Digital Atlas of Australian Soils (CSIRO 1991), mapped in Figure 7-2. This unit is defined as “plains of hard alkaline and neutral yellow mottled soils (Dy3.43 and Dy3.42), associated with various earths (Gn2.2 and Gn2.9) and other undescribed soils; data are limited; occurs on sheet(s)”.

Soils can be classified into a typical soil profile across the site as per the Australian Soil Classification system (Isbell 1996). Description of the typical soil type encountered in the soil assessment are as follows.

Chromosols

Chromosols have a strong texture contrast between A and B horizons. There is a clear or abrupt textural B horizon in which the upper portion of the horizon (0.2 m) is not strongly acid and not sodic. These soils are the most commonly encountered soils under agricultural use in Australia.

Topsoil

Light brown silty loams and white silts, moderately granular. pH (1:5 soil/water) 5.4 – 6.0 in the A horizon; to 20 – 60 cm depth. Pronounced A2 horizon on the lower lying areas. Clear boundary to B horizon.

Subsoils

Weakly to moderately massive structure. Hues vary from yellowish-brown to brownish-red in B horizon and brownish-red to yellowish-red in C horizon (where encountered). Light to medium clays in B horizon and sandy silty clays in C horizon.

7.1.3 Results

The results of the soil analysis are described in Table 7-1 and shown in Figure 7-2.

Table 7-1 Soil analysis results (McMahon 2018).

Description	pH	Salinity rating (EC)	Cation exchange capacity	Exchangeable Sodium Percentage (ESP)	Dispersion	Plant available phosphorus	Phosphorus buffering index	Calcium: magnesium ratio	Soil infiltration /water holding capacity
Topsoil	Slightly acid (6.1 – 6.5)	Very low (0.13 – 0.19 dS/m)	Low (6.9 – 8.7 cmol(+)/kg	Non-sodic (<1% - 1.4%)	Mostly slaking, no dispersion	Very high (36 to 66 mg/kg)	Very low (41 to 49)	6.5 to 28	Moderate to high (50 – 90 mm/hr)
Subsoil	5.2 – 6.3	0.02 – 0.08 µS/cm	-	-	Nil to partial	-	-	-	Very slow (<5 mm/hr), liable to waterlogging where there is limited topsoil horizon

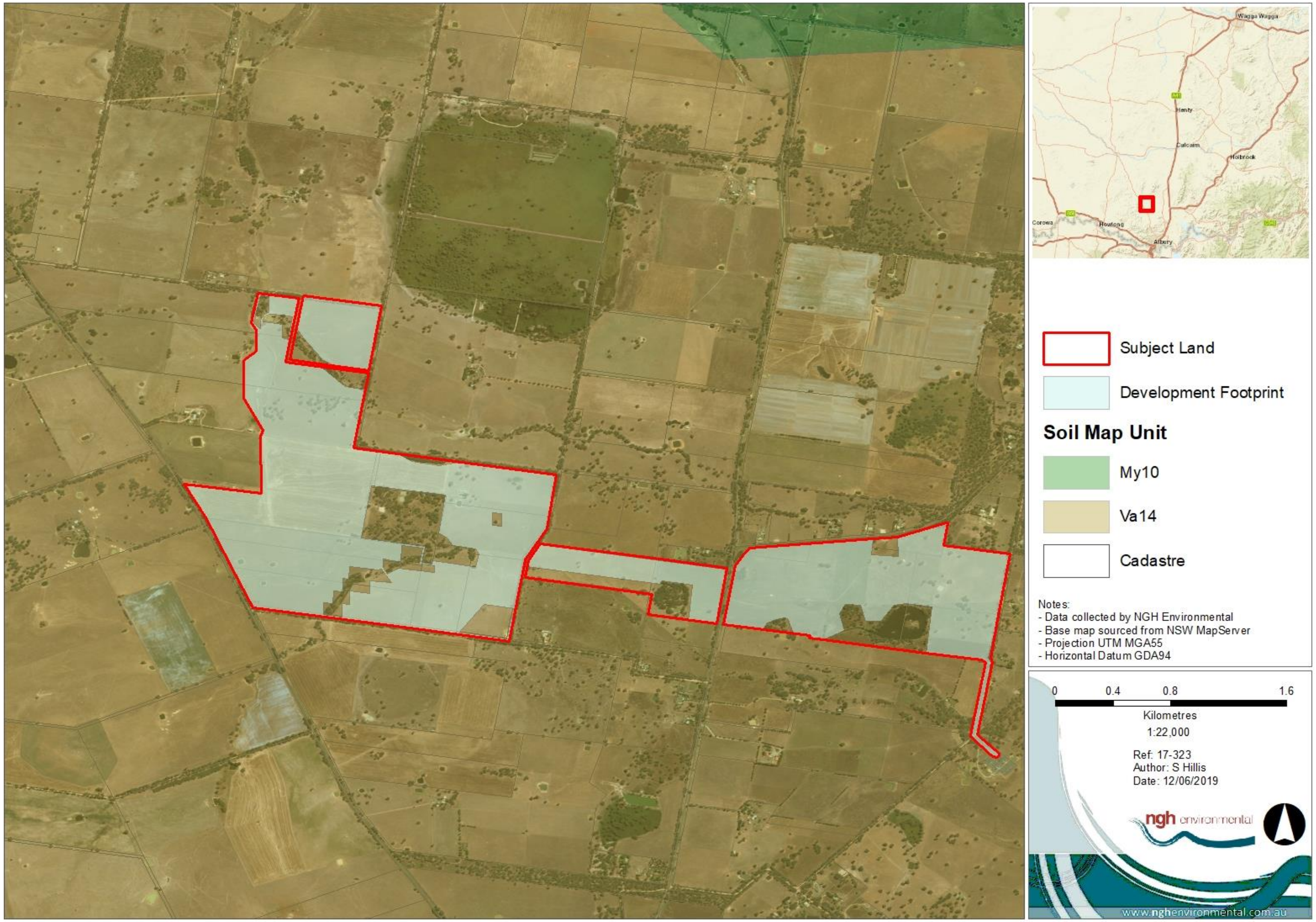

Figure 7-2 Soil mapping units of the development site.

Limitations

The identification of the landscape limitations of the site enable best practice management actions to be implemented for the construction, operation and decommissioning of the project. The potential landscape limitations are summarised below in Table 7-2.

Table 7-2 Landscape limitations (McMahon 2018).

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulphate soils	Infrastructure
Chromosol	Predominant across site	Low	Low	Yes	Low	No	Low

Chromosol characteristics and management responses are provided in Table 5 of the Soil Survey Report for the proposed Jindera Solar Farm (Appendix J).

Results summary

The risk of erosion on-site due to construction activities is considered low due to the low relief and generally low salinity and sodicity of topsoils and subsoils. Excavation of subsoils should be limited where possible, and excavated subsoil should be stockpiled and contained to avoid potential dispersion and sediment transfer.

Groundcover around structures should be maintained where possible. Maintenance of groundcover will also aid in the prevention of topsoil loss from wind erosion. *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2A* and *2C* (DECC 2008) should be consulted further in the development of an Erosion and Sediment Control Plan (ESCP).

Acid sulphate soil is the common name given to naturally occurring soils containing iron sulphides. Exposure of the sulphides present in these soils to oxygen from drainage or excavation will lead to the generation of sulphuric acid. Field pH of these soils in their undisturbed state is generally pH 4 or less.

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 and floodplains, and sulphurous-smelling areas following rain after prolonged dry periods (Stone *et al.* 1998) after soil disturbance were not observed. There was no evidence of a jarositic horizon or jarosite precipitates or coatings on any root channels or cracks in the soil. The results of the soil survey indicate that acid sulphate soils are not present on site.

Current operational procedures include dryland cropping and grazing. Associated water features across the investigated area include 26 dams. There are no registered groundwater bores within 500 m of the site boundary. Most of the paddocks on the higher ground to the west had maintained stubble at the time of the investigation. 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.

7.1.4 Potential impacts

Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, cause soil erosion and subsequent sedimentation. Earthworks are required during 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, approximately 57,000 piles at approximately 20 cm x 20 cm will be pile driven into the ground = 0.23 ha of disturbance (0.07 % of the 337 ha development footprint).
- 12.3 km of track at worst case 6 m wide = 7.38 ha of disturbance (2.19 % of the 337 ha development footprint).
- Substation pad of 80 m x 80 m = 0.64 ha of disturbance (0.19 % of the 337 ha development footprint).
- 25 inverter transformer stations of 13 m x 2.5 m = 0.08 ha of disturbance (0.02 % of the 337 ha development footprint).
- BESS facility of 70 m x 30 m = 0.21 ha disturbance (0.06 % of the 337 ha development footprint).

Excavation of trenches for cabling will also be required up to 1,000 mm deep and 1,000 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 limit plant growth due to inadequate topsoil layer. Overall, these impacts would occur in small, discrete parts of the development site and are not considered substantial.

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.

Pile driving/screwing of steel posts supporting the arrays as well as installation of fencing uses light equipment within a small and discrete footprint and is unlikely to result in substantial disturbance of soils. The areas of disturbance would be sparsely distributed, and groundcover would be retained as far as possible prior to, during and post-construction.

Overall, the risk of erosion is considered low. With limited topographic relief, runoff is considered to be readily manageable and unlikely to cause substantial erosion or lead to substantial sediment loads entering any natural waterways. 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.

Greater Hume Shire LGA is not classed as an area identified by NSW Government (2015) as containing naturally occurring asbestos (NOA). Therefore, it is unlikely that the minor earthworks required during construction would impact on any NOA.

Operation

The solar farm design creates a combination of impermeable panel area and open-air space between the arrays. Typically, this open-air space is at least 4 m. Rainfall between the panels would not alter from the current land use situation.

The primary risk of erosion during operation is from concentrated runoff from the panels. Such runoff could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts. The soils have a moderate to severe erosion risk and retaining vegetation underneath the panels 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.

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 over undisturbed soils. This is expected to be infrequent and not likely to increase the erosion risk.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site.

Vegetation and ground habitats are also likely be affected by reduced insolation and temperature and increased humidity underneath the solar modules. Wind speeds may also be reduced.

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.

In the grazed paddocks, the mix of existing native and exotic pasture across the site may change initially due to shading following PV array installation. This is likely to be localised to areas subjected to permanent shading, a small part of the panel arrays where despite the movement of the array, light will not penetrate. 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, although 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.

Ground cover will be established and maintained in line with the Groundcover Management Plan.

By reducing cultivation activities less soil disturbance would be observed, 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 be observed until decommissioning, thus improving overall quality of the soil structure and reducing erosion potential.

7.1.5 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 7-3).

Table 7-3 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 Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: • 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. • 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.	**Prior to and during construction**		**D**

No.	Safeguards and mitigation measures	C	O	D
SO2	A Groundcover Management Plan would be developed 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: o Live grass cover would be maintained at or above 70% at alL times to protect soils, landscape function and water quality. o Any grazing stock would be removed from the site when cover falls below this level. o 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.	**Prior to 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**		
SO4	A comprehensive Fire Management and Emergency Response Plan (FMERP) 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**
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:	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Integrate project design with any site constraints. • Preserve and stabilise drainageways. • Minimise the extent and duration of disturbance. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. • Install perimeter controls. • Stabilise disturbed areas promptly. • Protect steep slopes. • Employ the use of sediment control measures to prevent off- and on-site damage. • Protect inlets, storm drain outlets and culverts. • Provide access and general construction controls. • Inspect and maintain sediment and erosion control measures regularly.			

C: Construction; O: Operation; D: Decommissioning

7.2 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER) AND HYDROLOGY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Water –

Including:

- *an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Dead Horse Creek and Kilnacroft Creek, drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulphate 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);*

DOI WATER REQUIREMENTS

- *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.*
- *Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the NRAR Guidelines for Controlled Activities on Waterfront Land (2012) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).*

OEH REQUIREMENTS

Flooding –

- *Confirmation from OEH was received regarding there were no major flooding issues on site and recommended using the standard DPE SEARs.*
- *A simple flow model is required for the purposes of identifying the major flow paths across the site that activate during intense rainfall events. This will help inform the location of major and sensitive infrastructure.*
- *SES related requirements would be addressed through certain emergency management measures.*

7.2.1 Existing environment

Surface water

The development site is in the Murray Local Land Services area and is located in the Upper Murray Catchment. The proposal is approximately 18 km north of the Murray River. Two ephemeral creek systems, Dead Horse Creek and Kilnacroft Creek, traverse the western side of the proposal. These two creeks are classified as 1st or 2nd order streams under the Strahler Stream Classification System (DPI 2018). These creeks are tributaries of Bowna Creek, which flows into the northern arm of Lake Hume.

Both creeks are identified as Class 4 under the Waterway Classification System (DPI 2018). This is described as unlikely fish habitat, and/or as a named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or few standing water or pools after rainfall events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present). However, development is not proposed within the creek lines, no riparian vegetation would be cleared, and a riparian vegetation zone buffer retained.

A large man-made dam/wetland also exists on the eastern portion of the development site. Development is not proposed in this area. As such, there is unlikely to be any impact to threatened aquatic systems in these areas. Nine smaller farm dams within the development footprint would, however, be removed.

A gilgai wetland depression (refer to Figure 3-7) is also located in the eastern portion of the development site. Development is not proposed for this area and therefore, there is unlikely to be any impact to threatened aquatic systems in this area.

Figure 7-3 Typical farm dam on the property

One wetland is situated within the development site that is a mapped wetland in the Greater Hume LEP 2012. It lies to the south of Glenellen Road and west of Ortlipp Road. Two other mapped wetland areas in the Greater Hume LEP 2012 are located adjacent to the development site; Gum Swamp, a large area to the north and a smaller wetland area south of Klinberg Road.

An investigation into Surface Water Management was undertaken by Strategic Environmental & Engineering Consulting (SEEC) for the proposed Jindera Solar Farm (Appendix K). The study used the Infoworks ICM to model rainfall/runoff for pre- and post- development flows through the 15 sub-catchments surrounding and incorporating the subject land for a 10% AEP and a 1% AEP. The model data was compared to the model data from the Australian Rainfall and Runoff (AR&R) Regional Flood Frequency Estimation (RFFE) model. The results indicate that the existing peak flow for the sub-catchments combined is 141.48 m^3s for a 10% AEP and 402.79 m^3s for a 1% AEP.

Upper Murray Catchment

The Upper Murray Catchment makes up around 2% of the Murray-Darling Basin (MDB) and contributes about 17% of the water to the MDB (Australian Government n.d.). Lake Hume, which has been operational since 1936, is the main operational storage for the Murray River system (Singh *et al.* 2018). Key water users of the Upper Murray Catchment include hydro-electricity, urban water supply, and stock and domestic.

Flooding

The development site is located within the Upper Murray River Catchment. The site is situated on undulating to flat terrain at an elevation of 220 - 240 m ASL.

A flood study for Jindera was commissioned by the Greater Hume Council. The Jindera Flood Study Report (GHD 2015) includes modelled data of flood levels around the township of Jindera. However, the development site is situated outside the extent of flood modelling. Kilnacroft Creek and Dead Horse Creek are minor tributaries of Bowna Creek, which feeds into Lake Hume.

A floodplain risk management study and plan for Jindera was also commissioned by the Greater Hume Council. The Jindera Floodplain Risk Management Study and Plan (GHD 2017) is a plan formally adopted by the Greater Hume Council. However, the development site lies outside the extent of this Plan.

Groundwater

No free groundwater or seepage was observed during pit excavations for the soil survey (refer to section 7.1). The maximum depth of excavations at the site was 1.5 m.

The development site is situated within an outcropped area of the Lachlan Fold Belt MDB Groundwater Source (NSW Government 2011) and falls under the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011 (NSW Government 2011).

Bores

There are no groundwater sites within the development site. The NSW DPI database of groundwater sites lists one bore within 2 km of the development site (146.859, -35.910). The status of this bore is not listed. The purpose of this bore is for stock and the drilled depth is 106.7 m(Figure 7-4).

Groundwater Dependent Ecosystems (GDEs)

High potential for aquatic groundwater dependant ecosystems (GDE) is shown in the man-made dam/wetland on the eastern portion of the proposal, with a low to high potential for terrestrial GDE across the site (Figure 7-5). These areas are, however, located within proposed retained vegetation. As such, there is a low potential for groundwater to be encountered during excavations and earthwork for the construction. This is likely to be highly localised and no inception of groundwater is considered.

Aquatic Biodiversity

Species that could potentially be impacted under the *Fisheries Management Act 1994* were assessed in Table 7-4. It was determined that there would be no impact to aquatic biodiversity as a result of the proposed works due to the large man-made wetland being retained on-site, no work would be undertaken in Dead Horse Creek and Kilnacroft Creek, which traverse the site, and riparian vegetation would not be impacted.

Figure 7-4 Groundwater works in the area (NSW DPI 2019). The solar subject land is indicated by the red line.

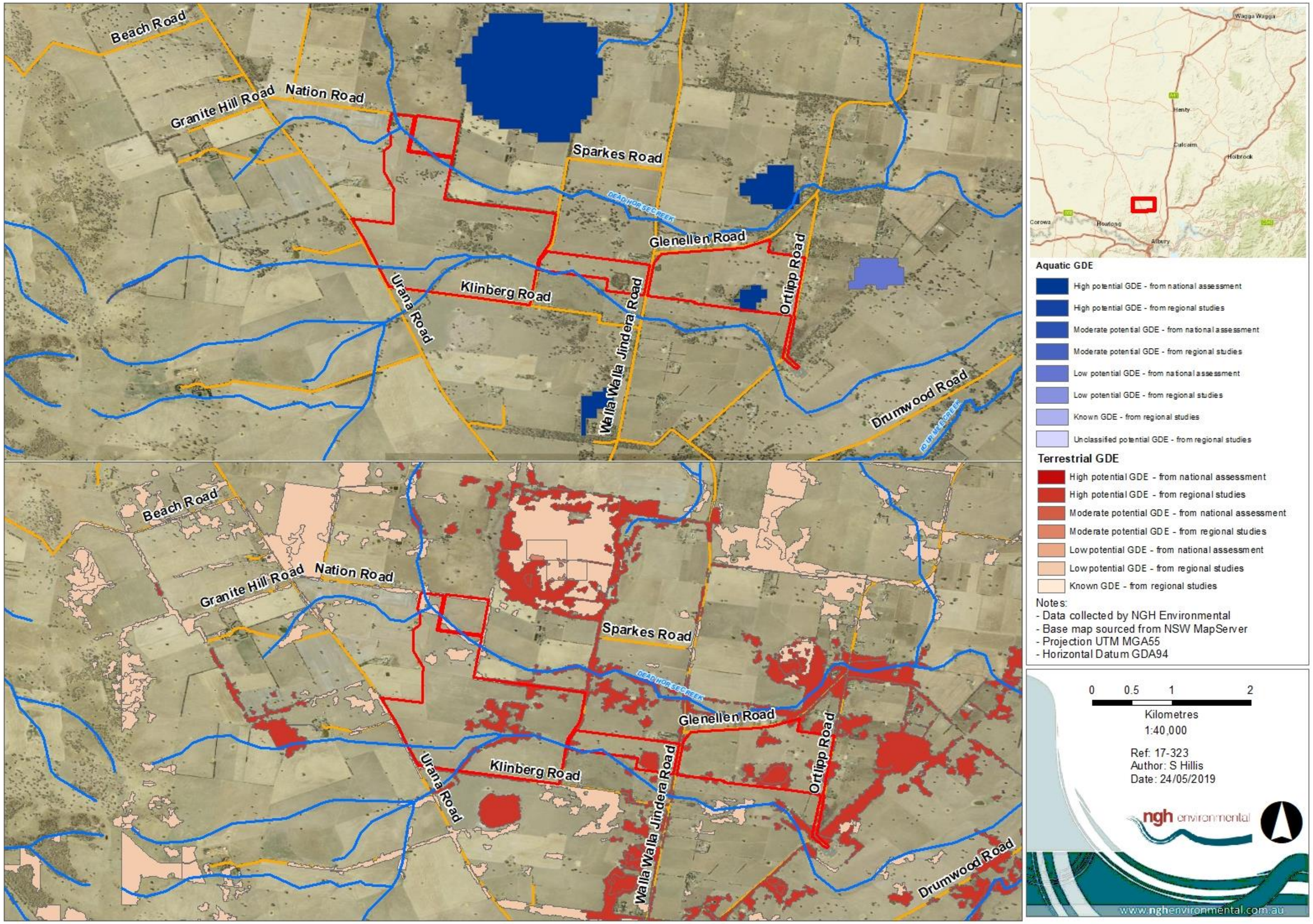

Figure 7-5 Aquatic and terrestrial GDEs in proximity to the development site

Table 7-4 Habitat assessment for threatened species listed under the *Fisheries Management Act 1994.*

Species and Status	Description of habitat[2]	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.	**No** No suitable permanent water. Above 150 m in altitude.	**Unlikely** Outside of known species distribution.	**No** No suitable habitat in study area.
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 of historic and indicative 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.
Eastern Freshwater Cod *Maccullochella ikei* E FM	Clear flowing rivers with rocky substrate and large amounts of in-stream cover.	**No** No flowing rivers.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.

[2] 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[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
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, vegetated habitats in small streams, lakes, billabongs and wetlands.	**No** No flowing or suitable permanent water.	**Unlikely** Outside species 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.	**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.	**Unlikely** Within species distribution.	**No** No suitable habitat in study area.
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.	**Unlikely** 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** Outisde species distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
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.
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.
Grey Nurse Shark *Carcharias taurus* CE FM	Inshore coastal waters along coast of NSW and southern Queensland.	**No** No coastal habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Scalloped Hammerhead Shark *Sphyrna lewini* E FM	Tropical and warm temperate seas between 45°N and 34°S, inshore and over continental shelf and in adjacent deep water from surface to at least 275 m depth.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Great Hammerhead Shark _Sphyrna mokarran_ V FM	Occurs along coastlines, continental shelves and adjacent drop-offs to about 80 m depth.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
White Shark _Carcharodon carcharias_ V FM	Inshore habitats to outer continental shelf and slope areas.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Southern Bluefin Tuna _Thunnus maccoyii_ E FM	Oceanic waters on seaward side of continental shelf.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Black Rockcod _Epinephelus daemelii_ V FM	Caves, gutters and beneath bommies on rocky reefs, from near shore environments to depths of at least 50 m.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Invertebrates				
Darling River Snail _Notopala sublineata_ CE FM	Darling River and its tributaries. Artificially introduced hard surfaces including irrigation pipelines.	**No** No artificial surfaces in waterways.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Hanley's River Snail _Notopala hanleyi_ CE FM	Artificially introduced hard surfaces including irrigation pipelines.	**No** No artificial surfaces in waterways.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.
Fitzroy Falls Spiny Crayfish _Euastachus dharawalus_ CE FM	Creates burrows in soft stream bed below waterline.	**No** No suitable permanent streams.	**Unlikely** Outside species distribution.	**No** No suitable habitat in study area.

Species and Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Murray Crayfish *Euastachus 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.	**Possible** Within species distribution.	**No** No suitable habitat in study area.
Marine Slug *Smeagol hilaris* CE FM	Small isolated location at Merry Beach, south of Ulladulla, NSW.	**No** No marine 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.
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.
Bousfield Marsh Hopper *Microrchestia bousfieldi* V FM	Mangrove swamps and salt marshes in eastern Australia.	**No** No coastal habitat.	**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.
Plants				

Species and Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Marine Brown Alga *Nereia lophocladia* CE FM	Port Phillip Heads in Victoria and Muttonbird Island, Coffs Harbour in NSW.	**No** No coastal habitat.	**No** Outside species distribution.	**No** No suitable habitat in study area.
Posidonia australis seagrass, Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations EP FM	Coarse sandy to fine silty sediments between the low tide and approximately 10 m in depth.	**No** No marine 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.
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.	**No** Ephemeral stream is tributary Bowna Creek that flows into the northern arm of Lake Hume.	**Unlikely** Within community distribution.	**No** No riparian vegetation impacted.

Species and Status	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Snowy River aquatic ecological community EEC FM	Rivers, creeks and streams of the Snowy River catchment. This includes Snowy, Eucumbene, Thredbo (or Crackenback), Gungarlin Mowamba, Bombala, McLaughlin, Delegate, Pinch and Jacobs Rivers and their tributaries.	**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.*

7.2.2 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 30 ML in total. About 1.2 ML potable water would be required for employees and contractors (refer to Table 7-5).

Table 7-5 Water requirements during construction

Water quality	Annual construction water requirement (ML)	Potential sources	Availability
Potable (drinking)	1.2 (for ~12 months)	Bottled water	Available as required – commercial supply
Non-potable	30 (for ~12 months)	Truck delivery	Available as required

All non-potable water would be sourced from the Greater Hume Council standpipe.

Water demand for the proposal would be relatively small as construction of the solar farm is not water intensive. Approval in principle has been granted from the Greater Hume Shire for use of a standpipe in Jindera for water extraction. Water can be accessed there and transported to site. Council would then invoice for water usage per kilolitre. No surface or groundwater extraction of water is required.

Surface Water Quality

The proposal would not directly affect surface water quality during construction. The wetland would be retained, and works would be avoided within Kilnacroft Creek and Dead Horse Creek. There would be no removal or impact to riparian vegetation. During the construction of the proposed overhead transmission line from the proposed site substation to the existing 132 kV transmission lines along Ortlipp Road, any works within the riparian areas can be completely avoided.

Indirectly, the proposed works would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff. This could affect water quality of local water ways during rainfall events. These potential impacts are discussed in Section 7.1 and are unlikely to significantly impact on water quality.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides, none of which is considered difficult to manage.

Detention basins, 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 7.1.

Groundwater

Ground water extraction is not required during construction. 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. Areas with high potential aquatic and terrestrial GDEs across the site would not be impacted by construction activities.

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 1.2 ML 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 dependent on weather. Some solar plants are never cleaned, others require more than two cleanings per year. Should water be required, it would be trucked in from a Greater Hume Council standpipe.

The toilet facilities would be connected to a septic tank installed in line with Greater Hume Council requirements.

Approval under Section 68 of the *Local Government Act* is required to operate an onsite sewage management system and to draw water from a council standpipe. Permission for use of the Council standpipe has been provided in Appendix C.1.

Surface Water

The model results from the SEEC Surface Water Management Investigation (Appendix K) for the proposed Jindera Solar Farm indicate that post-development peak flow for the sub-catchments combined is 141.86 m^3s or 0.3% increase for a 10% AEP and 403.25 m^3s or 0.1% increase for a 1% AEP.

The slight increase in peak flow during solar farm operation for a 10% AEP and 1% AEP are not expected to cause any impact downstream or be a nuisance for any downstream property owners (Appendix K).

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 development site is 404 ha and contains 26 farm dams, a man-made wetland and two creeks. Nine farm dams are currently a constraint for the solar farm and would be filled in. The creeks and man-made wetland will remain unimpacted. A site water balance has been calculated for the development site once in operation with the existing creeks, wetland and remaining farm dams. The development site would remain vegetated except for internal access tracks, the hardstands and gravel compounds. The substation would be a gravelled hardstand area. The runoff coefficient was used from the Wagga Wagga City Council Engineering Guidelines (WWCC 2017) as this information was not available for Greater Hume Council. The engineering guidelines were developed from work involving Wagga Wagga, Griffith, Albury, Wodonga and other Councils. The conservative runoff coefficients that have been used are presented in Table 7-6.

Table 7-6 Runoff coefficients

Feature	Fraction impervious	Runoff coefficient
Development site	0.0	0.18
Compacted gravel hardstands and roads	0.8	0.72

Water balance calculations used the design rainfall event for a 63.2% Annual Exceedance Probability (AEP) for a 24-hour period. The latest 2016 rainfall Intensity Frequency Duration (IFD) data was obtained from the Bureau of Meteorology (BOM). The IFD Design Rainfall Depth for the proposal (-35.913, 146.8868) for a 63.2% AEP with a 24-hour duration is 44.7 mm. This is a conservative figure when compared to the average decile 5 (median) rainfall statistic of 43.9 mm sourced from the Albury Airport Automatic Weather Station (site number 072160, 36.07°S, 146.95°E), which has a continuous record for 25 years. Table 7-7 presents the land size, precipitation volume for the design rainfall event and runoff for each feature.

Table 7-7 Site water balance for the operational phase of the proposed Jindera Solar Farm using a design rainfall event of 63.2% AEP 24-hour duration.

Feature	Fraction impervious	Size (m^2)	63.2% AEP 24 hour (m^3)	Runoff (m^3)	Comment
Development site	0.0	3081364	137737	0	Vegetated component of development site not including panelled areas (80 ha), channels, dams, hardstands, roads, inverter and battery hardstands or the substation.
Dead Horse Creek and Kilnacroft Creek	-	3871	173	0	It is expected that 100% of the precipitation on to the channel will either leave the site or be contained within these ephemeral channels. Channel widths vary, an average of 1 m width was used.
Wetland and remaining dams	-	65022	2907	0	Assuming the dams are half full. Assuming each dam is approximately 2 m deep, the total free volume would be 65,022 m^3.

Feature	Fraction impervious	Size (m^2)	63.2% AEP 24 hour (m^3)	Runoff (m^3)	Comment
Solar Panelled Area	0.1	800000	35760	3576	Assuming 10% imperviousness (Appendix K).
Internal gravel roads	0.8	61500	2749	1979	Including associated drainage if required.
Gravel compound areas	0.8	20430	913	658	
Inverter and BESS gravel hardstands	0.8	813	36	26	
Substation	0.8	7000	313	225	
Total (m^3)		4,040,000	180,588	**6,464**	

A total of 181 ML of rainfall falls within the boundary of the development site during a 63.2% AEP for a 24-hour duration. Of this volume of rainfall, 3.9% or 7 ML is runoff due to the impervious nature of the compaction of the gravel roads, hardstands, solar panelled area and substation. The majority of the site would remain vegetated and uncompacted and therefore, remain pervious.

The development would be compatible with any flood hazards identified in the mapping. The requirements of the EIS assessment for flooding are outlined in Table 7-8 below.

Table 7-8 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 25 inverter stations will be installed on concrete footings above gravel hardstands, 0.3 m above the ground. The BESS units will be installed on concrete footings on the gravel hardstand in the substation compound, 0.3 m above the ground. • The switch room and storage shed will be built on concrete footings 0.3 m above ground level on the gravel substation compound. • The site office would be erected on concrete footings 0.3 m above a gravel 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 for a 63.2% AEP 24-hour duration would increase by around 3.9% due to the addition of the beforementioned impervious surfaces. • Security fencing would be around 2 m high and surround the perimeter of the proposal and the substation. It is unlikely that this infrastructure would

	have an impact on floodwater. On-site floodways (Dead Horse Creek and Kilnacroft Creek) would remain unimpacted and assist in the removal of floodwater.
Location of critical infrastructure in relation to flood storage areas.	• The Dead Horse Creek and Kilnacroft Creek that traverse the development site would act as floodways. Infrastructure would be limited in these areas. • Removal of on-site flood storage areas will result from the filling of the nine 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.

Aquatic Biodiversity

No impact to aquatic biodiversity is expected as a result of the operation of the facility.

7.2.3 Safeguards and mitigation measures

Table 7-9 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**
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 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 to minimise the area of disturbance, runoff and pollutant generation.	**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**
WA9	Infrastructure should not be located in the overland flow channels to preserve the alignment and capacity of any natural drainage corridors.	**Design stage**		

No.	Safeguards and mitigation measures	C	O	D
WA10	Maintain minimal earthworks across the site and maintain the general slope of the land to reduce the potential of concentrated flows across the site.	**C**	**O**	**D**
WA11	Limit increases in runoff velocities and pollutants.	**C**	**O**	
WA12	Provide and maintain a stable coverage of grass / vegetation under and around the solar panels to encourage natural infiltration and prevention of flow concentration.		**O**	**D**
WA13	Re-use of stormwater should be considered wherever possible.		**O**	
WA14	Inspect stormwater control measures at least quarterly, and before and after rainfall of more than 10 mm in 24 hours.	**C**	**O**	

C: Construction; O: Operation; D: Decommissioning

7.3 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 peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;*
- *An assessment of the likely transport impacts to the site access route (including Urana Road, Walla Walla – Jindera Road, Glenellen Road, Klinbergs Lane and Sparkes Road), site access point, rail safety issues, any Crown land, particularly in relation to the capacity and condition of the roads;*
- *A cumulative impact assessment of traffic from nearby developments;*
- *A description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);*
- *A description of the measures that would be implemented to mitigate any transport impacts during construction; and*
- *Demonstration of consideration of potential cost-sharing of road upgrades with Glenellen Solar Farm.*

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.*

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. This is referred to in the submitted Preliminary Environmental Assessment Report. Details for deliveries of ancillary materials, such as gravel and concrete, should also be addressed 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.

The submitted plans indicate that access is proposed to Urana Road (MR125) and the Walla Walla Jindera Road (MR547) as the primary access rather than to the local road network, therefore the provisions of State Environmental Planning Policy (Infrastructure) particularly Clause 101 need to be addressed as part of the supporting documentation to be submitted with the application the proposed development.

Further to the above it is understood that a development proposal for the Glenellen solar farm project (SSD 9550) is being prepared for a nearby site. The potential for both projects being constructed at the same time needs to be considered. Therefore, unless it is guaranteed that the construction of these 2 projects will not coincide the cumulative traffic impacts of the simultaneous construction of both of these projects needs to be addressed as part of the TIA.

*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.*

GREATER HUME SHIRE COUNCIL REQUIREMENTS

Traffic assessment to include cumulative impacts of the possibility of an adjacent large scale solar development being constructed concurrently to this proposal.

7.3.1 Existing environment

Regional road network

Urana Road is an RMS regional road that runs in a northwest-southeast alignment in the vicinity of the site. It has a sealed road width of approximately 8 metres, accommodating one traffic lane in each direction. Urana Road has a posted speed limit of 100 km/h.

Urana Road is an approved RMS route for 26 m B-double trucks (General Mass Limits Network).

Local road network

Urana Street continues on from Urana Road at Quartz Hills Road, through Jindera before continuing on as Urana Road. It has a varying road width through Jindera, accommodating one lane of traffic in each direction and on-street parking along both sides of the road through the town. Urana Street has a posted speed limit of 50km/h.

Walla Walla Jindera Road is a local road under the care and management of Greater Hume Council (Council), that generally runs in a north-south alignment. Within the vicinity of the site, it has a sealed road width of approximately 7.5m, accommodating one traffic lane in each direction. Walla Walla Jindera Road has a speed limit of 100km/h.

Ortlipp Road is a local road under the care and management of Council that generally runs in a north-south alignment. Within the vicinity of the site, it has an unsealed road surface with a width of approximately 6m. Ortlipp Road is accessed via Lindner Road, which connects with Walla Walla Jindera Road. The intersection of Ortlipp Road / Lindner Road is designed to cater for heavy vehicles with large radii turns.

All of the above roads are approved RMS route for 26 m B-double trucks (General Mass Limits Network).

Additionally, the unformed crown road south of Sparkes Road would be impacted. This unformed road carries no traffic.

Traffic volumes

Traffic volumes were obtained from RMS traffic volume viewer for Urana Road and Walla Walla Jindera Road, with the most recent volumes available being recorded in 2010. The volumes were recorded at the following locations:

- Urana Road, between Hueske Road and Jelbart Road, recorded an ADT volume of 4,170 vehicles per day (vpd).
- Walla Walla Jindera Road, between Wehner Road and Five Chain Road, recorded an ADT volume of 889 vpd.

It is considered that a growth rate of 1% per annum be applied to approximate current levels of traffic, given the rural nature of the road network. It is therefore estimated that Urana Road and Walla Walla Jindera Road currently carry in the order of 4,600 vpd and 1,000 vpd respectively, which would result in approximate two-way peak hourly volumes of 740 and 160 vehicles per hour (vph) respectively.

Traffic volume data for the remaining roads are unknown, however given the rural and unsealed nature of the road network, it is not expected that daily traffic volumes are of considerable levels.

7.3.2 Traffic generation

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 and associated construction materials will occur over an approximate 12-month construction period, generating up to 100 light vehicles (200 vehicle movements) and 20 trucks (40 vehicle movements) daily during the peak construction period, which is expected to last for approximately three months. 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. It is expected for a total of 27 over-mass vehicles to access the site during the 12-month construction period (Table 7-10).

The largest design vehicle expected to access the site is a 26m B-double truck, with the typical mass associated with a vehicle of that size and nature. It is noted that while the majority of construction vehicles are expected to be 19m AVs (Articulated Vehicle as defined in AS 2890.2:2002) or smaller, anything exceeding the general mass limit will require a permit from the National Heavy Vehicle Register (NHVR).

Given the proposed site layout plan has approximately two-thirds of the solar farm to the west of Walla Walla Jindera Road and one-third to the east of Walla Walla Jindera Road, it is expected that the construction heavy vehicle delivery pattern would generally follow this distribution. It is expected that the heavy vehicle movements will be scheduled throughout the day, resulting in a steady distribution of construction heavy vehicle traffic to/from the site access points, and minimising simultaneous heavy vehicle movements. Assuming an eight-hour delivery window, this results in approximately five heavy vehicle movements to/from the site during peak construction periods, or 5 vph. It is important to note that these movements will be spread across Access Points 1 to 3, greatly reducing the potential of conflicting heavy vehicle movements in the vicinity of the site and each access point.

Accordingly, it is expected that during peak construction periods, up to 242 vehicle movements per day will be generated by construction activities across the site, spread across the various access points. This is comprised of up to 200 light vehicle movements (100 vpd in and 100 vpd out of the site) outside of construction hours, 40 heavy vehicle movements regularly scheduled throughout the day, and occasionally one over-mass vehicle (Table 7-10).

Table 7-10 Expected trip generation during construction and operation

Phase	Expected maximum number of vehicles per day	Maximum number of vehicle movements per day (vpd)
Construction	20 heavy vehicles	40 vpd
	100 light vehicles	200 vpd
	Average of 1 over-mass vehicle each fortnight	2 vpd
TOTAL		**242 vpd**
Operation	1 heavy vehicle	2 vpd
	2 light vehicles	4 vpd

7.3.3 Construction site access

It is proposed to provide construction access to/from the site via Urana Road and Walla Walla Jindera Road in 3 locations. The proposed site accesses will be designed to accommodate the largest vehicle expected to access the site, which is understood to be an 26m B-double truck. Emergency access to the site will be available from 2 locations on Klinberg Road and Ortlipp Road, however this will not be used as general construction access.

Due to the scheduling of construction for each site, it is anticipated that only one of the three sites will be required to cater for deliveries at any one time, such that there would be no conflicting movements between heavy vehicle movements at different site accesses. All of these movements will be regulated as described previously, in order to minimise simultaneous opposing heavy vehicle movements. All heavy vehicle movements will be arriving to the sites via Urana Road (from the south) and exiting via the same route (toward the south).

The accesses and on-site facilities will be designed such that all construction vehicles will be able to enter and exit the sites in a forward direction. Traffic management processes are proposed to be implemented to coordinate movements into and out of each site, specifically at the Walla Walla Jindera site access where a priority-controlled cross junction will be formed. It is anticipated that these movements would be controlled via a traffic controller to safely allow heavy vehicle movements to/from Walla Walla Jindera Road.

Urana Road / Walla Walla Jindera Road intersection

Heavy vehicles accessing the site via Walla Walla Jindera Road are required to travel through the Urana Road / Walla Walla Jindera Road intersection, performing a right turn manoeuvre in the northbound direction and a left turn manoeuvre in the southbound direction. A swept path assessment has been undertaken using the AutoTurn software package by Stantec to assess the appropriateness of the existing intersection layout for these movements. The assessment is included in Figure 7-6, and it is considered that the intersection in its current layout can satisfactorily accommodate two-way simultaneous movements for 26m B-double trucks.

Urana Road

Austroads Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings specifies the turning treatments required at intersections.

it is estimated that Urana Road currently carries in the order of 740 vph during peak hours. The turning volume per hour is approximated to be a combined 5 vph across all site accesses, and as such would be expected to be less than 5 vph for the Urana Road access (total movements into and out of the site). Accordingly, it is recommended that the site access provides a Basic Right Turn (BAR) turning treatment.

Figure 7-7 shows the proposed intersection design, which is based on a 26 metre B-double as the design vehicle. The swept path assessment, created using the software package ‘AutoTurn’, is shown in Figure 7-8. Accordingly, the proposed intersection turning treatments have been appropriately designed and in accordance with the Austroads dimensional requirements.

Walla Walla Jindera Road

It is proposed to provide a site access on either side of Walla Walla Jindera Road to the south of Glenellen Road. The two accesses are proposed to be located directly opposite one another. Heavy vehicle construction traffic is proposed to be regulated throughout each day via delivery scheduling and radio / phone communication. One vehicle movement per 12 minutes is expected throughout each day, divided across each of the three main access points. Vehicle movements are expected to be coordinated such that inbound vehicle movements have priority over outbound vehicle movements, thereby reducing any queuing impacts on the local road network.

All vehicles would be arriving from and departing to the south, and as such a situation involving simultaneous right turn movements out of or into the site would not occur. In the rare event whereby two vehicles would be simultaneously exiting from the Walla Walla Jindera Road access, the movements would be coordinated to allow each vehicle to turn out onto Walla Walla Jindera Road safely.

As such, it is considered that the access arrangements on Walla Walla Jindera Road are satisfactory to accommodate the proposed construction heavy vehicle activity.

7.3.4 Operational site access

Operational maintenance and emergency access will primarily be from the 3 major construction access points on Urana Road and Walla Walla Jindera Road. The 2 nominated emergency access points from Klinberg Road and Ortlipp Road will be used for emergency access only.

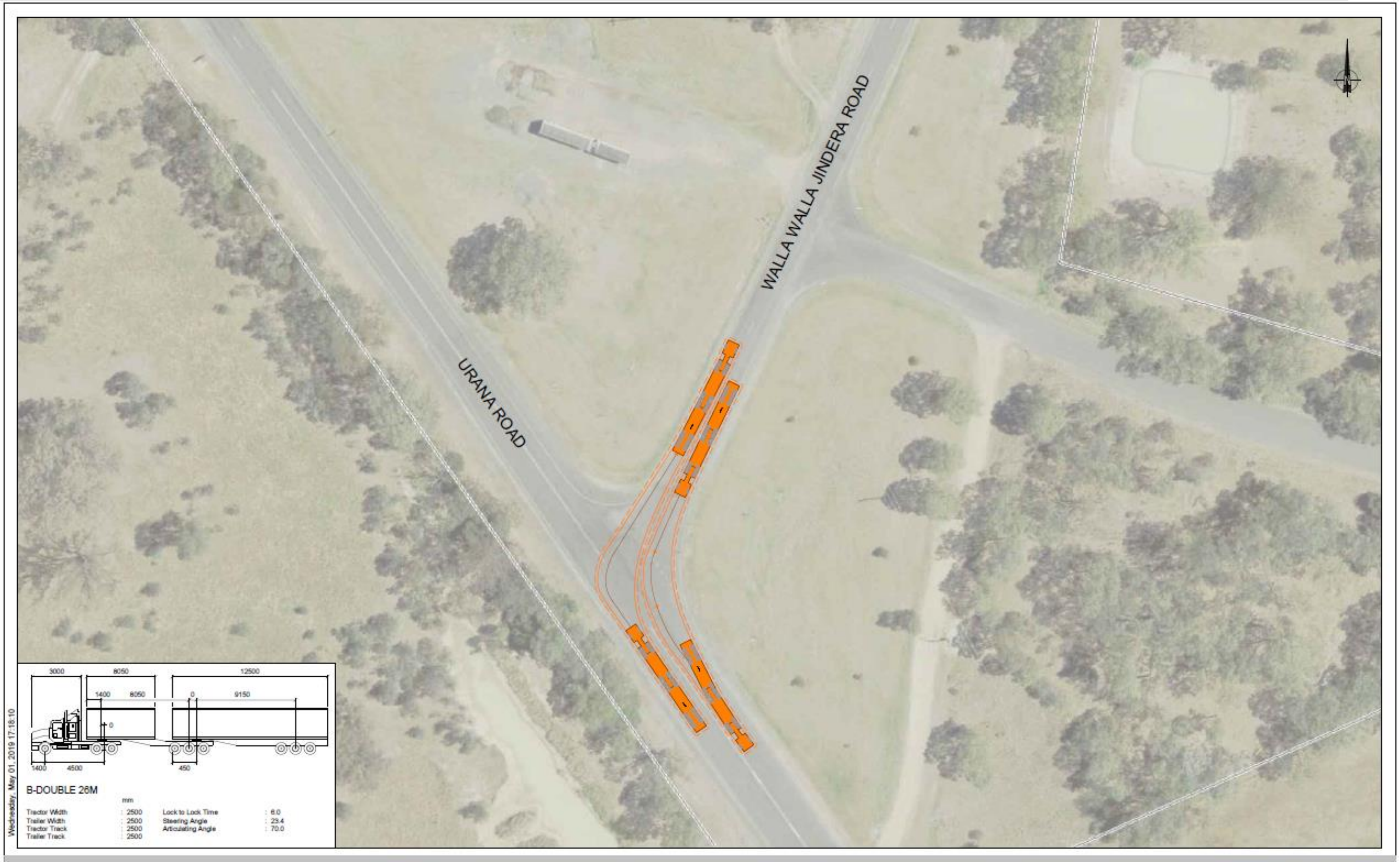

Figure 7-6 Swept-path analysis for turning vehicles from Urana Road to Walla Walla Jindera Road

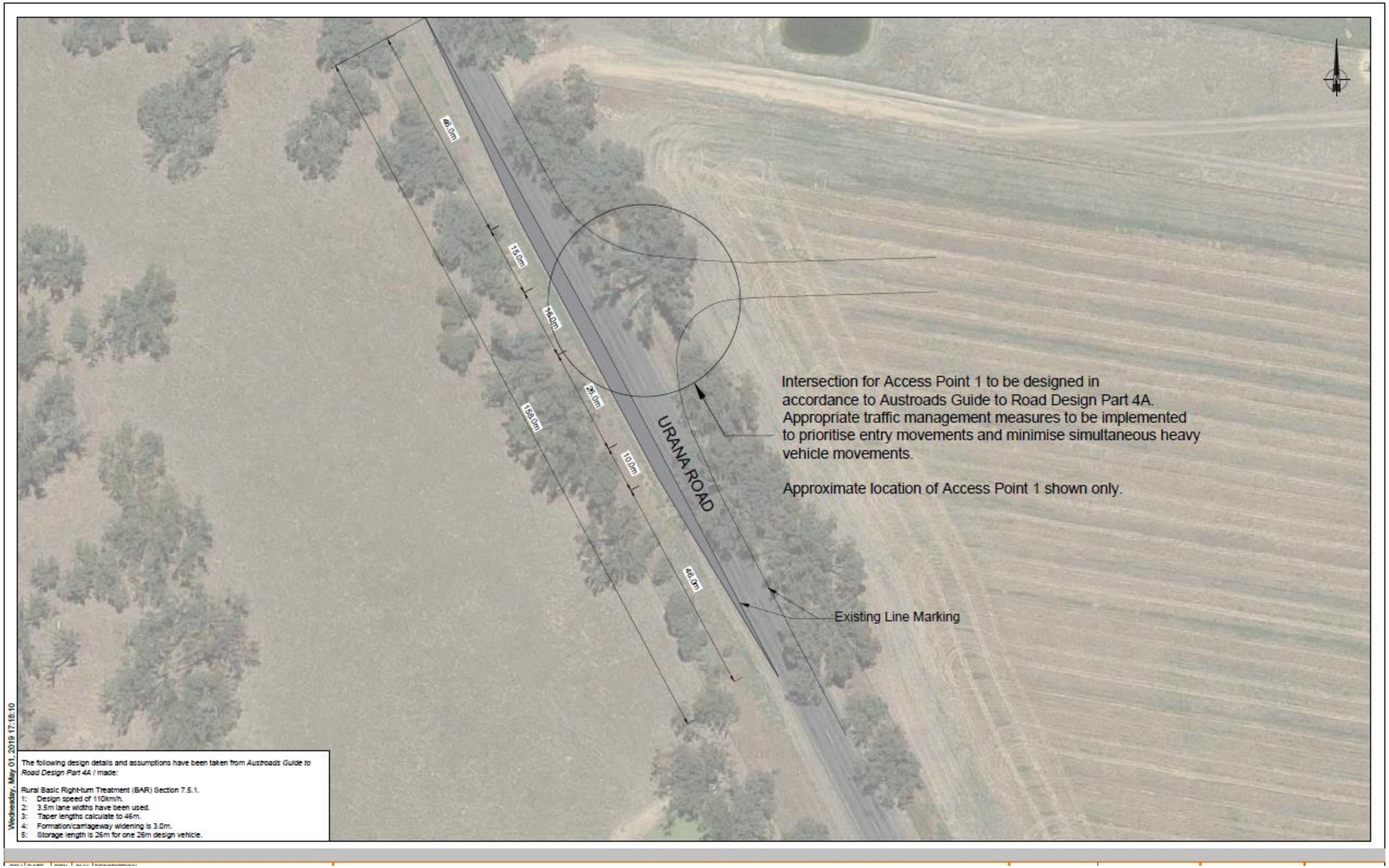

Figure 7-7 Turning treatment (Basic Right Turn) from Urana Road to the proposal

Figure 7-8 Swept-path analysis for turning vehicles from Urana Road to the site and vice versa

7.3.5 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. Car pooling is recommended 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.
- Solar substation and BESS facility.

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 Melbourne. From Sydney, the route would likely include the South Western Motorway (M5), the Hume Highway (M31), Wagga Road and Urana Road. From

Melbourne, the route would likely include the Hume Highway (M31), and Urana Road. The proposed route brings traffic through the industrial area of Lavington and Albury, rather than bypassing a large number of residences.

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

Approximately 40 employees would be required during the first month of construction, rising to 200 employees during the peak construction period (approximately 3 months duration). During peak construction time, approximately 200 employee vehicle movements per day to and from the site are predicted (including light vehicles).

On average, approximately 10 trucks will access the site per day throughout the construction period, with an expected peak of 20 trucks in the early weeks of construction and during peak construction. The delivery trucks will predominantly be 19 metre articulated vehicles, with a number of larger B-doubles.

Accordingly, during the peak construction period of the solar farm it is assumed that the site is expected to generate approximately 40 heavy vehicle movements per day.

Increased Collision Risk

The increased collision risk relates primarily to traffic entering and exiting the site from Urana and Walla Walla Jindera Roads. This relates to both oncoming traffic and traffic following vehicles that are turning on and off Urana Road and Walla Walla Jindera Road.

Damage to Road Infrastructure

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along Urana Road, the impact is expected to be negligible due to the existing capacity of the road network. However, the impact of turning traffic at the Urana Road / Walla Walla Jindera Road intersection would likely require monitoring to ensure that the road is maintained in an adequate condition.

Associated Noise and Dust

The increase in traffic during construction and decommissioning may increase noise and dust in the local area, particularly on the unsealed portion of Ortlipp Road. Impacts from dust generated from the proposed activity, including that associated with increased traffic is considered in Section 7.4.

The increase in traffic and heavy vehicle movement during construction and decommission would result in a minor increase in noise as a result of the proposed works. The traffic noise during construction and decommission would be unlikely to be noticeable at the nearest sensitive receiver.

Disruption to Existing Services

Increased traffic 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.

Transmission line installation works, where overhead, may cause minor traffic delays for works undertaken in the Ortlipp Road reserve. Temporary local traffic delays may be expected if lane closures or speed limit restrictions are implemented as traffic management controls. Where cabling crosses Walla Jindera Road and the unformed crown road south of Sparkes Road, underground cabling would be used and no impact on local traffic would result.

Summary of Construction and Decommissioning Impacts

Overall, the additional traffic associated with the construction and decommissioning of the solar farm would be a small component of the existing traffic loads on local and state roads. 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

Vehicles would use the designated road network to access the site and travel within the site during the operational phase. Up to two cars per day would be expected during normal operation of the solar farm. 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.

Additional risks to road safety from operational traffic would be minimal.

7.3.6 Cumulative Impacts

Glenellen Solar Farm

Access Routes

The proposed Glenellen Solar Farm is located 600m south-east of Jindera Solar Farm. Glenellen Solar Farm would be accessed via Walla Walla Jindera Road, Lindner Road and Ortlipp Road, with the route to still be confirmed. In the unlikely event that both solar farms are constructed at the same time, this route may be potentially shared concurrently with construction heavy vehicles associated with the construction of the Jindera solar farm. The more likely scenario is that these roads would be used by both solar farm construction vehicles, but not at the same time. The Lindner Road / Ortlipp Road route is only proposed to be used sporadically by the over-mass heavy vehicles for the Jindera solar farm (one vehicle per fortnight), accompanied by the appropriate traffic management measures. If the two construction periods overlap, it is not expected that the combined effects of both solar farms would have a considerable impact on the operations of Lindner Road or Ortlipp Road.

The proposed heavy vehicle access route for Glenellen Solar Farm during construction is via Urana Road and Walla Walla Jindera Road. Maintenance and emergency vehicles for Glenellen Solar Farm are proposed to access the site via Lindner Road and Ortlipp Road. This route may be shared with heavy vehicles during construction of the Glenellen solar farm, subject to Development Application approval

The Lindner Road / Ortlipp Road route is only proposed to be used as a maintenance and emergency vehicle access during both the construction and maintenance phases, with no construction vehicles associated with the Jindera solar farm accessing the site via this route.

Traffic Generation – Construction

Peak construction traffic was estimated for Glenellen Solar farm based on the size of Glenellen relative to the proposed Jindera Solar Farm. It has been conservatively estimated that the Glenellen solar farm represents 150% of the proposed solar farm traffic, and accordingly the following traffic generation numbers have been estimated:

- 60 heavy vehicle movements per day.
- 300 light vehicle movements per day.
- 1 over-mass/over-size vehicle every fortnight.

Heavy vehicles accessing the site via Walla Walla Jindera Road are required to travel through the Urana Road / Walla Walla Jindera Road intersection. The temporary addition of construction heavy vehicle traffic through the intersection associated with both the proposed Jindera Solar Farm and Glenellen Solar Farm may impact upon traffic. A preliminary assessment was carried out by Stantec to determine the appropriate intersection layout to facilitate additional heavy vehicle movements (refer to Appendix H). The peak hour light and heavy vehicle movements generated for both sites during peak construction were calculated (Table 7-11).

Table 7-11 Jindera and Glenellen Solar Farm combined peak hour traffic generation during peak construction.

Peak Hour	Urana Road Right Turn Movements			Walla Walla Jindera Road Left Turn Movements		
	Light Vehicles (vph)	Heavy Vehicles (vph)	Total (vph)	Light Vehicles (vph)	Heavy Vehicles (vph)	Total (vph)
Am Peak Hour	250	5	255	0	5	5
Pm Peak Hour	0	5	5	250	5	255

The assessment determined that a Channelised Right Turn (CHR) be provided on Urana Road to facilitate these additional movements. Stantec also recommended that a dedicated right turn lane should be provided on Urana Road in order to safely accommodate larger vehicles. This would occur within the area of the existing road formation and would not result in further impacts upon biodiversity.

Traffic Generation – Operation

During operation of the proposed Glenellen Solar the daily level of traffic expected to be generated is expected to be minimal, and similar to that of the proposed Jindera solar farm.

7.3.7 Safeguards and mitigation measures

Table 7-12 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.). • All heavy vehicle movements to/from each access point are to be managed to ensure that only one inbound or outbound vehicle is travelling along the access route in the vicinity of the site at a time. • Heavy vehicle movements into and out of Walla Walla Jindera Road will be controlled via traffic management means, including a traffic	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	controller, temporary lowered speed limit and additional road signage alerting vehicles of truck movements in the area.			
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 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. • If the construction and operation of the proposed Glenellen Solar Farm coincides with the proposal the traffic management plan would address cumulative impacts.	**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 consult with Greater Hume Shire Council and RMS regarding the proposed upgrade of Urana Road for site access. The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT5	If the construction of the Glenellen Solar Farm coincides with the proposal, additional consultation will be undertaken with Greater Hume Shire Council, RMS and the developers of Glenellen Solar Farm, CTP.	**C**	O	
TT6	If Glenellen Solar Farm and the proposal receive planning approval, consultation between both proponents would occur and would consider the option of cost sharing the road upgrades.	**Design Stage**		
TT7	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	**C**		**D**
TT8	The proponent would 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**
TT9	Prior to the commencement of construction on-site, the Proponent would 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**
TT10	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

7.4 CLIMATE AND AIR QUALITY

7.4.1 Existing environment

Climate

The Greater Hume LGA is part of the NSW South Western Slopes Bioregion, Lower Slopes subregion. This bioregion is dominated by a sub-humid climate that generally experiences hot summers and cool wet winters (OEH 2016). The BOM (2018) temperature records available from the nearest long-term climate station at Albury Airport (station no. 072160) indicate a mean summer maximum of 32.3 °C (January) and a mean winter minimum of 3.1 °C (July) (Figure 7-9). The BOM (2018b) rainfall records from the same station show a mean annual rainfall of 623.7 mm, and that rainfall is generally greatest over winter and spring, with the average monthly maximum occurring in August (66.5 mm).

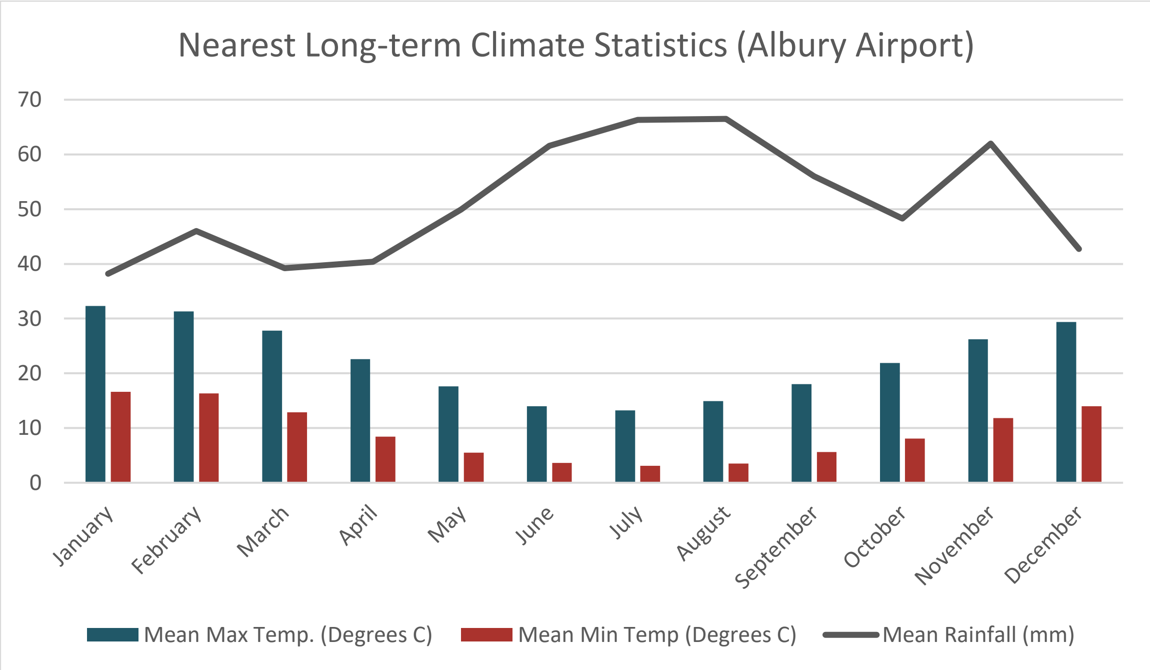

Figure 7-9 Climate statistics for Albury Airport (BOM 2018).

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, burning of paddocks or earth moving.

A search of the National Pollutant Inventory (Australian Government 2018) identified five substance emissions facilities located within the Greater Hume LGA, which include:

- Albury Galvanizing Pty Ltd, Jindera;
- APT Management Services Pty Ltd, Culcairn;
- Boral CSR Bricks Pty Ltd, Jindera;
- Boral Resources (Country) Pty Ltd, Culcairn; and
- Rivalea (Australia) Pty Ltd, Bungowannah.

There is one residence within the development site, and adjoining land uses include grazing and cropping for agriculture. Two properties have been identified as being involved with the project, with an additional 23 uninvolved neighbours, 4 unoccupied residences and 9 vacant properties within 1 km of the site. Topography of the development site is undulating to flat and there is minimal vegetation screening the development site.

Criteria

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m^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 decline 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.

7.4.2 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 (Dean and Green 2017). 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 the unsealed access road during construction and decommissioning of the proposed solar farm. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving or lead to adverse health impacts when severe or prolonged (Dean and Green 2017). Emission of GHGs are likely to contribute to climate change.

The construction phase is expected to last approximately 12 months with a peak period lasting approximately 3 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 (carpooling) transport, (up to 200 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in Section 7.3).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. The construction of the solar arrays uses a piling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be less than 0.1% of the development site.

Additional disturbance and earthworks will be associated with trenching for cables, the construction of concrete footings for infrastructure and internal access tracks.

Five residential dwellings are located within 100 m of the subject land boundary and are the key receivers for adverse air quality impacts. Existing mature vegetation occurs between some 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 7.4.3.

25 occupied residential dwellings are 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.

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

Air Quality

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 7-13). As discussed in Section 2.2, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 275,000 MWh per annum, the proposal would offset the brown coal equivalent of more than 92,00 tonnes per annum of CO_2 emissions and power the equivalent of about 65,000 NSW homes.

Table 7-13 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, limited vehicles would be present at the site on a permanent basis. 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

Several studies have shown that Photovoltaic (PV) panels convert incident solar radiation into heat and this can alter the airflow and temperature profiles within and adjacent to the panels. This is referred to as the Photovoltaic Heat Island (PVHI) Effect. Whether such changes may subsequently affect the thermal environment of near-by populations of humans and other species have been questioned (Fthenakis & Yu, 2013). To date there are limited empirical studies on the potential for a heat island effect in utility scale solar plants.

Published papers relevant to this issue include;

- *Armstrong A, Ostle N and Whitaker J, Solar park microclimate and vegetation management effects on grassland carbon cycling,2016 (Armstrong et al (2016)).*
- *Barron-Gafford, GA, Minor, RL, Allen, NA, Cronin, AD, Brooks, AE & 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.*
- *Yang L, Gao X, 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 (Yang et al (2017).*

The issue has also been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton for solar farms proposed by Neoen and X-Elio. This is 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, commissioned a *Statement of Evidence by Greg Barron-Gafford* from the Research Group Biography, Ecosystem Science (University of Arizona) (Barron-Gafford 2018).

Studies completed show results that can be seen as contradictory, as they are so site and project 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 whilst 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. 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.
- Differences in the above ground plant biomass and species diversity, with both lower under the PV array.

- Photosynthesis and net ecosystem exchange in spring and winter were also lower under the PV array.

Yang *et al* (2017) looked at air and soil temperature within a solar farm and at a control site without PV. This found that at a height of 2m in the two sites studied the daytime temperature was essentially the same during winter, while during the other seasons the daytime air temperature in the PV array is higher than that in the control without PV, with the maximum difference appearing in summer. At a height of 2m, the night-time air temperatures during the four seasons in the solar farm are higher than the control outside of the PV array. It also found that the annual range of soil temperatures at depths of 5–180 cm in the solar farm was larger than that in the region without PV. The soil temperature at different depths during winter at the solar farm was clearly lower than that in the region without PV, indicating that the PV farm is a cooling system.

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 at the centre of the solar plant the annual average air temperature at a height of 2.5m increased by up to 1.9^{0}C. However, this increase in temperature dissipated at a height of 5m. 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 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 m from the edge of the PV array (Figure 7-10). In his SoE he 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'*.

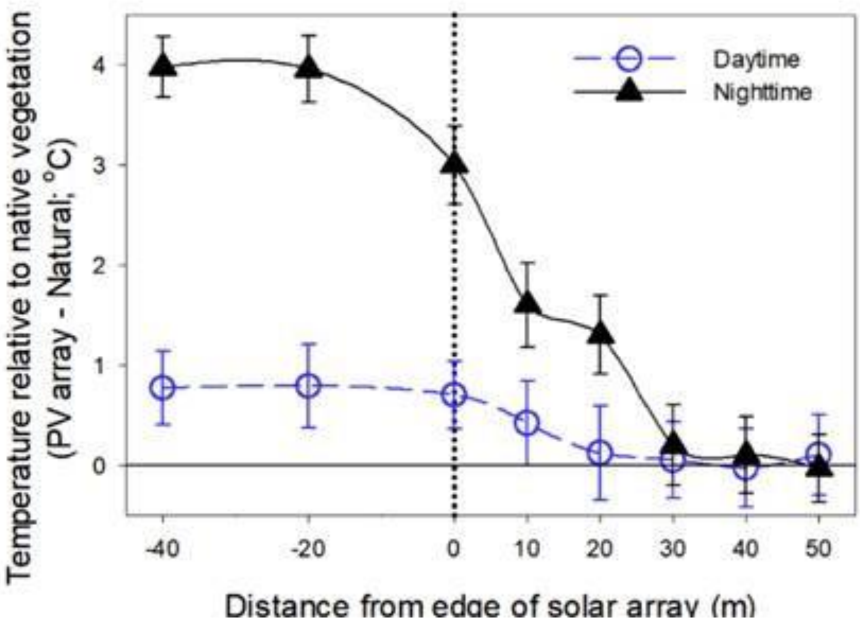

Figure 7-10 Measures of air temperature within and outside of the PV array (source:- Barron-Gafford 2018)

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.

The research indicates a small potential effect on climate within the solar plant site. This effect may actually enhance retention of ground cover in very cold or hot conditions onsite. Negligible impacts on adjacent properties and agricultural activities such as plant growth and health of cattle would occur. It is also unlikely that the heat would be carried offsite by the wind. Where sensitive land use occurs adjacent to solar panels, consideration to maintaining a 30 m buffer could be made.

The proposal mostly adheres to the Victorian Planning Panel Report recommendation, with minimum 30 m setback from the edge of the closest panel to the neighbouring property boundary for most properties. The exception is Receiver 21 (where the residence is more than 100 m from panel infrastructure) and Receiver 32 (a vacant block).

Approximate distances for each property to solar infrastructure is summarised in Table 3-1 and Figure 3-8.

7.4.3 Safeguards and mitigation measures

Air quality impacts would be addressed via the mitigation strategies in Table 7-14.

Table 7-14 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**		
AQ5	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.5 HAZARDS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

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 NSW REQUIREMENTS

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:

1. *That a comprehensive ERP is developed for the site.*
2. *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.*
3. *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).*
4. *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.*
5. *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.*
6. *Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC). The LEMC is a committee established by Section 29 of the State Emergency and Rescue Management Act 1989. LEMCs are required to be established so that emergency services organisations and other government agencies can proactively develop comprehensive inter-agency local emergency procedures for significant hazardous sites within their local government area. The contact details of members of the LEMC can be obtained from the relevant local council.*

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.

7.5.1 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 7-15, with the location of the proposed storage sites shown on Figure 3-9 and Figure 3-10. It can be seen the BESS facility is approximately 40 m from the subject land boundary, and more than 350 m from the closest residence, 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 7-15 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
Class 9 Miscellaneous Dangerous Substances and Articles					
Li-ion batteries	N/A	>1000 cumulative >60/week	30 x 21.99 m^3 containers (total 660 m^3)	Housed across the site in up to 30 customised containers	No

<u>Class 2.2 Non-flammable, non-toxic gases</u>

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 that 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 (Randal Environmental Consulting, 2016).

Other Risk Factors

The proposal would not involve the storage or transport of incompatible materials, generation of hazardous wastes, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, or storage or processing operations involving high (or extremely low) temperatures.

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 6.6); noise emissions may be hazardous to neighbouring residents. Water pollution risks have been assessed as low (Section 7.2), 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.

7.5.2 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, BESS and other electrical components).

Existing environment

The subject land is currently agricultural land comprising several large paddocks which are gently undulating, mostly cleared of native vegetation and have been historically cultivated for cropping and grazing. Two creeks, Dead Horse Creek and Kilnacroft Creek, run west-east through the western portion of the subject land. These creeks are generally dry, experiencing water flow only at times of high rainfall.

Within the development site, sections of these creek lines are bordered by planted native vegetation. 26 dams are also scattered throughout the subject land, which includes a large man-made dam/wetland area.

The surrounding landscape is gently undulating and similarly agricultural. The proposal area is bound by Urana Road, Nation Road, and Ortlipp Road, and intersected by Walla Walla Jindera Road, Sparkes Road, Glenellen Road and Klinberg Road. Proposed transmission lines would connect to an existing TransGrid substation located 600 m to the south-east of the proposal.

Most of the development site has been cleared and cultivated in the past. Parts of the site are identified as category 2 vegetation bushfire prone land.

The existing bushfire hazards within the development site are as follows:

- Narrow strips of remnant eucalypt woodland along the internal boundaries and roads.
- Remnant patches of vegetation located throughout the site.

Ground cover has largely been removed or maintained at low levels due to cultivation practices and grazing.

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 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, several farm dams will be retained on the subject land. There are scattered farm dams on properties surrounding the site. Two ephemeral channel transects the subject land. There are several Rural Fire Services (RFS) and other emergency responses within 20 km of the development site. The closest RFSs are at Glenellen and within Jindera itself, followed by Lavington and North Albury. Two 20,000 L water storage tanks would be maintained on-site as a fire-fighting resource.

Internal access tracks would be 3.5 to 6 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, 25 occupied residences are located within one kilometre of the development site. Another 28 occupied residences are located within 2 km. Additionally, farm sheds, watering points, silos and equipment are common in the local area. As stated above, November to mid-December represents a period of high activity when many people may be active in harvest and other farm activities onsite and in the local area.

Planning for Bushfire Protection Guidelines

According to the *Planning for Bushfire Protection (PBP) guidelines* (RFS 2006), an acceptable level of protection from bushfires is achieved for developments through a combination of strategies which:

- *control the types of development permissible in bush fire prone areas.*
- *minimise the impact of radiant heat and direct flame contact by separating the development from the bush fire hazard.*
- *reduce the rate of heat output (intensity) of a bush fire close to a development through control of fuel levels.*
- *minimise the vulnerability of buildings to ignition from radiation and ember attack.*
- *enable relatively safe access for the public and facilitate fire-fighting operations.*
- *provide adequate water supplies for bush fire suppression operations.*
- *implement community education programs, focusing on property preparedness, including emergency planning and property maintenance requirements.*

- *facilitate the maintenance of APZs, fire trails, access for firefighting and on-site equipment for fire suppression.*

The PBP guidelines provide six key Bush Fire Protection Measures for developments:

a) *the provision of clear separation of buildings and bush fire hazards in the form of fuel reduced APZ (comprising inner and outer protection areas and defendable space).*
b) *construction standards and design.*
c) *appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation.*
d) *adequate water supply and pressure.*
e) *emergency management arrangements for fire protection and/or evacuation.*
f) *suitable landscaping to limit fire spreading to a building.*

Draft Planning for Bush Fire Protection 2017

The draft *Planning for Bush Fire Protection (RFS 2017)* provides the following bushfire management objectives for National Construction Code Class 5 to 8 buildings (including commercial and industrial facilities) and Class 10 non-habitable buildings and structures (such as garages and fences):

- *to provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress with evacuation.*
- *to provide adequate supplies of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*
- *to provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development and consideration of storage of hazardous materials away from the hazard wherever possible.*

The guidelines do not specifically address solar farms but, in relation to wind farms, provide for a 10 m Asset Protection Zone (APZ) from structures, and adequate firefighting access. Requirements of the APZ include the following design parameters:

- A minimum carriageway width of four metres for rural/residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint).
- In forest, woodland and heath situations, rural property access roads have passing bays every 200 metres that are 20 metres long by two metres wide, making a minimum trafficable width of six metres at the passing bay.
- A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches.
- Internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum 12 metre outer radius.
- Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress.
- The minimum distance between inner and outer curves is six metres.
- The crossfall is not more than 10 degrees.
- Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads.

Standards from the guidelines to reduce hazard include:

1. **Raking or manual removal of fine fuels**: Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.
2. **Mowing or grazing of grass:** Grass needs to be kept short and, where possible, green.
3. **Removal or pruning of trees, shrubs and understorey**: The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.
4. **Slashing and trittering**: Slashing and trittering are economical methods of fuel reduction for large APZs that have good access. However, these methods may leave large amounts of slashed fuels (grass clippings etc) which, when dry, may become a fire hazard. For slashing or trittering to be effective, the cut material must be removed or allowed to decompose well before summer starts. If clippings are removed, dispose of them in a green waste bin if available or compost on site (dumping clippings in the bush is illegal and it increases the bush fire hazard on your or your neighbour's property). Although slashing and trittering are effective in inhibiting the growth of weeds, it is preferable that weeds are completely removed. Care must be taken not to leave sharp stakes and stumps that may be a safety hazard.
5. **Ploughing and grading**: Ploughing and grading can produce effective firebreaks. However, in areas where this method is applied, frequent maintenance may be required to minimise the potential for erosion. Loose soil from ploughed or graded ground may erode in steep areas, particularly where there is high rainfall and strong winds.
6. **Burning (hazard reduction burning)**: Hazard reduction burning is a method of removing ground litter and fine fuels by fire. Hazard reduction burning of vegetation is often used by land management agencies for broad area bush fire control, or to provide a fuel reduced buffer around urban areas. Any hazard reduction burning, including pile burns, must be planned carefully and carried out with extreme caution under correct weather conditions. Otherwise there is a real danger that the fire will become out of control. More bush fires result from escaped burning off work than from any other single cause.
7. **Burning (pile burning)**: In some cases, where fuel removal is impractical due to the terrain, or where material cannot be disposed of by the normal garbage collection or composted on site, you may use pile burning to dispose of material that has been removed in creating or maintaining an APZ.

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.

7.5.3 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.

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 substation. 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 30MW/60MWh rated capacity units of BESS. All energy storage systems carry risks associated with the uncontrolled release of energy. While Li-ion batteries offer significant advantages over competing commercialised storage technologies in terms of energy density, efficiency and charging times, these advantages also elevate the risk of fire. The Li-ion based BESS unit 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).

<u>Fire Risks</u>

Li-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Li-ion systems can span -10 to 50 degrees Celsius but the cells inside the containers are kept within a smaller range, 10 to 30 degrees Celsius, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come in contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350-400°C (Recharge, 2013). Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated.

There is potential for a fire event in the BESS which could initiate a bush fire in the surrounding grazed grasslands. Prevention measures to reduce the likelihood of a fire starting and effective mitigation measures to contain the fire reduces risk.

<u>Fire causes</u>

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). Li-ion batteries 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 BESS are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum and Long, 2016).

A large majority of incidents involving Li-ion batteries have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge, 2013).

<u>Risk and incident management</u>

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 BSU by:

- Maintaining an APZ around each BSU.
- Locating the BSU 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 BESS containers are not vulnerable to external heat effects in the event of a bushfire.
- Designing appropriate separation and isolation between individual BESS 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 BESS unit would comprise the storage and release of inert gas within each BESS container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

There would be spare aircon units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all aircon units fail, the auto shutdown of the batteries would prevent overheating.

<u>Standards and guidelines</u>

The installation of Li-ion batteries has been identified as in need of relevant standards and Standards Australia has developed a new standard (AS/NZS 5139) for smaller scale battery installations. 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 BESS systems (Department of Commerce, 2017).

BUSHFIRE AND COMPLIANCE WITH PBP GUIDELINES

<u>Asset Protection Zones</u>

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, 2017) specifies the following minimum APZ widths for residential subdivisions on flat ground in FDI 80 areas:

Grassy woodlands	11 m
Semi-arid woodlands (grassy)	6 m.

An APZ of minimum width of 10 m would be provided around the solar farm buildings, substation and BSU, 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 BSU and substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

<u>Fuel hazard management</u>

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.

<u>Access</u>

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).

<u>Fire-fighting resources and preparedness</u>

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 65 mm 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.

7.5.4 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 electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO, 2012).

Electric fields are produced by voltage. Magnetic fields are produced by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances while operational (WHO, 2007). Electric and magnetic field strengths reduce rapidly with distance from the source and, while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50 Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

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 50 Hz 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 300 GHz) 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 7-16.

Table 7-16 ICNIRP reference levels for electric and magnetic fields. Values are for 50 Hz

Exposure characteristics	Electric 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 132 kV and 330 kV transmission line.
4. Solar substation.
5. BESS.

Typical and maximum EMF levels for these types of infrastructure are discussed below. Strength attenuates with distance from the infrastructure, as seen below.

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal.

The substation is classified as an intermediate substation (rated maximum capacity of 132 kV). The highest electromagnetic field is usually produced by the lines and cables supplying the substation and not by the equipment inside the substation itself. If the substation itself produces a field outside its perimeter, it usually falls away over the first few m (EMFs info, 2019. Works undertaken to facilitate the connection of the transmission line would require mitigation measures to ensure reduced exposure.

7.5.5 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 200 µT and 1000 µT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing 330 kV and 132 kV overhead transmission lines. Exposure to EMFs during the construction of the substation and its connection to the existing transmission line 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.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts minimised also.

The site is surrounded by agricultural land. Public access would be restricted by fencing around the site including substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

Using the Principle of Prudent Avoidance to design and site infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

7.5.6 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 7-17).

Table 7-17 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**		

No.	Safeguards and mitigation measures	C	O	D

HA6	A Fire Management and Emergency Response Plan (FMERP) would be developed and implemented during construction, operation and decommissioning, with input from the local RFS centre, and include but not be limited to:
	• Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.
	• 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.
	• 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.
	Two copies of the FMERP will be stored in a prominent location in a position directly adjacent to the main entry point.
		C	**O**	**D**

HA7	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, BESS units, outside	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	perimeter of the solar array, and all areas of unmanaged vegetation being retained within the site.			
HA8	Two 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**
HA9	Once constructed and prior to operation, the operator of the facility will contact the relevant local emergency management committee (LEMC).	**C**	**O**	
HA10	All chemicals and fuels used on-site must be stored and handled in accordance with: • The requirements of all relevant Australian Standards; and • The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook if the chemicals are liquids*. In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	**C**	**O**	**D**
HA11	A Fire Safety Study (FSS) be prepared for the energy storage facility (ESF) part of the site and submitted to FRNSW for review and determination prior to the construction of the ESF. The FSS should be developed in consultation with and to the satisfaction of FRNSW.	**C**		

C: Construction; O: Operation; D: Decommissioning

7.6 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, provision of or increase the demand for public amenities and public services within the area, and a consideration of the construction workforce accommodation.

GREATER HUME SHIRE COUNCIL'S REQUIREMENTS

Clarity concerning the numbers employed during the operational phase of the development.

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 adverse impacts, such as creating strains on existing infrastructure (e.g. 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.

7.6.1 Background

Socio-economic profile

Greater Hume is located in the southern NSW transport corridor between the regional centres of Albury and Wagga Wagga. The shire borders Victoria and is linked by the Hume Freeway, Riverina and Olympic Highways. The Main Southern Railway Line traverses the shire, which has proximity to the Ettamogah Rail Hub, regional airports at Albury and Wagga Wagga and offers frequent direct flights to Sydney and Melbourne.

The town of Jindera is located approximately 40 km south-west of the major town of Culcairn, with a population of 2,222 as at the 2016 Census (ABS 2019). Jindera has a number of attractions including the Jindera Pioneer Museum, the Jindera Country Golf Club, Four Mile Creek, Jindera Wetland, Jindera Village Green and a number of recreational reserves.

The median age of persons in the Greater Hume LGA is 44; this is higher than the Australian average of 38 (ABS 2016). The 2016 census records state that 3.3% of the population are Aboriginal and Torres Strait Islander people (ABS 2019). A large portion, 86.2% of the community were born in Australia; 1.9% in England, 0.9% in New Zealand, 0.5% in Germany and 0.4% in the Netherlands (ABS 2019).

The local economy is based primarily on mixed farming enterprises. This includes grain production, sheep for wool and meat, animal husbandry for cattle and pigs, grain production, storage and transport (Greater Hume Shire Council 2012). Sheep, beef cattle and grain farming employ 22% of the population (ABS 2019). Other sectors that support the economy include manufacturing (9.2%), construction (7.5%), retail (8.7%) and aged care residential services (9.6%) (ABS 2019). The unemployment rate for Greater Hume LGA is 4.1%, which is less than the national rate of 5.6% (ABS 2019).

Jindera township is a service centre for the area, located approximately 3 km from the proposal. It is located in the north-east Riverina region of NSW on the Urana Road approximately 551 km from Sydney via the Hume highway. It is approximately 14 km northwest of Albury-Wodonga and centrally located between Sydney and Melbourne.

Jindera includes:

- Agricultural suppliers and agronomy services;

- Several manufacturing businesses;
- Earthworks and electrical services;
- Shopping precinct including newsagency, hairdressers, supermarket, hotel, automotive services, etc.
- St John's Lutheran School;
- Jindera Pioneer Museum; and
- Recreational facilities including the Jindera swimming pool and Jindera Country Golf Club.

It is likely that Jindera would be the key service centre of the Jindera Solar Farm construction work force, with other service centres including Holbrook, Albury Wodonga, Henty, Walla Walla and other smaller surrounding towns.

Community make up and priorities

Greater Hume Shire Council has four key strategic themes in their Community Strategic Plan 2030 (Greater Hume Shire Council 2012). The shire's vision for the future is:

"Living in an idyllic rural landscape that sets us apart, we draw on our passion and location to maintain a model community for people of all ages whilst building an economy that abounds with opportunities."

The plan identifies the community's main priorities and aspirations for the future. The four key themes include:

- Greater ideas by our people
- A simply greater place to live
- Simply greater natural surroundings
- A simply greater place to work

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with particular reference to 'building an economy that abounds with opportunities.'

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 largescale solar energy facilities and 87% are in favour of domestic installations. The largescale solar energy sector is still at a relatively early stage of development in Australia. While most members of the community are aware of largescale solar energy, many do not know a great deal about their impacts (ARENA n.d.).

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 to provide information about the proposal and enable communication and feedback to be received.

Direct Engagement

Direct engagement was offered to the nearest neighbours of the boundary of the development site (within 2 km). This occurred through flyer/letter drops, emails, phone calls and face to face meetings. Concerns raised during the engagement include:

- Visual/aesthetic impacts (including glint and glare).
- Road maintenance.

- Water pollution.
- Heating of surrounding land.
- Water requirements.
- Grassing.
- Clearing.
- Devaluation of land.
- Location of the proposal.
- Loss of productive farming land.
- Acquisition of land.
- Effect on current farming operations.
- Traffic impacts.
- Noise and dust impacts.
- Disposal/recycling of modules.
- Tree/habitat clearing.
- Runoff/flooding impacts.
- Heat island effect.

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

Road maintenance was also addressed through direct correspondence with concerned residents.

Open Days

Two open days were held in Jindera. Feedback forms were completed at these sessions. Respondents were generally in support of solar development, but not in its proposed location. A number of the concerns were raised with specific reference to the proposal. Additional concerns that were not raised in the direct engagement include:

- Drying effect on land and soil by the solar panels (1 respondent).
- Removal of good topsoil (1 respondent).
- Land value (6 respondents).
- Potential for terrorist attack.
- Loss of growth in the community – deterrent for people to buy in the area.
- Biodiversity impacts (including microclimate, habitat removal and fauna displacement).
- Weed and pest impacts.
- Rezoning of land.
- Loss of subdivision potential.
- Loss of purchase potential for agriculture.
- Fire risk and impacts.
- Foreign investment and lack of community benefits.
- Hazards from batteries and health risks.

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

Website

The proponent has established a dedicated project website (https://jinderasolarfarm.com.au), which provides information on the proposal. The website includes a comments section, where feedback may be left by any members of the community. A phone number also allows anyone interested to reach the proponent about general enquiries and project related enquiries.

Accommodation availability

Jindera, with a population of 2,222, is a small town and offers only 1 hotel/motel. Albury is the nearest major centre, about 17 km south of the development site and provides substantial accommodation opportunities, and community and health services. The large regional centre of Wagga Wagga is also located about 120 km north of the development site and offers further accommodation, community and health services.

Other services

Other services required by temporary construction staff that are not local include (but are not limited to) food outlets, local retail, health services and entertainment. While providing an economic boost to the area, it can also put pressure on services.

7.6.2 Potential impacts

Construction

During construction, it is considered the proposal would generate some adverse socio-economic impacts, however significant positive impacts are also likely. Likely positive impacts include:

- Significant boost to the local and regional economies through generation of employment. About 200 staff would be employed during peak construction, and many of these could be drawn from the local area.
- A range of employment and contracts including landscaping, fencing, security, catering, trenching, maintenance, piling, roads and electrical work.
- Significant boost to the local and regional economies through increased demand for accommodation, goods and services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to sections 6.4 and 7.3).
- Change in the rural landscape character and visual amenity of the area (refer to section 6.5).
- Influx of workers may put pressure on local accommodation, 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.

Jindera 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. The project would engage with local accommodation providers and Greater Hume Shire Council if necessary, to provide additional short term and temporary accommodation at these businesses. The proponent would also consult with Greater Hume Shire Council 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 go back home.

It is considered that the demand for health care and other services would also be dispersed throughout the surrounding towns to coincide with where workers are staying.

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 2-3 full-time jobs will be supported on an ongoing basis through the operation and maintenance of the proposal. A further 6 service contractors are expected to be required to operate the facility (e.g. 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.

It is estimated that the solar farm would require around $12 000 per MW per year of spending to maintain, or about $1.8M per year. It is estimated that around 65% of this is spent locally on wages, contractors and materials. Over an average year of operation, the project would generate over $1M of economic activity in the local community.

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.

Six respondents listed solar farm effects on land use or land values as a concern via the community feedback forms, via direct engagement of through the dedicated website. It is generally considered that land prices around the development site are strongly linked to the agricultural productivity of the land. Agricultural productivity on surrounding land would not be affected by the proposal.

Studies into the effects of solar development and land valuation have not been undertaken in Australia, as large solar installations are still relatively new, and sales data is not available. However, in 2016 the NSW Office of Environment and Heritage (OEH) commissioned an independent study into the potential impacts of wind farm developments on property prices in NSW (Urbis, 2016). There was insufficient sales data to provide a definitive answer, therefore the study was based on the best available data and traditional valuation sales analysis techniques to compare the change in values around wind farms over time and qualitative information from a review of the international literature on the impact of wind farms on property values.

Based on the outcome of the study, it was determined that wind farms may not significantly impact the value of rural properties used for agricultural purposes, with no or limited definable impacts.

As solar farms do not have the same impacts as wind farms (i.e. landscape views, shadowing, light flicker etc.), the impacts on property values are anticipated to be less. Mitigation measures in the form of vegetative screening and offsetting infrastructure from residences is an effective method to obscure views of the proposal.

Studies in the United States also suggest the impacts to land valuation due to solar farms is negligible (The University of Texas, 2018).

7.6.3 Safeguards and mitigation measures

Table 7-18 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

7.7 RESOURCE USE AND WASTE GENERATION

> ***GREATER HUME SHIRE COUNCIL***
>
> *The Council wishes to make the following comments for inclusion within the forthcoming EIS:*
>
> *Detailed information concerning the proposed recycling of generated packaging waste.*

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 Table 3-2.

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 314 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); and
- Disposal.

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

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) and
- Liquid 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 liquid wastes and sanitary (clinical waste) classified in accordance with the POEO Act.

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; and
- 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 7.2.

Separate waste receptors would be located on site during construction to receive recyclable and non-recyclable waste. Recyclable waste is likely to be generated from packaging (carboard, plastic, wood). Non-recyclable waste would be disposed of at an appropriate facility.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. The proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. The majority of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

Operation

Lifecycle analysis

Lifecycle 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 lifecycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the lifetime of the panels, it is expected that 28 g of GHG emissions 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, which is referred to as the system's. 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 systems' lifecycle (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 project.
- Potential to reuse and recycle component parts.

Resources and Waste Streams

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy 2004). Only limited amounts of fuels would be required for maintaining 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.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Provision of toilet facilities for onsite workers and how sewage 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: 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 adequate consultation with the local Aboriginal community.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

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:*

a. *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),*
b. *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),*
c. *Include a statement of heritage impact for all heritage items (including significance assessment),*
d. *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*
e. *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 search of listed items (under the NSW *Heritage Act 1977*, the Australian Heritage Database and those listed by local Councils and State Government agencies) was completed for the Greater Hume LGA on 2 October 2018.

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. Greater Hume LGA was used in the search as the development site is situated within the Greater Hume Shire. Walla Walla Jindera Road runs directly west of the site, which is situated within Greater Hume LGA. 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 Greater Hume 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 Greater Hume LEP (2012) 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

A summary of the results of the heritage searches is illustrated in Table 7-20. Details of listed items are provided below.

Table 7-20 Summary of heritage listings in the Greater Hume LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	0
NSW State Heritage Register	4
State Agency Heritage Register	12
Greater Hume LEP 2012	172

State Heritage Register

A search of the NSW heritage Register on 31 July 2018 for the Greater Hume LGA identified 4 items under the NSW Heritage Act and 61 items listed under the Greater Hume LEP and by state agencies. None of the items listed in the State Heritage Search were located within 3 km of the development site.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register for the Greater Hume LGA indicated 12 listings. These include:

- Bethanga Bridge over the Murray River, Riverina Highway (SH 20), Albury;
- Culcairn Police Station and Official Residence, 33 Balfour Street, Culcairn;
- Culcairn Railway Precinct, Melville Street, Culcairn;
- Gerogery Gatekeeper's Residence, Main Street, Gerogery;
- Henty Police Station and Official Residence, 41 Sladen Street, Henty;
- Henty Railway Precinct, Railway Parade, Henty;
- Holbrook Courthouse and Residence, Albury Street, Holbrook;
- Holbrook Police Station and Lockup Keeper's Residence, 64 Albury Street Holbrook;
- Ten Mile Creek Bridge, Hume Highway, Holbrook;
- Union Bridge over Murray River, Hume Highway (SH2), Albury;
- Vokins Creek Bridge, Little Billabong Road, 54.4 km west of Tumbarumba; and
- Wymah Ferry Crossing on the Murray River, Main Road 282, Wymah.

The above items are listed by State Agencies under s.170 of the *Heritage Act 1977*. None of the above items are located within or in close proximity to the development site.

Local Heritage Schedule

A search of the Greater Hume LEP indicated 172 local heritage items listed in the LGA. No items are located in the development site. However, there are two heritage items in close proximity to the development site.

These are listed below and shown in Figure 7-11:

The results of the heritage searches listed above indicate that two known historic items listed on schedule 5 of the LEP are located approximately 1.5 km from the development site. These include:

- Drumwood homestead and outbuildings, located at 344 Drumwood Road, Jindera (I128); and

- Jindera General Cemetery, corner Drumwood Road and Hannah Lane, Jindera (I131)

7.8.3 Potential impacts

A number of heritage items were identified from the desktop study outlined above. Most of these items are found in Jindera and other towns and villages. Two of these items are found within 2 km of the development site.

The proposal is not considered likely to have a significant impact on heritage values in accordance with the *NSW Heritage Act 1977*, the EP&A Act, and the EPBC Act.

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**

C: Construction; O: Operation; D: Decommissioning

Figure 7-11 Greater Hume LEP (2012) Heritage Map results for the Jindera Solar Farm (NSW Government 2012). *Red boundary indicates the proposed solar farm.*

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.

The proposed Jindera Solar Farm will contribute to overall infrastructure development in the region.

A review of the State Significant Development register for the Greater Hume LGA and surrounding LGAs of Albury City, Federation, Lockhart, Wagga Wagga and Snowy Valleys (bordering LGAs) was conducted on 02 October 2018. Four major solar farms developments have been applied for within the Greater Hume LGA including Culcairn, Walla Walla, Glenellen and Jindera, although the Culcairn application has recently been withdrawn. Note, none of these solar farms have received development approval at this stage.

Solar farms registered in surrounding LGAs include Mulwala Solar Farm, Gregadoo Solar Farm and Bomen Solar Farm. A number of other State Significant Developments have been applied for within the surrounding LGAs. Major projects listed on the Major Projects Register within the Greater Hume LGA include:

- Jindera Solar Farm – SEARs Issued
- Glenellen Solar Farm – SEARs Issued
- Walla Walla Solar Farm -SEARs issued
- Culcairn Solar Farm – SEARs issued
- Rockley Falls Quarry (Modification 7 – 24-hour Concrete Production) – Determination
- Rockley Falls Quarry (Modification 6 – Extended operations) – Determination
- Hume Highway Duplication (Woomargama Bypass (modification 1) – Determination
- Rockley Falls Quarry (Modification 5 – Wet Batch Plant and Operating Hours) – Determination
- Rockley Falls Quarry (Modification 3 – Dry-Mix Batch Plant) – Determination
- Rockley Falls Quarry (Modification 4 – Vegetation Offset Areas) – Determination
- Hume Highway Duplication (Holbrook Bypass) – Determination
- Hume Highway Duplication (Woomargama Bypass) – Determination
- Hume Highway Duplication (Tarcutta Bypass) – Determination
- Rockley Falls Quarry Project – Determination
- Hume Highway Duplication (Woomargama to Mullengandra Modification 1) – Determination
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 3) – Determination
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 2) Determination
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 1) Determination
- Hume Highway Duplication (Kyeamba Hill Modification 1) – Determination
- Hume Highway Duplication (Yarra to Holbrook Modification 1) – Determination
- Hume Highway Duplication (Yarra to Holbrook) – Determination
- Hume Highway Duplication (Woomargama to Mullengandra) – Determination
- Hume Highway Duplication (Concept Plan) – Determination

- Hume Highway Duplication (Sturt Highway to Tarcutta) – Determination
- Hume Highway Duplication (Kyeamba Hill) – Determination
- Hume Highway Duplication (Little Billabong) – Determination
- Hume Highway Duplication (Tarcutta Bypass Modification 1 Ladysmith Road Quarry) – Withdrawn

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 would assist to manage cumulative impacts should additional developments become relevant to the proposal.

During construction and operation, key cumulative impacts may include additional stress on the grid, community complaints such as visual amenity impacts, stress on local business for supply and demand (in particular staff accommodation), noise impacts, air quality, waste management, traffic etc.

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 the 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) 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.

Visual and landscape character impacts

The visibility of the facility (the operation view) may generate a cumulative impact with the existing substation and transmission lines. The proposal requires security fencing and steel dominated infrastructure. The mitigation measures recommended in this report and the VIA (Appendix F 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.

However, the majority of residential and other noise sensitive receivers are a considerable distance from the proposal area where construction noise from the proposal are considerably lower than noise management levels (refer section 6.6). During operation, the proposal would generate negligible noise impacts. 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, primarily on Walla Walla Jindera Road. Walla Walla Jindera Road is a high capacity road designed for heavy vehicle traffic and is likely to absorb any cumulative impacts. Any impact to Ortlipp Road and Lindner Road is expected to be noticeable; however, any impact from increased traffic would be predominately limited to the 12-month construction period. 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, only a small maintenance team using light 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 benefit in relation to developments in the region will be a continuous ongoing benefit 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 impacts 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 337 ha of cropping land would be converted into solar farm development. The proposal would not fragment any resource lands throughout the operational period. Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing productive capacity for agricultural land use.

Continued use of this land for livestock production could be maintained. 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 7.6 and found to be highly manageable.

The proposed Glenellen Solar Farm has had SEARs issued. If both the applications of the proposed Jindera and Glenellen solar farms are submitted and successful, the close proximity of the proposed solar farms has the potential to increase the cumulative impacts affecting land use change and local agriculture. The development footprint of the Jindera Solar Farm in addition to the subject land for the Glenellen Solar Farm, which is approximately 385 ha, equates to approximately 722 ha.

The Greater Hume Shire covers an area of approximately 5,746 km^2 (~574,600 ha). Of this area, approximately 4,359 km^2 (~435,900) is used for agriculture (Greater Hume Council 2018). The temporary loss of 722 ha of agricultural land within the Greater Hume Shire represents a small fraction (~0.17%) of the land being used for agricultural production and would result in a negligible decrease in the overall productivity of the region. A case study of a solar farm in Nyngan by Dr Turlough Guerin of the Agricultural Institute of Australia (Australia Farm Institute 2017) indicated that the project did not significantly reduce the agricultural output of the locality.

Solar farm infrastructure is typically low in height and results in minimal physical impact to the land surface. As an example, 328 ha of the proposal would remain vegetated and approximately 9 ha would be compacted gravel surfaces. These surfaces would include internal access tracks, compounds, inverter and BESS hardstands and the substation. As a result of the low scale of development of the solar farms, the agricultural capability of the land would not be affected by the proposals. As previously mentioned, grazing could continue to be managed across the sites to maintain the height of groundcover during the operational period.

The land can be returned to agricultural use following decommissioning of the proposals. There are many benefits of resting the land for a period of time (NSW Government 2012) and include:

- Increased groundcover and diversity of groundcover with biosecurity management.
- Increase in soil moisture and nutrients.
- Increases in soil organic matter means less evaporation, less impact of raindrops, less impact of runoff and less erosion.
- Controlled stocking rates will reduce soil compaction.
- Perennial grasses can be encouraged to increase soil stability of the grassland around the panels.
- A return of soil organisms for decomposition of organic matter, nutrient cycling and improving soil structure.

Potential loss of 0.17% of agricultural land within the region should be measured against wider government strategic goals and environmental benefits, which include:

- Strategic goals of the Commonwealth and NSW Governments for renewable energy development going forward.
- The environmental benefits of solar energy production, in particular the reduction of greenhouse gas emissions.
- The economic benefits of using an area with reliable solar resources and access to existing electricity infrastructure.
- The benefits of alternative and increased energy supply for grid stability and reliability.

Currently, there are 5 full time equivalent (FTE) staff employed in agriculture at the proposal with around 2-3 subcontractors employed during harvesting and during other busy periods. The figure is likely to be similar for the proposed Glenellen Solar Farm. During construction there would be approximately 50 FTE staff on average and 2-3 FTE staff for the operational period of the proposal. This would include up to 6 service contractors annually for the proposal. Due the larger size of the proposed Glenellen Solar Farm, these figures could be as high as around 60 FTE staff on average during construction and 3-4 FTE staff during the operational period and similar 6 contractors.

The potential cumulative impact of the reduction in agricultural employment would be balanced by the additional employment during construction and on-going employment of staff during operation. Additional local services could be maintained during operation. For example, to maintain the solar farm area mowing/slashing services would be required. Local agricultural services could be maintained if livestock are to be retained throughout the facility.

As such, no cumulative impacts to agricultural enterprise or local agricultural land use 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 5 and 7 and summarised below.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan, consisting of a CEMP, an Operation Environmental Management Plan and a 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	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 on Superb Parrots, Major Mitchell Cockatoo and Corben's Long-eared Bat. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.	**C**		
BD2	Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events, including: • Pre-clearing checklist. • Tree clearing procedure.	**C**		
BD3	Relocate 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 and**		
BD4	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	**C**		

No.	Safeguards and mitigation measures	C	O	D
	• In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance; • Access to the Box-Gum Woodland EEC would not be permitted via vehicles to reduce understorey impacts and clearing; and • Strict weed protocol must be observed at all times.			
BD5	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**	
BD6	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**
BD7	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**		
BD8	Temporary fencing to protect significant environmental features such as riparian zones should be installed prior to construction commencing. Exclusion fencing, and signage would be installed around habitat to be retained	**C**		
BD9	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. A Weed Management Procedure would be developed 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 and after construction. • Weed hygiene protocol in relation to plant, machinery, and fill. Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported. The weed management procedure would be incorporated into the Biodiversity Management Plan.	**C**	**O**	
BD10	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; and • Site speed limits to be enforced to minimise fauna strike.	**C**	**O**	
BD11	Preparation of a vegetation management plan to regulate activity in vegetation and habitat adjacent to the proposed development. Preparation of a Biodiversity Management Plan that would include protocols for: • 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; • Unexpected threatened species finds; • Exclusion of vehicles through sensitive areas;	**C**		

No.	Safeguards and mitigation measures	C	O	D
	• Best practice clearing of overstorey vegetation for construction of the transmission line to avoid understorey impacts; and • Rehabilitation of disturbed areas.			
BD12	Barbed wire would not be used on internal and external fences surrounding Sparkes Rd and retained native vegetation would be considered as an offset site	**Pre - constructio n and**		
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.		**O**	
BD15	Installation of Glider Poles to connect central woodland patch to Sparkes Road.	**C**		
BD16	Install hollows of felled trees onto younger trees or on ground in retained vegetation patches.	**C**		
AH1	The development avoids the three cultural tree sites Jindera 488918, Jindera 488995 and Jindera SF Cultural Site 1. A minimum 20 m buffer should be in place around each cultural tree to prevent any inadvertent impacts to the canopy and root system.	**C**		
AH2	To ensure no inadvertent impacts occur to the three cultural tree sites no plantings for the vegetation screening or any form of ground disturbance during fencing activities can occur within the 20 m buffer zone. Any fencing wire installed will be a minimum of 1 m from physical contact with any part of the tree.	**C**		
AH4	If complete avoidance of the 15 isolated find sites and 10 artefact scatters recorded within the proposal area is not possible the surface stone artefacts within the development footprint must be salvaged. The salvage of these objects must occur prior to the proposed work commencing. Until salvage has occurred a minimum 5 m buffer must be observed around all stone artefact sites.	**C**		
AH5	The collection and relocation of the surface 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 any works commencing.	**C**		
AH6	A minimum 5 m buffer should be observed around all sites with stone artefacts that are being avoided by the proposed development.	**C**		
AH7	Subject to TransGrid defining the scope of any works within the Jindera Substation lot, further assessment of this area will be required. If Aboriginal cultural heritage sites are identified, they must also be subject to salvage collection and reburial as outlined in Recommendation 3 and 6 above.	**C**		
AH8	Jindera Solar Pty Ltd 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**		
AH9	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**		

No.	Safeguards and mitigation measures	C	O	D
AH10	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	C		
VA1	Screening would be required on-site, generally in accordance with the draft Landscape Plan provided in the VIA (Appendix F): • Plantings would be more than one row deep and where practical, planted on the outside of the permitter fence, to break up views of infrastructure including the fencing. The majority of proposed visual screening is 15 m wide, with a 50 m buffer incorporating vegetative screening on the boundary of the proposal and Glenellen Road. • The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. They should be fast growing with mixed canopy height. Species selection could be undertaken in consultation with affected near neighbours and a botanist, horticulturalist or landscape architect. Suitable species are listed within the VIA Appendix F). • The timing is recommended to be chosen to ensure the best chance of survival and can commence during the construction of the proposal if timing suits. • 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	Prior to the commencement of construction, a detailed landscape plan will be prepared including: • Screening location. • Species type. • Planting density and spacing. • Method for planting. • Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method). A program to manage, monitor and report on the effectiveness of implemented measures.	**Design Stage**		
VA3	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.	**Design stage**		
VA4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	C		
VA5	Construction night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be directed away from roads and residents so as not to cause light spill that may be hazardous to drivers.	C	O	D
VA6	If construction of the Glenellen Solar Farm occurs, a 15 m vegetative buffer for the full length of Ortlipp Road would be required. This would occur in consultation with the developers of Glenellen Solar Farm.	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 Jindera 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			D

No.	Safeguards and mitigation measures	C	O	D
	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 Greater Hume 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	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning.	**C**		
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**	**O**	**D**
NS2	A Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The CNVMP would generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The CNVMP would include the following: • Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Noise measurements would be consistent with the procedures documented in AS1055.1-1997 Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Vibration measurements would be undertaken in accordance with the procedures documented in the OEH's Assessing Vibration-a technical guideline (2006) and BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings. • Valuation and measurement for vibration in buildings.	**Prior to construction**		**D**
NS3	Operate plant in a conservative manner, which includes: • Selection of the quietest suitable machinery. • Avoidance of noisy plant working simultaneously where practical. • Turning off plant and equipment that is not being used. • Utilise broadband reverse alarm in lieu of high frequency type.	**C**	**O**	**D**
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner. Provide toolbox meetings, training and education.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
NS5	A letter box drop would be prepared and provided to residences in close proximity to the works (within 1 km). The letter would contain details of the proposed works including timing, duration, expected impacts and a contact person for any enquiries or complaints.	**Prior to and during construction**	**O**	**D**
NS6	For Sensitive Receiver 20, 21, 17, 18, 19, 16 and 10: • Specific consultation at least 2 weeks prior to the commencement of highly noise affecting works would be undertaken. This aim of this consultation is to identify any management measures required to minimise impact at this receiver. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities. • The residences would be provided a contact person for any enquiries or complaints. For other residences and other noise sensitive receptors likely to be noise affected (within 550 m) of the proposed: • The residence would be provided a contact person for any enquiries or complaints. • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur at least two weeks prior to the commencement of construction works. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities.	**C**	**O**	**D**
NS7	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**
NS8	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	**C**	**O**	**D**
NS9	Scheduling of activities to minimise the number of work fronts and simultaneous activities occurring within 200m of the project boundary to minimise noise levels.	**C**	**O**	**D**
NS10	Where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver (within 200m) including areas in constant or regular use (e.g. unloading and laydown areas).	**C**		**D**
NS11	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**
NS12	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**
NS13	Where noise level exceedances cannot be avoided during operation, sound barriers such as sound walls and acoustic fencing would be used to minimise noise levels.		**O**	
NS14	In the event the proposed Glenellen Solar Farm commences construction and operation, sensitive receiver 10 would receive: • Specific consultation at least 2 weeks prior to the commencement of highly noise affecting works would be undertaken. This aim of this consultation is to identify any management measures required to minimise impact at this receiver.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of construction activities. • Use of mobile screens or noise walls at the noise source (within 300 m of receiver 10) would be considered in consultation with receiver 10.			
NS15	For receivers located within 300 m of development infrastructure during maintenance activities including grass slashing, panel cleaning or major works/repairs: • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur at least two weeks prior to the commencement of works. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of activities. • Consider the use of mobilised screening or noise walls around the invertors to reduce the level of noise at the source for noise affected receivers if verification of noise levels finds an exceedance above the NML occurs.		**O**	
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: • 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. • 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.	**Prior to and during construction**		**D**
SO2	A Groundcover Management Plan would be developed in consultation with a soil scientist and 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.	**Prior to construction**		

No.	Safeguards and mitigation measures	C	O	D
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements: ○ Live grass cover would be maintained at or above 70% at alL times 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.			
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**		
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**
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: • Integrate project design with any site constraints. • Preserve and stabilise drainageways. • Minimise the extent and duration of disturbance. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. • Install perimeter controls. • Stabilise disturbed areas promptly. • Protect steep slopes. • Employ the use of sediment control measures to prevent off- and on-site damage. • Protect inlets, storm drain outlets and culverts. • Provide access and general construction controls. • Inspect and maintain sediment and erosion control measures regularly.	**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**

No.	Safeguards and mitigation measures	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**
WA9	Infrastructure should not be located in the overland flow channels to preserve the alignment and capacity of any natural drainage corridors.	**Design stage**		
WA10	Maintain minimal earthworks across the site and maintain the general slope of the land to reduce the potential of concentrated flows across the site.	**C**	**O**	**D**
WA11	Limit increases in runoff velocities and pollutants.	**C**	**O**	
WA12	Provide and maintain a stable coverage of grass / vegetation under and around the solar panels to encourage natural infiltration and prevention of flow concentration.		**O**	**D**
WA13	Re-use of stormwater should be considered wherever possible.		**O**	
WA14	Inspect stormwater control measures at least quarterly, and before and after rainfall of more than 10 mm in 24 hours.	**C**	**O**	
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.). • All heavy vehicle movements to/from each access point are to be managed to ensure that only one inbound or outbound vehicle is travelling along the access route in the vicinity of the site at a time. • Heavy vehicle movements into and out of Walla Walla Jindera Road will be controlled via traffic management means, including a traffic controller, temporary lowered speed limit and additional road signage alerting vehicles of truck movements in the area.	**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.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	• 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 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. • If the construction and operation of the proposed Glenellen Solar Farm coincides with the proposal the traffic management plan would address cumulative impacts.			
TT3	Obtain a Section 138 Consent from the relevant council/agency to perform works within the road reserve.	**C**		
TT4	The proponent would consult with Greater Hume Shire Council and RMS regarding the proposed upgrade of Urana Road for site access. The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT5	If the construction of the Glenellen Solar Farm coincides with the proposal, additional consultation will be undertaken with Greater Hume Shire Council, RMS and the developers of Glenellen Solar Farm, CTP.	**C**		
TT6	If Glenellen Solar Farm and the proposal receive planning approval, consultation between both proponents would occur and would consider the option of cost sharing the road upgrades.	Design Stage		
TT7	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
TT8	The proponent would 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**
TT9	Prior to the commencement of construction on-site, the Proponent would 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**
TT10	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 dust leaving the development site. This includes covering loads and watering of unsealed roads and stockpiles.	**C**	**O**	**D**
AQ4	During construction, operation and decommissioning, dust would be monitored and managed to prevent dust leaving the development site. This includes dust from stockpiled materials.	**C**	**O**	**D**
AQ5	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		
AQ6	Fires and material burning are prohibited on the development site.	**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**		

No.	Safeguards and mitigation measures	C	O	D
HA6	A Fire Management and Emergency Response Plan (FMERP) would be developed and implemented during construction, operation and decommissioning, with input from the local RFS centre, and include but not be limited to: • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm. • 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. • 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. Two copies of the FMERP will be stored in a prominent location in a position directly adjacent to the main entry point.	**C**	**O**	**D**
HA7	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, BESS units, outside perimeter of the solar array, and all areas of unmanaged vegetation being retained within the site.	**C**	**O**	**D**
HA8	Two 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**
HA9	Once constructed and prior to operation, the operator of the facility will contact the relevant local emergency management committee (LEMC).	**C**	**O**	
HA10	All chemicals and fuels used on-site must be stored and handled in accordance with: • The requirements of all relevant Australian Standards; and • The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook if the chemicals are liquids*. In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	**C**	**O**	**D**
HA11	A Fire Safety Study (FSS) be prepared for the battery energy storage system facility (BESS) part of the site and submitted to FRNSW for review and determination prior to	**C**		

No.	Safeguards and mitigation measures	C	O	D
	the construction of the BESS. The FSS should be developed in consultation with and to the satisfaction of FRNSW.			
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**
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 sewage 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**

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* Environmental 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 Jindera Solar Farm would involve the construction, operation and decommissioning of up to 150 MW DC PV solar farm at Jindera, in southern NSW. The 521 hectare (ha) development site is located on freehold rural land, approximately 3 km northeast of Jindera in the Greater Hume LGA. The development footprint of the proposal is approximately 337 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 2013). 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 Australian Government's objective to achieve an additional 33,000 GW/h of energy from renewable sources by 2020 under the LRET scheme.

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 200 employees at the peak of construction (3 to 4 months) and two to three 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.

It is estimated that the solar farm would require around $12 000 per MW per year of operational spending to maintain, or about $1,800,000 per year. This would mostly be spent on local wages, local contractors, and material.

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, Green Switch Australia Pty Ltd. 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.

ngh environmental

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 that the proposal cannot avoid.
- Aboriginal heritage impacts – the Aboriginal Heritage survey and assessment found that no operational impact to Aboriginal cultural heritage would occur from the proposal. Minor impacts will be seen from construction. A mitigation strategy has been developed for each site recorded and forms a commitment of the project, which includes salvage and avoidance.
- Visual impact - the VIA concluded that the operational solar farm would have a very low visual impact on the majority of people living in or travelling through the landscape surrounding the proposed solar farm. Specific native vegetation plantings would be located in consultation with affected landowners, to soften views of infrastructure.
- Noise impacts – the noise assessment concluded that generally noise impacts during construction, operation and decommissioning would be within the accepted noise criteria. One residence may be highly noise affected during piling operations.
- 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 Jindera area. The proposal is reversible and would not result in the permanent loss of agricultural land.

A suite of management measures has been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. Key management strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks. The 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 designed setbacks and 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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APPENDIX A SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

APPENDIX B PROPOSAL MAPS AND DRAWINGS

APPENDIX C CONSULTATION

C.1 AGENCY CONSULTATION

C.2 FEEDBACK FORM

C.3 CONSULTATION LETTERS AND FLYERS

APPENDIX D BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT (BDAR)

APPENDIX E ABORIGINAL CULTURAL HERITAGE ASSESSMENT

APPENDIX F VISUAL IMPACT ASSESSMENT

APPENDIX G RESULT OF NOISE ASSESSMENT

Construction Noise Assessment

Scenario 1

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	63	Moderately Intrusive	N, V
R21 (uninvolved)	115	62	Moderately Intrusive	N, V
R17 (uninvolved)	130	60	Moderately Intrusive	N, V
R18 (uninvolved)	135	60	Moderately Intrusive	N, V
R19 (unoccupied)	190	55	Moderately Intrusive	N, V
R16 (uninvolved)	200	54	Clearly audible	
R10 (unoccupied)	220	53	Clearly audible	
R23 (uninvolved)	315	48	Clearly audible	
R1 (uninvolved)	330	48	Clearly audible	
1 (involved)	433	44	Not noticeable	
R8 (uninvolved)	440	44	Not noticeable	
R12 (Unoccupied)	460	43	Not noticeable	
R13 (uninvolved)	480	43	Not noticeable	
R2 (uninvolved)	500	42	Not noticeable	
R3 (uninvolved)	555	41	Not noticeable	
R4 (uninvolved)	640	39	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R22 (uninvolved)	640	39	Not noticeable	
R3 (involved)	730	37	Not noticeable	
R5 (uninvolved)	780	36	Not noticeable	
R7 (uninvolved)	815	36	Not noticeable	
R26 (uninvolved)	825	35	Not noticeable	
R14 (uninvolved)	830	35	Not noticeable	
R28 (uninvolved)	960	33	Not noticeable	
R27 (uninvolved)	1155	31	Not noticeable	
R41 (uninvolved)	1180	30	Not noticeable	
R6 (uninvolved)	1280	29	Not noticeable	
R49 (uninvolved)	1280	29	Not noticeable	
R50 (uninvolved)	1330	29	Not noticeable	
R51 (uninvolved)	1460	27	Not noticeable	
R40 (uninvolved)	1500	27	Not noticeable	
R56 (uninvolved)	1540	26	Not noticeable	
R52 (uninvolved)	1640	26	Not noticeable	
R33 (uninvolved)	1670	25	Not noticeable	
R25 (uninvolved)	1730	25	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R57 (uninvolved)	1760	24	Not noticeable	
R42 (uninvolved)	1800	24	Not noticeable	
R44 (uninvolved)	1804	24	Not noticeable	
R43 (uninvolved)	1810	24	Not noticeable	
R45 (uninvolved)	1850	24	Not noticeable	
R47 (uninvolved)	1855	24	Not noticeable	
R38 (uninvolved)	1890	23	Not noticeable	
R55 (uninvolved)	1890	23	Not noticeable	
R46 (uninvolved)	1900	23	Not noticeable	
R53 (uninvolved)	1915	23	Not noticeable	
R24 (uninvolved)	1940	23	Not noticeable	
R48 (uninvolved)	1980	23	Not noticeable	
R54 (uninvolved)	2130	5	Not noticeable	
R58 (uninvolved)	2430	5	Not noticeable	
R59 (uninvolved)	2490	5	Not noticeable	
R60 (uninvolved)	2500	5	Not noticeable	
R2 (involved)	2590	5	Not noticeable	

Scenario 2

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	66	Moderately Intrusive	N, V
R21 (uninvolved)	115	65	Moderately Intrusive	N, V
R17 (uninvolved)	130	63	Moderately Intrusive	N, V
R18 (uninvolved)	135	62	Moderately Intrusive	N, V
R19 (unoccupied)	190	58	Moderately Intrusive	N, V
R16 (uninvolved)	200	57	Moderately Intrusive	N, V
R10 (unoccupied)	220	56	Moderately Intrusive	N, V
R23 (uninvolved)	315	54	Clearly audible	
R1 (uninvolved)	330	53	Clearly audible	
R1 (involved)	433	53	Clearly audible	
R8 (uninvolved)	440	51	Clearly audible	
R12 (Unoccupied)	460	50	Clearly audible	
R13 (uninvolved)	480	47	Clearly audible	
R2 (uninvolved)	500	47	Clearly audible	
R3 (uninvolved)	555	46	Clearly audible	
R4 (uninvolved)	640	45	Not noticeable	
R22 (uninvolved)	640	45	Not noticeable	
R3 (involved)	730	43	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R5 (uninvolved)	780	42	Not noticeable	
R7 (uninvolved)	815	42	Not noticeable	
R26 (uninvolved)	825	40	Not noticeable	
R14 (uninvolved)	830	39	Not noticeable	
R28 (uninvolved)	960	38	Not noticeable	
R27 (uninvolved)	1155	38	Not noticeable	
R41 (uninvolved)	1180	38	Not noticeable	
R6 (uninvolved)	1280	36	Not noticeable	
R49 (uninvolved)	1280	33	Not noticeable	
R50 (uninvolved)	1330	33	Not noticeable	
R51 (uninvolved)	1460	32	Not noticeable	
R40 (uninvolved)	1500	32	Not noticeable	
R56 (uninvolved)	1540	31	Not noticeable	
R52 (uninvolved)	1640	30	Not noticeable	
R33 (uninvolved)	1670	30	Not noticeable	
R25 (uninvolved)	1730	29	Not noticeable	
R57 (uninvolved)	1760	28	Not noticeable	
R42 (uninvolved)	1800	28	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R44 (uninvolved)	1804	27	Not noticeable	
R43 (uninvolved)	1810	27	Not noticeable	
R45 (uninvolved)	1850	27	Not noticeable	
R47 (uninvolved)	1855	27	Not noticeable	
R38 (uninvolved)	1890	27	Not noticeable	
R55 (uninvolved)	1890	26	Not noticeable	
RR46 (uninvolved)	1900	26	Not noticeable	
53 (uninvolved)	1915	26	Not noticeable	
R24 (uninvolved)	1940	26	Not noticeable	
R48 (uninvolved)	1980	26	Not noticeable	
R54 (uninvolved)	2130	26	Not noticeable	
R58 (uninvolved)	2430	26	Not noticeable	
R59 (uninvolved)	2490	25	Not noticeable	
R60 (uninvolved)	2500	8	Not noticeable	
R2 (involved)	2590	8	Not noticeable	

Operation Noise Assessment

Scenario 1

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	45	Moderately Intrusive	N, V
R21 (uninvolved)	115	44	Moderately Intrusive	N, V
R17 (uninvolved)	130	42	Moderately Intrusive	
R18 (uninvolved)	135	42	Moderately Intrusive	
R19 (unoccupied)	190	37	Clearly audible	
R16 (uninvolved)	200	37	Clearly audible	
R10 (unoccupied)	220	35	Clearly audible	
R23 (uninvolved)	315	33	Clearly audible	
R1 (uninvolved)	330	33	Clearly audible	
R1 (involved)	433	32	Clearly audible	
R8 (uninvolved)	440	30	Clearly audible	
R12 (Unoccupied)	460	30	Clearly audible	
R13 (uninvolved)	480	26	Not noticeable	
R2 (uninvolved)	500	26	Not noticeable	
R3 (uninvolved)	555	26	Not noticeable	
R4 (uninvolved)	640	25	Not noticeable	
R22 (uninvolved)	640	25	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R3 (involved)	730	24	Not noticeable	
R5 (uninvolved)	780	22	Not noticeable	
R7 (uninvolved)	815	22	Not noticeable	
R26 (uninvolved)	825	21	Not noticeable	
R14 (uninvolved)	830	20	Not noticeable	
R28 (uninvolved)	960	20	Not noticeable	
R27 (uninvolved)	1155	20	Not noticeable	
R41 (uninvolved)	1180	19	Not noticeable	
R6 (uninvolved)	1280	17	Not noticeable	
R49 (uninvolved)	1280	15	Not noticeable	
R50 (uninvolved)	1330	13	Not noticeable	
R51 (uninvolved)	1460	13	Not noticeable	
R40 (uninvolved)	1500	13	Not noticeable	
R56 (uninvolved)	1540	13	Not noticeable	
R52 (uninvolved)	1640	11	Not noticeable	
R33 (uninvolved)	1670	11	Not noticeable	
R25 (uninvolved)	1730	11	Not noticeable	
R57 (uninvolved)	1760	9	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R42 (uninvolved)	1800	9	Not noticeable	
R44 (uninvolved)	1804	9	Not noticeable	
R43 (uninvolved)	1810	9	Not noticeable	
R45 (uninvolved)	1850	8	Not noticeable	
R47 (uninvolved)	1855	8	Not noticeable	
R38 (uninvolved)	1890	8	Not noticeable	
R55 (uninvolved)	1890	8	Not noticeable	
R46 (uninvolved)	1900	8	Not noticeable	
R53 (uninvolved)	1915	8	Not noticeable	
R24 (uninvolved)	1940	8	Not noticeable	
R48 (uninvolved)	1980	7	Not noticeable	
R54 (uninvolved)	2130	7	Not noticeable	
R58 (uninvolved)	2430	7	Not noticeable	
R59 (uninvolved)	2490	7	Not noticeable	
R60 (uninvolved)	2500	N/A	Not noticeable	
R2 (involved)	2590	N/A	Not noticeable	

Scenario 2

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	52	Moderately Intrusive	N, V
R21 (uninvolved)	115	51	Moderately Intrusive	N, V
R17 (uninvolved)	130	49	Moderately Intrusive	N, V
R18 (uninvolved)	135	49	Moderately Intrusive	N, V
R19 (unoccupied)	190	44	Moderately Intrusive	
R16 (uninvolved)	200	43	Moderately Intrusive	
R10 (unoccupied)	220	42	Clearly Audible	
R23 (uninvolved)	315	40	Clearly Audible	
R1 (uninvolved)	330	39	Clearly Audible	
R1 (involved)	433	39	Clearly Audible	
R8 (uninvolved)	440	37	Clearly Audible	
R12 (Unoccupied)	460	37	Clearly Audible	
R13 (uninvolved)	480	33	Not noticeable	
R2 (uninvolved)	500	31	Not noticeable	
R3 (uninvolved)	555	30	Not noticeable	
R4 (uninvolved)	640	28	Not noticeable	
R22 (uninvolved)	640	26	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R3 (involved)	730	26	Not noticeable	
R5 (uninvolved)	780	26	Not noticeable	
R7 (uninvolved)	815	25	Not noticeable	
R26 (uninvolved)	825	25	Not noticeable	
R14 (uninvolved)	830	25	Not noticeable	
R28 (uninvolved)	960	23	Not noticeable	
R27 (uninvolved)	1155	20	Not noticeable	
R41 (uninvolved)	1180	20	Not noticeable	
R6 (uninvolved)	1280	19	Not noticeable	
R49 (uninvolved)	1280	19	Not noticeable	
R50 (uninvolved)	1330	18	Not noticeable	
R51 (uninvolved)	1460	17	Not noticeable	
R40 (uninvolved)	1500	17	Not noticeable	
R56 (uninvolved)	1540	16	Not noticeable	
R52 (uninvolved)	1640	15	Not noticeable	
R33 (uninvolved)	1670	15	Not noticeable	
R25 (uninvolved)	1730	14	Not noticeable	
R57 (uninvolved)	1760	14	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R42 (uninvolved)	1800	14	Not noticeable	
R44 (uninvolved)	1804	14	Not noticeable	
R43 (uninvolved)	1810	14	Not noticeable	
R45 (uninvolved)	1850	14	Not noticeable	
R47 (uninvolved)	1855	14	Not noticeable	
R38 (uninvolved)	1890	13	Not noticeable	
R55 (uninvolved)	1890	13	Not noticeable	
R46 (uninvolved)	1900	13	Not noticeable	
R53 (uninvolved)	1915	13	Not noticeable	
R24 (uninvolved)	1940	12	Not noticeable	
R48 (uninvolved)	1980	12	Not noticeable	
R54 (uninvolved)	2130	N/A	Not noticeable	
R58 (uninvolved)	2430	N/A	Not noticeable	
R59 (uninvolved)	2490	N/A	Not noticeable	
R60 (uninvolved)	2500	N/A	Not noticeable	
R2 (involved)	2590	N/A	Not noticeable	

Scenario 3

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	66	Moderately Intrusive	N, V
R21 (uninvolved)	115	64	Moderately Intrusive	N, V
R17 (uninvolved)	130	63	Moderately Intrusive	N, V
R18 (uninvolved)	135	63	Moderately Intrusive	N, V
R19 (unoccupied)	190	58	Moderately Intrusive	N, V
R16 (uninvolved)	200	57	Moderately Intrusive	N, V
R10 (unoccupied)	220	56	Moderately Intrusive	N, V
R23 (uninvolved)	315	53	Moderately Intrusive	
R1 (uninvolved)	330	53	Moderately Intrusive	
R1 (involved)	433	52	Moderately Intrusive	
R8 (uninvolved)	440	51	Moderately Intrusive	
R12 (Unoccupied)	460	50	Moderately Intrusive	
R13 (uninvolved)	480	47	Clearly audible	
R2 (uninvolved)	500	46	Clearly audible	
R3 (uninvolved)	555	46	Clearly audible	
R4 (uninvolved)	640	45	Clearly audible	
R22 (uninvolved)	640	45	Clearly audible	
R3 (involved)	730	43	Clearly audible	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R5 (uninvolved)	780	41	Not noticeable	
R7 (uninvolved)	815	41	Not noticeable	
R26 (uninvolved)	825	40	Not noticeable	
R14 (uninvolved)	830	39	Not noticeable	
R28 (uninvolved)	960	38	Not noticeable	
R27 (uninvolved)	1155	38	Not noticeable	
R41 (uninvolved)	1180	38	Not noticeable	
R6 (uninvolved)	1280	36	Not noticeable	
R49 (uninvolved)	1280	33	Not noticeable	
R50 (uninvolved)	1330	33	Not noticeable	
R51 (uninvolved)	1460	32	Not noticeable	
R40 (uninvolved)	1500	32	Not noticeable	
R56 (uninvolved)	1540	31	Not noticeable	
R52 (uninvolved)	1640	30	Not noticeable	
R33 (uninvolved)	1670	29	Not noticeable	
R25 (uninvolved)	1730	29	Not noticeable	
R57 (uninvolved)	1760	28	Not noticeable	
R42 (uninvolved)	1800	28	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R44 (uninvolved)	1804	27	Not noticeable	
R43 (uninvolved)	1810	27	Not noticeable	
R45 (uninvolved)	1850	27	Not noticeable	
R47 (uninvolved)	1855	27	Not noticeable	
R38 (uninvolved)	1890	27	Not noticeable	
R55 (uninvolved)	1890	26	Not noticeable	
R46 (uninvolved)	1900	26	Not noticeable	
R53 (uninvolved)	1915	26	Not noticeable	
R24 (uninvolved)	1940	26	Not noticeable	
R48 (uninvolved)	1980	26	Not noticeable	
R54 (uninvolved)	2130	26	Not noticeable	
R58 (uninvolved)	2430	26	Not noticeable	
R59 (uninvolved)	2490	25	Not noticeable	
R60 (uninvolved)	2500	N/A	Not noticeable	
R2 (involved)	2590	N/A	Not noticeable	

Scenario 4 – Standard working hours

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R20 (uninvolved)	105	62	Moderately Intrusive	N, V
R21 (uninvolved)	115	61	Moderately Intrusive	N, V
R17 (uninvolved)	130	59	Moderately Intrusive	N, V
R18 (uninvolved)	135	59	Moderately Intrusive	N, V
R19 (unoccupied)	190	54	Moderately Intrusive	
R16 (uninvolved)	200	53	Moderately Intrusive	
R10 (unoccupied)	220	52	Moderately Intrusive	
R23 (uninvolved)	315	50	Moderately Intrusive	
R1 (uninvolved)	330	50	Clearly audible	
R1 (involved)	433	49	Clearly audible	
R8 (uninvolved)	440	47	Clearly audible	
R12 (Unoccupied)	460	47	Clearly audible	
R13 (uninvolved)	480	43	Clearly audible	
R2 (uninvolved)	500	43	Clearly audible	
R3 (uninvolved)	555	42	Clearly audible	
R4 (uninvolved)	640	42	Clearly audible	
R22 (uninvolved)	640	41	Not noticeable	
R3 (involved)	730	40	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R5 (uninvolved)	780	38	Not noticeable	
R7 (uninvolved)	815	38	Not noticeable	
R26 (uninvolved)	825	36	Not noticeable	
R14 (uninvolved)	830	35	Not noticeable	
R28 (uninvolved)	960	34	Not noticeable	
R27 (uninvolved)	1155	47	Not noticeable	
R41 (uninvolved)	1180	47	Not noticeable	
R6 (uninvolved)	1280	32	Not noticeable	
R49 (uninvolved)	1280	29	Not noticeable	
R50 (uninvolved)	1330	29	Not noticeable	
R51 (uninvolved)	1460	28	Not noticeable	
R40 (uninvolved)	1500	28	Not noticeable	
R56 (uninvolved)	1540	27	Not noticeable	
R52 (uninvolved)	1640	26	Not noticeable	
R33 (uninvolved)	1670	26	Not noticeable	
R25 (uninvolved)	1730	26	Not noticeable	
R57 (uninvolved)	1760	24	Not noticeable	
R42 (uninvolved)	1800	24	Not noticeable	

Receiver	Distance (m) from development infrastructure	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = 10 – 20 dB (A) above NML Highly intrusive = > 20 dB (A) above NML	Recommended additional mitigation measures
R44 (uninvolved)	1804	24	Not noticeable	
R43 (uninvolved)	1810	24	Not noticeable	
R45 (uninvolved)	1850	23	Not noticeable	
R47 (uninvolved)	1855	23	Not noticeable	
R38 (uninvolved)	1890	23	Not noticeable	
R55 (uninvolved)	1890	22	Not noticeable	
R46 (uninvolved)	1900	22	Not noticeable	
R53 (uninvolved)	1915	22	Not noticeable	
R24 (uninvolved)	1940	22	Not noticeable	
R48 (uninvolved)	1980	22	Not noticeable	
R54 (uninvolved)	2130	22	Not noticeable	
R58 (uninvolved)	2430	22	Not noticeable	
R59 (uninvolved)	2490	21	Not noticeable	
R60 (uninvolved)	2500	N/A	Not noticeable	
R2 (involved)	2590	N/A	Not noticeable	

APPENDIX H NOISE MANAGEMENT PLAN

APPENDIX I TRAFFIC IMPACT ASSESSMENT

APPENDIX J JINDERA SOIL SURVEY

APPENDIX K RUNOFF MODEL