

Environmental Impact Statement

JEMALONG HYBRID SOLAR PARK: 50MW SOLAR PHOTOVOLTAIC (PV)
PLANT



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Certification

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*.

EIS prepared by: NGH Environmental

Applicant: Vast Solar Pty Ltd

Proposed Development:

The Jemalong Hybrid Solar Park: 50MW PV Proposal includes the construction, operation and decommissioning of a photovoltaic plant that would produce around 50 megawatts of electricity. Associated infrastructure would include a substation and 66kV overhead power line.

Land to be developed:

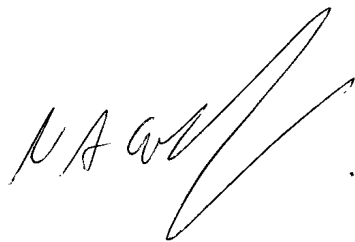
The 165 hectare Jemalong Hybrid Solar Park: 50MW PV Plant site would be located on part of Lot 13 DP753118, otherwise known as Hallidays and the land for the transmission line up to the West Jemalong substation. This PV Plant site is located on Jemalong Station, Lachlan Valley Way, Forbes, NSW, 2871.

Certification

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

Name: Nick Graham-Higgs

Signature:



Date: 10 November 2017

ABBREVIATIONS AND ACRONYMS

ABS	Australian Bureau of Statistics
AC	Alternating current
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHCRP	<i>Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010</i>
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
APZ	Asset Protection Zone (bushfire)
ARENA	Australian Renewable Energy Agency
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASC	Australian Soil Classification
ASL	Above Sea Level
BAR	Biodiversity Assessment Report
BCA	Building Code of Australia
BOM	Bureau of Meteorology
BOS	Balance of Systems
BSAL	Biophysical Strategic Agricultural Land
CASA	Civil Aviation Safety Authority
CCP	Community Consultation Plan
CCTV	Closed-circuit television
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
dB	Decibel
DC	Direct current
DECCW	Refer to OEH
DEE	Department of the Environment and Energy (Commonwealth)
DEMP	Decommissioning Environmental Management Plan
DP&E	Department of Planning and Environment (NSW)
DPI	Department of Primary Industries (NSW)
EEC	Endangered Ecological Community
EIA	Environmental impact assessment
EIS	Environmental Impact Statement
ELF	Extremely Low Frequency
EMF	Electric and magnetic field
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>

EPA	Environmental Protection Authority (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development
FBA	Framework for Biodiversity Assessment
FDI	Fire Danger Index
FIA	Flood Impact Assessment
GDE	Groundwater Dependant Ecosystem
GHGs	Greenhouse Gases
GW	Gigawatts
GWh	Gigawatt hour
ha	Hectares
HAZMAT	Hazardous Material
HV	High voltage
Hz	Hertz
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEA	International Energy Agency
INP	Industrial Noise Policy
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
JIL	Jemalong Irrigation Limited
kL	Kilolitre
km	Kilometre
kV	Kilovolt
LALC	Local Aboriginal Land Council
LCA	Life Cycle Analysis
LEP	Local Environment Plan
LGA	Local Government Area
m	Metres
mm	Millimetres
MNES	Matter of National Environmental Significance
MW	Megawatt
MWe	Megawatts electric
MWh	Megawatt hour
MWth	Megawatts thermal
NEM	National Electricity Market
NHMRC	National Health and Medical Research Council
NOW	NSW Office of Water
NPI	National Pollution Inventory
NPW Act	<i>National Parks and Wildlife Act 1974</i>

NPWS	National Parks and Wildlife Service
NSW	New South Wales
NV Act	<i>Native Vegetation Act 2003</i>
O&M	Operation and Maintenance
OEH	Office of Environment and Heritage (NSW)
OEMP	Operational Environmental Management Plan
pa	Per annum
PAC	Planning Assessment Commission
PAD	Potential Archaeological Deposit
PBP	<i>Planning for Bushfire Protection Guidelines 2006</i>
PCT	Plant Community Type
PCU	Power Conversion Unit
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PV	Photovoltaic
PVP	Property Vegetation Plan
RAPs	Registered Aboriginal Parties
RE Act	<i>Renewable Energy (Electricity) Act 2000</i> (Commonwealth)
RET	Renewable Energy Target
RFP	Request for Proposal
RFS	Rural Fire Service (NSW)
RMS	Roads and Maritime Services (NSW)
RNP	Road Noise Policy
SEARs	Secretary's Environmental Assessment Requirements (DP&E)
SEPP	State Environmental Planning Policy
SHI	NSW State Heritage Inventory
SP	Solar Park
SRD SEPP	<i>State Environmental Planning Policy (State and Regional Development) 2011</i>
SSD	State Significant Development, as defined by section 89C of the EP&A Act (<i>c.f.</i>)
TEC	Threatened Ecological Community
TMP	Traffic Management Plan
TSC Act	<i>Threatened Species Conservation Act 1995</i>
VIA	Visual Impact Assessment
VLM	Visual Landscape Management
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WHO	World Health Organisation
WM Act	<i>Water Management Act 2000</i>
WMP	Waste Management Plan
WSP	Water Sharing Plans

TABLE OF DEFINITIONS

Jemalong Hybrid Solar Park	The proposed development of a combined solar park comprising the PV Plant and the CSP Plant.
Jemalong Solar PV Plant (PV Plant)	The construction, operation and decommissioning of an approximate 50MW solar plant generally comprising a solar field, access roads, underground and above ground cables, on-site substation and associated operational facilities including the construction of a 66kV Power line from the proposed on-site substation to the existing West Jemalong Substation, as set out in this EIS.
Jemalong CSP Plant (CSP Plant)	The construction, operation and decommissioning of a 30 MW concentrating solar thermal power plant and associated infrastructure which is the subject of an existing SSD application (SSD 14_6588), as amended.
Landowner	Twynam Pastoral Co. Pty Ltd ACN [000 193 377].
Proponent	Vast Solar Pty Ltd ACN [136 258 574]
Project	The PV Plant.
Jemalong Station	17,478ha rural property located at Jemalong, Lachlan Valley Way, NSW owned by the Landowner.
Hallidays	A 165ha parcel of land within the Jemalong Station being part of Lot 13 in DP 753118.
Study Area (Biodiversity Assessment)	The area of land surveyed for the purposes of the biodiversity assessment. The Study Area includes the Development Envelope and the surrounding landscape approximately one kilometre from the boundary around the PV Plant and all the vegetation within the proposed transmission line including adjacent patches of remnant bushland
Development Envelope	The land that will be used for the construction and operation of the Project, being the land set out in the Proposal Site map provided herein this EIS, comprising parts of the following lots: Lot 13 DP753118, Lot 41 DP 753118, Lot 1 DP 652274, the land known as Naroo Lane, Lot 5 DP 1118332, lot 48 753118, Lot 1 DP 1118332, the land comprising the Cadow Channel and Lot 1 DP 441702. This comprises the land required to construct the substation, the solar field, the proposed internal access tracks, and the corridor for the 66kV power line and connection to the existing West Jemalong substation. The Proposal Site has been defined in a precautionary manner, in that it is a 'worst case' area; some areas within it may not be required to be impacted during construction. This is to ensure this assessment is robust to any minor changes that may occur to the layout during the detailed design phase.
Proposal Site	This is a smaller and more in-depth area surveyed for the purposes of the biodiversity assessment and includes the Development Envelope, immediate surrounds and the area assessed for the 66kV powerline with a 45m buffer.
Contractor	Responsible for the construction of the PV Plant and will implement the requirements of the development consent, EIS, CEMP and associated management plans.
Operator	Responsible for the operation and management of the PV Plant and will implement the requirements of the development consent, EIS and OEMP and associated management plans.
Sub contractor	Construction and operation subcontractors are contractually bound to implement the development consent, EIS, CEMP, OEMP, and associated management plans provided by the Contractor and/or Operator.
West Jemalong Substation	The Essential Energy substation located at Lot 1 DP441702, located at the corner of Lachlan Valley Way and Whispering Pines Lane as identified on the Proposal Site map provided herein this EIS.

EXECUTIVE SUMMARY

Introduction

Vast Solar Pty Ltd (Vast Solar), the proponent, proposes to develop the Jemalong Solar PV Plant at Jemalong within the Forbes Local Government Area. This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed Jemalong 50MW PV Plant (The Proposal). The Proposal site for the PV Plant is located on a paddock named Hallidays that in 2016 was also proposed as the site for Vast Solar's first commercial scale 30MW CSP Plant. Hallidays paddock is part of Jemalong Station.

Vast Solar is an Australian company developing unique modular concentrating solar thermal power (CSP) technology. This CSP technology has the potential to deliver utility scale renewable energy power generation with affordable thermal energy storage, contributing much needed dispatchable renewable energy to the electricity grid. Vast Solar has undertaken CSP research and development activities since 2009. This journey has involved progressive development of demonstration facilities to trial, test and scale different aspects of the technology. Since 2011, research, development and demonstration projects have been built at Jemalong, 30 km west of Forbes, NSW.

Vast Solar's 1.1 MW CSP Pilot Plant is currently in its penultimate stages of completion with final commissioning anticipated in early 2018. This will enable detailed engineering design of the 30MW CSP Plant to be undertaken and for the planning and development of the CSP Plant to be appropriately progressed.

In August 2016, a development application (SSD 14_6588) for development on the Hallidays paddock of the Jemalong 30MW CSP Plant and associated infrastructure was submitted. Vast Solar still intends to develop the 30MW CSP Plant but in a paddock adjoining Hallidays and it expects to lodge an amendment to SSD 14_6588 in due course which will seek to amend the proposed location of the CSP Plant.

The proposed Jemalong Solar PV Plant is an independent and standalone PV Plant Proposal located on the original site of the proposal 30MW CSP Plant. If approved, the PV Plant will be the first stage of the Jemalong Hybrid Solar Park. It will showcase the value of co-located PV and CSP power generation facilities demonstrating to Australia and the world the capability to deliver dispatchable renewable power from CSP (able to generate when PV cannot) to complement intermittent renewable energy delivered by PV using the same transmission and grid connection infrastructure.

The PV Plant is proposed to be developed on the 165-hectare site located on part of Lot 13 DP753118 and known as 'Hallidays', located approximately 36 km west of Forbes within the Forbes Local Government Area. It is accessed from the Lachlan Valley Way to the north, via Wilbertroy Lane and Naroo Lane.

NGH Environmental has prepared the EIS on behalf of the proponent Vast Solar Pty Ltd, in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. The Proposal is being assessed as a State Significant Development (SSD) in accordance with *State Environmental Planning Policy (State and Regional Development) 2011*. The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), issued to the proponent by the NSW Department of Planning and Environment (DP&E) on 26 October 2017.

The Proposal

Vast Solar proposes to construct a photovoltaic solar plant (of approximately 50 MWac capacity), with an on-site substation. The Proposal infrastructure includes:

- photovoltaic solar modules (up to approximately 170,000 modules);
- single-axis tracking module framing system mounted on steel piles;
- up to approximately 22 containerised Power Conversion Units (PCUs);
- a substation containing transformers, associated switchgear and control and protection equipment;
- operations and maintenance buildings with associated car parking;
- development of the road intersection between Lachlan Valley Way and Wilbertroy Lane, being the main access turn off to the PV Plant
- minimal upgrade and maintenance of Wilbertroy Lane and Naroo Lane, being the roads used to access the PV Plant;
- above ground and underground cabling;
- internal all-weather access tracks;
- security lighting (infra-red), closed-circuit television (CCTV) system and security fencing;
- native vegetation plantings to provide visual screening;
- meteorological station(s); and
- a 66kV overhead power line (approximately 5km long) connecting the PV Plant substation to the existing West Jemalong Essential Energy substation.

The layout of the infrastructure components is shown on Figure 4-2. The plans and specifications of the components are subject to detailed design and ultimate product selection.

Approximately 170,000 solar panels would be mounted in rows on a fixed or single axis tracking system. A single axis tracker would have a typical maximum tilt height of 3m – 3.5m. Ground cover would be established under the panels, and would likely be managed using sheep grazing. The Proposal is wholly located within the boundaries of the Jemalong Station property.

Approximately 22 PCUs (solar) would be installed around the site, each containing multiple inverters and a transformer.

A 5 km (approx.) 66kV overhead power line will be installed to connect into the existing West Jemalong Essential Energy substation, located 3.2km north of the Proposal Site. The power poles would be 22m high, spaced approximately 200m apart and located within an easement approximately 30m wide, as per TransGrid Easement Guidelines for third party developers.

The Proposal also includes the subdivision of the property to create an approximately 0.5 hectare lot for the proposed on-site grid connection substation. A 165 hectare lot will also be created to accommodate the PV Plant.

The substation will contain transformers, associated switchgear and control and protection equipment such as drainage and an oil containment system. It may also include a control building and switch room.

It would be constructed on a gravel bench and surrounded by security fencing. Almost all of the electrical cabling on the site would be buried.

An internal road system would be established for the construction and maintenance of the PV Plant.

The Proposal covers the construction, operation and decommissioning phases of the project. The construction phase would last approximately 12 months, occur indicatively between spring 2018 and winter 2019, and have an estimated capital cost of up to approximately \$70.25 million (Refer Appendix M).

The PV Plant will be expected to operate for 30 years. When the solar plant is decommissioned, all above ground infrastructure would be removed to a depth of 500 millimetres. Farm infrastructure, soil condition and vegetation cover within the project footprint would be reinstated in consultation with the landowner and consistent with land use requirements.

Jemalong Hybrid Solar Park

An SSD application currently exists over the Site. SSD 6588 was lodged with DPE in August 2016 for the construction, operation and decommissioning of Jemalong Solar Station, a 30MW CSP Plant at the Property.

There remains, however, additional planning and design work to complete the response to agency submissions and ensure the design and capacity of the CSP Plant is optimal and effective. In parallel with that continuing planning and design work for the CSP Plant, Vast Solar is developing the PV Plant the subject of this EIS. It is proposed that the PV Plant will ultimately be co-located with the CSP Plant to form the Jemalong Hybrid Solar Park (Refer Appendix L).

On the basis that project timelines for the PV Plant are significantly shorter and that the planning and design work for the CSP Plant is ongoing, Vast Solar proposes the following steps and timing for the assessment and determination of each of the development applications for the Jemalong Hybrid Solar Park:

1. PV Plant SSD 8803 standalone: the PV Plant application SSD 8803 will be completed and assessed on its own merits as a standalone development. This means that the EIS for the PV Plant contains an assessment of the PV Plant, its associated infrastructure, transmission and connection assets without reference to the CSP Plant, including without reference to any potential cumulative impacts associated with both components of the Jemalong Hybrid Solar Park. This is on the basis that the impacts of the CSP Plant can only be identified once the final design has been determined;
2. CSP Plant SSD 6588 modification: the CSP Plant application will be modified to relocate the CSP Plant to an adjacent site south-east of the original location that still includes part of Lot 13 DP 753118 but also includes part of the immediately adjacent lots.
3. CSP Plant SSD 6588 revised EIS and re-notification: the previous EIS for the CSP Plant will be revised to accommodate the new location and the final design and technology of the CSP Plant, as well as the nature and scope of the shared assets (primarily transmission and connection infrastructure and shared civil works) and the cumulative impacts arising from co-location and operation as the Jemalong Hybrid Solar Park. As noted above, this is on the basis that the cumulative impacts of the Jemalong Hybrid Solar Park can only be assessed once the PV Plant SSD 8803 application the subject of this EIS has been assessed and determined and the design of the CSP Plant has been finalised; and

4. CSP Plant SSD 6588 response to submissions: the response to agency submissions that is currently due will be deferred and, instead, be prepared in response to the submissions that will be received on the revised EIS for the finalised design and location of the CSP Plant.

Consultation

The proponent has consulted Forbes Shire Council, property neighbours and the local community during the planning and development of the CSP Plant and PV Plant proposals. This consultation has been coordinated using a detailed project-specific Community Liaison Plan (CLP) which was updated in 2017 to include and address the proposed development of the PV Plant. The CSP Plant and PV Plant proposals have been developed iteratively in response to community, stakeholder and agency inputs. Community consultation activities for both Plants have included:

- presentations to and meetings with Forbes Shire Council
- direct contact with neighbours via telephone or farm visits
- a project website <http://www.vastsolar.com/>
- morning tea/s held at Vast Solar's pilot CSP plant attended by 15-20 neighbours
- meetings with immediate neighbours of the Proposal Site.

Consultation for the CSP Plant was undertaken with Condobolin Local Aboriginal Land Council (LALC) and two Registered Aboriginal Parties in accordance with relevant legislation and policy guidelines. A member of the Condobolin LALC was also engaged to participate in the field archaeological survey at the site.

The SEARs for the PV Plant proposal were prepared by the DP&E in consultation with Forbes Shire Council and the relevant State Government agencies. The proponent has also undertaken its own consultation with relevant agencies and organisations during the development of the PV Plant proposal including the DP&E, Forbes Shire Council, Roads and Maritime Services and the Office of Environment and Heritage. With regards to the CSP Plant, consultation was also carried out with Department of Defence, Department of Primary Industries, and Central West Local Land Services.

Key Environmental Issues

A site constraints analysis, environmental risk assessment and the consultation process were used to identify the following key issues relevant to the assessment of the Proposal:

- biodiversity
- Aboriginal heritage
- visual amenity and landscape character
- hydrology (including flooding).

These issues have been assessed in detail in the EIS. A range of other issues including soil and water values, social and economic values, traffic, noise, hazards, historic heritage and air quality impacts have also been assessed.

Impact Assessment and Management

The EIS identifies environmental values, the potential impacts of the project on these values and the relative significance of the potential impacts. A comprehensive suite of mitigation measures is provided

in the EIS to avoid and minimise impacts. The mitigation measures would be implemented through an Environmental Management Strategy including a Construction Environmental Management Plan, an Operation Environmental Management Plan, a Decommissioning Environmental Management Plan and a series of specialised sub-plans.

Biodiversity

Biodiversity (flora and fauna) investigations included searches of relevant databases and field survey. A total of 0.84 ha of moderate to good condition native vegetation is proposed for removal, comprised of Poplar Box grassy woodland and River Red Gum swampy woodland wetland. The total amount of this vegetation occurring within the Proposal Site and Transmission Line is approximately 10.08ha. A further 101.31 ha of exotic-dominated vegetation would be impacted, from a total area of 176.72ha occurring in the Proposal site and Transmission Line.

One listed Endangered Ecological Community (EEC) under the Threatened Species Conservation Act 1995 (TSC Act) occurs adjacent to the Transmission Line. However, this EEC community of Western Grey Box – Poplar Box – White Cypress Pine open woodland will not be impacted by the development of the Proposal.

Two hundred and five hollow-bearing trees are located within or are very close to the Proposal Site. Ten of these trees within the Development Envelope will require removal for the proposed works. The loss of these trees represents a proportional reduction of approximately 5% of all hollow-bearing trees observed within the Proposal Site. The impact resulting from the loss of these hollows is assessed as minor.

Mitigation and management measures have been proposed which include a staged habitat removal process and the development and implementation of an offset plan to minimise injury and mortality and account for the loss in habitat resources.

No threatened flora species were observed during the field survey or are considered likely to occur or be impacted by the Proposal. Five threatened bird species and four threatened microbats are considered to potentially occur in the study area. Assessments of significance determined that the Proposal is not likely to have a significant impact on any of the listed fauna species likely to occur in the study area. Avoidance and minimisation measures centre on protecting areas of better habitat from direct and indirect impacts.

Aboriginal Heritage

Aboriginal heritage investigations included Aboriginal community consultation, background research, field survey and significance assessment. A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted for a 400 km² area encompassing the Proposal Site. Five Aboriginal object sites were identified as being listed for the search area, none of which occur in the Proposal Site. During the cultural heritage and archaeological survey, six low density stone artefact locales were recorded near the Proposal Site. No Aboriginal objects or survey units with potential conservation value have been identified to have a high probability of being present or impacted by the works.

Visual Amenity

From the results of the community consultation, there appears to be little concern in the local community about the visual impacts of the Proposal. Twenty-six viewpoints were assessed separately, 24 viewpoints were considered to have low impact significance. The other two viewpoints were identified as significant visual impact due to the visibility of the powerline. Overall the visual impact of the proposed development is of low significance. This is a consequence of the relatively low height of the proposed design, presence of screening vegetation throughout the study area, the relatively low population density

and the distance of publicly available views from the proposed solar plant. Where significant visual impacts have been identified, there are not expected to be any significant residual visual impacts if the mitigation and management measures are implemented, such as a Landscape Management Plan.

Hydrology, including Flooding

The Proposal Site is located on the Lachlan River floodplain, immediately downstream of the Jemalong Gap. Floods in this area are common, and cover a large area of the floodplain for prolonged periods. The Proposal Site however is outside the floodway. Modelling found that the Proposal would not generate a significant change in flood levels during flood events. Flooding impacts on the Proposal will be minimised by raising the height of PV modules in potentially affected areas and by ensuring that critical infrastructure is not located in areas that could be impacted by significant flooding events.

LOWER RISK ISSUES

Soils

The Proposal Site occurs on the Lachlan River Catchment. Soil at the Proposal Site is mapped as three soil landscapes including Corinella, Scrubby plains and Warroo Channel (King, 1998). Evidence of moderate wind erosion was noted during field inspections, all soils were noted to be hard setting and cracking could occur during dry periods. The NSW Natural Resources Atlas searches did not show any occurrences of ASS or dryland salinity. The soils at the site have been extensively disturbed by paddock levelling, repeated cultivation and the construction of irrigation infrastructure. Soils and water values would be protected during construction by best practice erosion, sedimentation and pollution control, and during operation by maintaining adequate perennial groundcover at all times (subject to climatic conditions).

Noise

Construction noise activities for the PV Plant and power line are unlikely to exceed the NML for standard work hours at all identified receivers. As such a construction noise management plan is not required, however mitigation and construction management measures have been recommended to ensure that receivers are not impacted by the Proposal's activities. Operational noise impacts resulting from the operation of the PV Plant are unlikely.

Public Utilities

The Proposal would not adversely affect any public utilities infrastructure or the public road network. The proponent would facilitate the repair of any damage to local roads caused by heavy traffic associated with the project during the construction phase.

Roads

The Proposal Site would be accessed via the Lachlan Valley Way and the unsealed local road Wilbertroy Lane and Naroo Lane. A Construction Traffic Management Plan would be prepared to manage haulage traffic during construction. The plan would include:

- consultation with local road users and road authorities
- traffic controls to ensure road user safety
- timing of heavy vehicle movements to minimise disturbance to residents, school bus routes and potential inconvenience for tourists (on Lachlan Valley Way)
- road condition monitoring.

Social and Economic Impacts

The Proposal would not be likely to affect local tourism or the supply of goods and services to the local area. Where a potential impact on local tourism or the supply of goods and services is identified during construction the proponent will consult with local representative bodies and businesses to identify solutions to minimise the potential conflict between construction activities and tourism or local supply needs. Impacts on local tourism and the supply of goods and services are unlikely during operational phase.

The Proposal would support 100 direct and 100 indirect jobs over the construction period, and four direct and nine indirect jobs during operation. Wherever possible local businesses would be used to supply goods and services during all phases of the project, and local business transactions are expected to represent at least 50% of the project's procurement spend.

The Proposal Site is located in a rural area with a dispersed settlement pattern and predominantly broad scale agricultural land uses. The PV Plant property comprises a paddock that has been used for grazing and cropping. The suspension of grazing and cropping for the life of the PV Plant would represent a potential impact on only a small percentage of local and regional production.

Use of Agricultural Land

The State Government has mapped Biophysical Strategic Agricultural Land (BSAL) across the State; this is land which features the best quality soil and water resources and is capable of sustaining high levels of productivity. The Proposal Site is not located in an area mapped as BSAL. The site is also not likely to be considered 'Important Agricultural Land' as defined in Department of Primary Industries mapping as lands that are 'highly suitable for important agricultural industries at a local and regional scale'. Furthermore, the Proposal would not affect unique or significant agricultural land as none are listed under Schedule 2 of the SEPP Rural Lands (2008) Clause 13. As such, the development and operation of the PV Plant is not likely to negatively impact the overall land capability or future land use options.

The PV plant is also not likely to restrict or negatively impact any surrounding land uses. The limited quantities of water used for the project during the construction and operation phases would not be likely to place pressure on local water supplies. Approximately 3.4 ML of water would be required during construction, however the precise amount would be affected by prevailing weather conditions and the need for watering to suppress dust generation.

Other Impacts

The project includes comprehensive preparation and planning to account for potential hazards including hazardous materials and fire risks.

Cumulative impacts involving the combined effect of similar or different impacts associated with the Proposal and other major projects are not expected to be significant.

Justification

The assessments presented in the EIS indicate that the proposed PV Plant should be approved principally because:

- the Proposal is generally permissible (except for the subdivision of the substation lot) and meets all planning requirements. The Proposal Site is zoned RU1 under the Forbes LEP, and no Crown lands are present within the boundary of the Proposal Site.
- the identified impacts are generally minor, highly localised, capable of mitigation or offsetting and often confined to the construction phase

- the site is highly suited to utility scale solar electricity generation, with adequate capacity in the local transmission network and a high-quality local solar resource
- the Proposal reflects the technology best suited to the site and network requirements
- the Proposal provides an important contribution to the urgent need to abate carbon emissions in the electricity sector
- the Proposal offers a range of community benefits relating to electricity supply, economic activity, and local employment opportunities
- the Proposal is reversible and would not result in any permanent loss of land use potential or restrict future land and resource use options
- the Proposal can operate in a manner co-existent with agricultural land use activities, including sheep grazing.

Additionally, as set out above, the PV Plant will be one component of the proposed Jemalong Solar Hybrid Park, being a world leading, hybrid renewable energy facility.

Geographical and grid constraints modelling and a comprehensive set of criteria were used to select the Proposal Site. The site provides a high quality solar resource, flat, stable and low-risk terrain, good road access and locally available HV substation. The site location enables the placement of an on-site substation resulting in a consequential reduction in the potential project footprint and the potential environmental impacts associated with the project.

The Proposal is consistent with the objects and matters for consideration in the EP&A Act and with the principles of Ecologically Sustainable Development.

Conclusion

The primary potential impacts of the proposed PV Plant are:

- minor paddock tree clearing
- intermittent noise during the construction phase
- increased traffic during the construction phase
- potential visual impacts from the power line, but not the PV Plant
- the temporary suspension of agricultural cropping during the 30-year operation phase.

The key benefits likely to flow from the Proposal include a substantial contribution to climate change objectives, improved electricity reliability and security and a range of local and regional social and economic benefits.

The PV Plant has been located and designed to avoid and minimise impacts. Identified mitigation measures include:

- accessible and responsive consultation
- native tree and shrub plantings to provide visual screening
- soil protection by establishing a perennial groundcover across the site
- residual biodiversity impacts would be offset
- following decommissioning, the PV Plant infrastructure would be removed and the site would be restored to full agricultural and land use potential.

The EIS concludes that the Proposal would not significantly affect environmental, cultural, social and economic values at both the local or regional scales. The Proposal would form an important part of

Australia's response to climate change and government commitments to reduce carbon emissions in the electricity sector. In view of the demonstrated need for, and benefits of, the Proposal, the PV Plant is considered to be justified and clearly in the public interest.

1 INTRODUCTION

1.1 PROPOSAL OVERVIEW

Vast Solar Pty Limited ('Vast Solar') is proposing to develop the Jemalong Hybrid Solar Park at Jemalong in central New South Wales (NSW). The proposed Jemalong Hybrid Solar Park comprises a solar photovoltaic ('PV') plant of approximately 50 megawatt (MWac) ('PV Plant') and a 30MW Concentrating Solar Thermal Power Plant ('CSP Plant') within the Forbes Local Government Area (LGA). The location is shown on Figure 1.1.

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed PV Plant only. The facility would be developed on the site of the existing Development Application (DA) (SSD 14_6588) for the originally proposed Jemalong Solar Station 30 MW CSP Plant and associated infrastructure, as discussed earlier (CSP Plant). As such the results and observations of the baseline and specialist studies prepared for the 30MW CSP Plant EIS have been referenced in the preparation of this EIS but have been reviewed and revised where necessary to accommodate the changed of the infrastructure and the effluxion of time.

The proponent is seeking approval to operate the Proposal for up to 30 years.

DA for SSD 14_6588 was submitted to DPE on 16 August 2016 and Vast Solar expects to lodge a modification to that application to amend the proposed location of the CSP Plant (refer Appendix L).

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The Proposal is also considered a State Significant Development (SSD) under Clause 20, schedule 1 of the *State Environmental Planning Policy (SEPP)*. As such, the structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DP&E) on 26 October 2017.

Further details on the Project's design, infrastructure and works activities are provided in section 4.

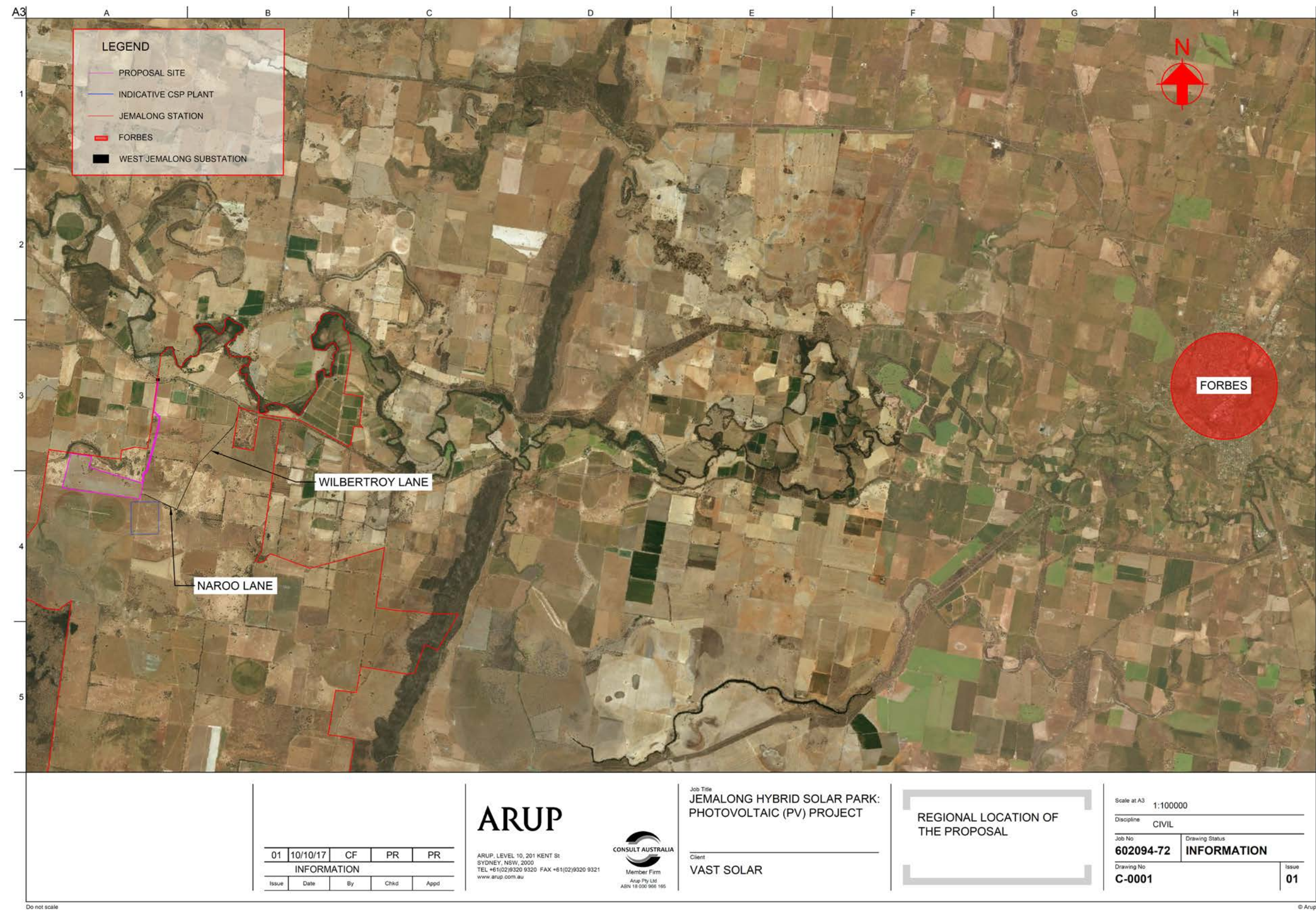


Figure 1-1 Regional Location of the Proposal

1.2 THIS REPORT

This EIS identifies and assesses the potential environmental issues associated with the construction, operation and decommissioning of the proposed PV Plant. NGH Environmental has prepared the EIS on behalf of the proponent Vast Solar.

The EIS:

- describes the proposed works, the Proposal Site and the wider study area
- identifies statutory approval requirements
- identifies and assesses the significance of impacts on environmental values
- provides mitigation measures to avoid, minimise or mitigate identified impacts.

The EIS has been prepared to support the DA lodged with the DP&E for approval under Part 4 of the EP&A Act. The structure and content of the EIS is intended to satisfy the SEARs for the Proposal issued by DP&E as part of the SSD process. The content of the EIS is also consistent with the draft EIS guidelines recently released by DP&E (DP&E 2017a).

The DA and Scoping Report for the PV Plant were submitted to DP&E on 9 October 2017, and SEARs for the assessment were issued by DP&E on 26 October 2017 (refer Appendix A). The SEARs and corresponding sections in the EIS are shown in Table 1-1.

Table 1-1 SEARs and EIS references

Secretary's Environmental Assessment Requirements	EIS reference
A stand-alone executive summary.	Executive summary
A full description of the development, including: <ul style="list-style-type: none"> ○ 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 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. 	Section 4
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).	Section 11
An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: <ul style="list-style-type: none"> ○ 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, 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 8 Section 9
A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS.	Section 10
The reasons why the development should be approved having regard to: <ul style="list-style-type: none"> ○ relevant matters for consideration under the Environmental Planning and 	Section 11 Section 2.3

Secretary's Environmental Assessment Requirements	EIS reference
<p>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;</p> <ul style="list-style-type: none"> 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. 	
The EIS must address the following specific issues:	
<ul style="list-style-type: none"> Biodiversity – including an assessment of the biodiversity values and the likely biodiversity impacts of the development, a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development; 	Section 8.1
<ul style="list-style-type: none"> 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; 	Section 8.2 Section 6.2
<ul style="list-style-type: none"> Land – including an assessment of the impact of the development on agricultural land and flood prone land, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land; 	Section 3 Section 9.1
<ul style="list-style-type: none"> 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 8.3
<ul style="list-style-type: none"> Noise – including an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Industrial Noise Policy</i> (INP), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria; 	Section 9.3
<ul style="list-style-type: none"> Transport – including an assessment of the site access route (including Naroo Lane, Wilbertroy Lane and Lachlan Valley Way), site access point and likely transport impacts (including peak and average traffic generation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); 	Section 9.5
<ul style="list-style-type: none"> Water - including <ul style="list-style-type: none"> an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including the Thurumbidgee Lagoon, wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; details of water requirements and supply arrangements for construction and operation; and a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom 2004); 	Section 9.2

Secretary's Environmental Assessment Requirements	EIS reference
<ul style="list-style-type: none"> ○ Hazards and Electromagnetic Interference – an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields. 	Section 9.6 Section 9.7
<ul style="list-style-type: none"> ○ Socio-economic – including an assessment of the likely impacts on the local community and consideration of the construction workforce accommodation. 	Section 9.4 Section 6
<p>During the preparation of the EIS for the development, 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 Forbes Council. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.</p>	Section 6
<p>The development application must be accompanied by:</p> <ul style="list-style-type: none"> ○ a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the <i>Environmental Planning and Assessment Regulation 2000</i>); and ○ the consent in writing of the owner of the land (as required in clause 49(1)(b) of the <i>Environmental Planning and Assessment Regulation 2000</i>). 	Provided separately

1.3 Vast Solar

Vast Solar is an Australian Company developing solar energy generating technology known as Concentrating solar thermal power (CSP). CSP technology uses the thermal energy of the sun to produce power. The Australian Renewable Energy Agency (ARENA) and organisations that include Doosan Skoda are significant investors and/or partners in the Company and their work.

Vast Solar has undertaken CSP research and development activities since 2009. This has involved progressive development of demonstration facilities to trial, test and scale different aspects of the technology. Since 2011, three research and development projects or project 'phases' have been undertaken, with demonstration sites each built at Jemalong, 30 km west of Forbes, NSW.

In August 2016 a development application (SSD 14_6588) for the development of the Jemalong 30 MW CSP Plant and associated infrastructure was submitted. The 30MW CSP Plant proposal represents the culmination of the above Australian research and engineering innovation and will be Vast Solar's first commercial scale CSP plant. The Proposal, will showcase Australian research and innovation to the local region, Australia and the world, and provide dispatchable renewable energy to the grid and contribute to state and national government commitments to reduce greenhouse gas emissions. Vast Solar expects to lodge an amendment to SSD 14_6588 on or about the same time as it lodges the Development Application and EIS for the PV Plant Proposal, which will seek to amend the proposed location of the CSP Plant.

The proposed PV Plant is an independent PV Plant proposal, located on the same parcel of land that was previously assessed for the proposed 30MW CSP Plant, that Vast Solar proposes to develop in recognition of the growing demand for renewable energy. If approved, the PV Plant will be the first stage of the Jemalong Hybrid Solar Park that will showcase the value of co-located PV and CSP power generation facilities that will demonstrate to Australia and the world the capability to deliver dispatchable renewable power from CSP (able to be dispatched when PV cannot generate power, when the sun goes down) to

complement renewable energy delivered by PV using the same transmission and grid connection infrastructure.

The Jemalong Hybrid Solar Park will offer NSW the opportunity to realise a world leading solar hybrid facility that will have the capacity to generate and dispatch renewable energy throughout the day and during the critical evening and morning peak periods.

2 STRATEGIC NEED, OBJECTIVES AND ALTERNATIVES

2.1 STRATEGIC NEED AND BENEFITS

2.1.1 Climate change mitigation

Paris Agreement

Under the United Nations Paris Agreement on climate change, Australia has committed to the following greenhouse gas emission reduction targets:

- 5 per cent below 2000 levels by 2020
- 26 to 28 per cent below 2005 levels by 2030
- net zero emissions in the second half of the century.

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

It has been argued that the electricity generation sector should aim to achieve considerably higher reductions than the general 26-28% target to reduce pressures on other industries (such as agriculture, construction and manufacturing), where abatement is more difficult and expensive. A more efficient abatement model would see the electricity sector reduce emissions by 40-55% below 2005 levels, requiring renewable penetration in the order of 66-75% by 2030 (Australia Institute 2017).

In terms of renewable energy technologies, solar projects have the capacity to provide faster results 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.

The PV Plant Proposal would generate around 109,500 megawatt hour (MWh) per year, saving approximately 36,530 tonnes of carbon dioxide per year. This assumes generation would otherwise be made by brown coal with a carbon factor of 0.33372 tonnes per MWh (DOE 2016). Precise generation figures may change subject to final site design and product selection.

Renewable Energy Target Scheme

The legislated objectives of the Commonwealth Renewable Energy Target (RET) Scheme are:

- to encourage additional generation of electricity from renewable sources
- to reduce emissions of greenhouse gases in the electricity sector
- to ensure generation of electricity from ecologically sustainable renewable energy sources.

The RET works by creating a market for renewable energy certificates, which drives investment in the renewable energy sector. Renewable energy generators create certificates for electricity generated or displaced. Electricity retailers purchase these certificates to meet their renewable energy obligations.

The RET aims to achieve large-scale renewable generation of 33,000 gigawatt hours (GWh) in 2020, meaning that about 23.5% of Australia's electricity generation would be from renewable sources.

The Large-scale Renewable Energy Target component of the RET requires an estimated 6,000MW of new renewable power stations to be built by 2020, which is likely to consist of approximately 75% wind and 25% solar (Clean Energy Regulator 2015 in Finkel *et al.* 2016). This would represent a doubling of the total renewable capacity installed since 2001 (Ernst and Young 2016 in Finkel *et al.* 2016).

The additional committed new build capacity for renewable energy generation of 3,000MW required in 2016 was not reached (CER 2017). For the 2020 target to be achieved, around 3,000MW will need to be committed in 2017 and a further 1,000MW in 2018. The 2020 target remains achievable provided investment momentum can be maintained throughout 2017 (CER 2017).

The proposed PV Plant would directly contribute to meeting the RET renewable energy generation target by generating around 109,500 MWh per year, which represents the power consumption of approximately 18,500 homes (assuming an average household consumption of 5,920 kilowatt hours (kWh) per annum (pa). The Proposal has the added advantage that the shorter potential time lag between investment and commissioning in solar projects allows RET certificates to be processed and made available to the market sooner (CER 2017).

NSW Goals and Policies

The NSW Climate Change Policy Framework (State of NSW and Office of Environment and Heritage 2016) aims to 'maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change'. The framework endorses and is intended to complement national Paris Agreement targets, and has the following aspirational long-term objectives:

- achieve net-zero emissions by 2050
- NSW is more resilient to a changing climate.

Implementation of the framework encompasses emission reduction and adaptation, and includes the development of an advanced energy action plan, a new energy efficiency plan, a climate change adaptation action plan, and additional policy investigations for sectors with significant opportunities and risks. Under the framework, a draft Climate Change Fund Strategic Plan has been released for public consultation (OEH 2016a). The Proposal would directly contribute to the objectives of the framework by reducing greenhouse gas emissions.

The Proposal would also contribute to the New South Wales Renewable Energy Action Plan (NSW Government 2013), which supports national renewable energy targets. The Proposal will progress 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 further assist in achieving the following goal in NSW 2021: A plan to Make NSW Number One (NSW Government 2011):

- *Contribute to the national renewable energy target ... by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources.*

2.1.2 Electricity reliability and security

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life (DIS 2015). Nine coal-fired power stations have closed since the 2011-2012, representing around 3,600 MW of installed capacity (AER 2015 in Commonwealth of Australia 2016). In addition, decommissioning commenced at the 1,600 MW Hazelwood Power Station in Victoria in March this year and the future of 2,000MW Liddell Power Station in NSW is uncertain beyond 2022.

The Commonwealth RET scheme is supporting the transition to renewable energy sources, principally solar and wind. The PV Plant Proposal would generate around 109,500 MWh per year, which represents the power consumption of approximately 18,500 homes.

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

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

2.1.3 Socio-economic benefits

Employment

The Proposal would support 100 direct and 100 indirect jobs over the construction period, and three to four direct jobs during operation. In 2012, 24,000 Australians were employed in the renewable energy sector and the industry is set to generate an additional new 18,400 jobs by 2020 (CEC 2015). Large scale renewable projects create long term skilled employment opportunities, which are rare in many rural communities.

These include the provision of:

- Direct business volume benefits for local services, materials and contracting businesses.
- Contribution to tourism development in the Forbes region (the Parkes Radio-telescope has demonstrated the potential of scientific and engineering projects to provide an anchor for tourism business over the long term).
- Delivery of sufficient solar energy into the national electricity system at Forbes to power a substantial portion of the Forbes LGA.

The Proposal would increase the economic value of the land without materially affecting the agricultural viability of Jemalong Station or the overall productivity of the property for food production

Electricity prices

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

per year beyond 2020 (Roam Consulting 2014). Renewables increase diversity and competition in the wholesale energy market – and as in any market, less competition means higher prices.

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

Several studies on the impacts of increased large scale renewable energy generation under the RET have indicated that this is likely to put downward pressure on electricity prices (Australia Institute 2015). To the extent that competition amongst retailers is limited, and to the extent that the RET creates greater contestability through the creation of economically sustainable new entrant retailers, there will be further downward pressure on the retail margins (Sinclair Knight Merz 2013).

New solar energy generation is at least as cheap as coal in Australia, and the levelised cost of electricity from solar is set to drop another 66% by 2040. Solar will beat the cost of existing, fully depreciated and unrefurbished coal plants by 2032 (BNEF 2017). Solar is also cheaper than ‘clean coal’; the cost per MWh of new solar is \$78-\$140, whereas new ‘ultra supercritical’ coal is \$134-\$203 and coal with carbon capture and storage is \$352 (Climate Council 2017).

2.2 PROPOSAL OBJECTIVES

The objectives of the Project Proposal are to:

- Select a site which is suitable for utility scale solar electricity generation, in terms of solar yield, transmission grid connection and environmental constraints (refer section 11.2)
- Develop an economically viable commercial solar electricity generation project
- Produce clean and renewable energy to help reduce greenhouse gas emissions and contribute to efforts to meet state and national climate change mitigation targets
- Obtain broad support for the PV Plant, and the Hybrid Solar Park that it will be part of, from the local community
- Provide local and regional employment opportunities and other community benefits
- Avoid and minimise environmental impacts wherever practicable through careful design and best practice environmental protection and impact mitigation.
- Provide a high value added land use to the host property, where the Proposal would be operated.

2.3 ALTERNATIVES

Various options relating to location, design and technology were evaluated in the planning of the Proposal taking into account strategic needs and benefits and Proposal objectives.

2.3.1 The ‘do nothing’ option

The direct consequence of not proceeding with the Proposal would be to forgo the benefits outlined in section 2.1. This would entail:

- loss of opportunity to reduce GHG emissions in the electricity generation sector and contribute to state and national climate change targets and commitments
- loss of electricity network reliability and security benefits

- loss of direct and indirect social and economic benefits, including employment and increased demand for local goods and services.
- Loss of opportunity to promote Research and Development in the field of renewable energy. Specifically, the Proponent a leading Australian R&D company seeks to develop an Australian first “hybrid” solar park – demonstrating the ability of solar PV and CSP to generate and dispatch renewable energy throughout the day and during the critical evening and morning peak periods.

Doing nothing would avoid the environmental impacts associated with the development and operation of the Proposal. These include construction noise, traffic and dust, visual impacts and foregone agricultural production at the site for the life of the PV Plant. However, these impacts are considered to be manageable and would not be likely to result in a substantive negative impact to the environment or community over the medium and long term (refer section 8).

Given the clear benefits of the Proposal and the acceptability or manageability of environmental impacts, ‘do nothing’ is not the preferred option from an environmental, economic and social standpoint.

2.3.2 *Alternative locations and layouts*

A number of locations on Jemalong Station were considered for the Proposal. Candidate locations were discussed with the owner and operator of the farming operation, Twynam Pastoral Co Pty Ltd, to determine locations which would have acceptable impact on farming operations. The selection of the location considered potential impacts on native vegetation, visual amenity, and heritage. A key consideration was to determine a location within reasonable proximity to the transmission infrastructure operated by Essential Energy, and specifically the Essential Energy West Jemalong substation, located at the intersection of Lachlan Valley Way and Whispering Pines Lane, Jemalong.

After consideration of multiple locations, two potential locations were short-listed: the Hallidays paddock and an alternative location to the north-east of Hallidays, straddling an area from the eastern side of Wilbertroy Lane to the south-east corner of the Jemalong Polo complex.

The alternative site, north-east of the Hallidays paddock, had specific advantages in terms of proximity to the Essential Energy transmission line, and ease of access from Wilbertroy Lane. However, this site would have increased significantly the visual impacts of the Proposal for neighbours, users of Lachlan Valley Way, and the broader community.

The Hallidays paddock is positioned and oriented such that the Proposal would be almost invisible from the Lachlan Valley Way (the nearest public road), would have low visibility to surrounding neighbours and to the general public, given the lot provides natural screening from established tree-lines to the north, west and (at a distance) south. As well as the aesthetic benefits this provides, preserving the rural amenity of the Jemalong area, this also provides security benefits by limiting public access.

Ultimately the Hallidays paddock was selected as the preferred site. Development of the Proposal on the Hallidays paddock would demonstrate the minimal impact of Vast Solar’s design on visual amenity in rural and regional locations, where PV projects of 30-70MW scale are most likely to be developed.

2.3.3 *Alternative technologies*

Alternative technologies for renewable energy generation at the Proposal Site encompass generation technology (principally solar or wind), and PV solar equipment. This site is particularly well suited for PV. CSP technology has also been considered for this site and is the subject of an SSD application for which an amendment is currently being sought in order to relocate the proposed CSP Plant to only part of Hallidays

and part of the paddock immediately south of Hallidays. This alternative location for the CSP Plant is on adjacent high land.

Generation technology

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

Solar PV project components

Technology options considered for the PV Plant Proposal include:

- the type of PV panels
- solar panel mounting system - fixed tilt or tracking
- the type and number of PCUs.

Solar panels

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

Array mounting system

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

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

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

Table 2-1 Comparison of mounting options

Element	Fixed	Single axis tracking system	Dual axis tracking system
Land area required	Low	Medium	Very high
Production	Medium	High	High
High generation output window	Noon +- 2 hours	From sunrise + 30 min to sunset -30 min	From sunrise + 30 min to sunset -30 min
Investment	Low	Medium	Very high

Element	Fixed	Single axis tracking system	Dual axis tracking system
Operational expenses	Low	Low	High
Wind resistance	Very high	Very high	Low
System reliability	Very high	Very high	Medium

Power Conversion Units

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

2.3.4 Scale of the proposal

The scale of the Proposal has been influenced by:

- property boundaries
- demand for new renewable electricity generation to meet generation targets
- commercial investment and viability considerations
- future development of a CSP Plant, adjacent to the PV Plant
- the infrastructure capacity of the West Jemalong substation.

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

A range of plant size options were considered for the Proposal from 10MW to 50MW, and several scenarios were the subject of techno-economic modelling. 10MW and 20MW scale were ultimately eliminated from consideration as the effective cost of energy delivered from this scale would not have been viable.

The final configuration for the Proposal of 50MW was determined as an acceptable compromise of scale, having regard to capital cost and potential sources of capital, and achievable delivered cost of energy.

2.3.5 Preferred option

The preferred option is to develop an appropriately sited, designed and scaled proposal to achieve the Proposal objectives (section 2.2). The Proposal balances technological, energy and environmental aspects, while retaining the flexibility and adaptability required in the final design stage of the Proposal.

The preferred option represents a commercially viable, technologically feasible contribution to the need to reduce carbon emissions in the energy sector, while achieving a low level of environmental impact. Solar generation using PV panels is particularly well-suited to the topographical and climatic conditions of the Proposal Site.

3 SITE DESCRIPTION

3.1 THE PROPOSAL SITE

The PV Plant's Proposal Site comprises of the Development Envelope, immediate surrounds and the alignment for the 66kV powerline with a 45m buffer (survey buffer of the Biodiversity Assessment). The Development Envelope, is the land that will be used for the construction and operation of the PV Plant, and comprises the land required to construct the substation, the solar field, the proposed internal access tracks, and the corridor for the 66kV power line with a 30m clearing easement (as described by TransGrid Easement Guidelines for third party developers).

The largest portion of land occupied by the Development Envelope is the Hallidays paddock, which is a 165 ha lot and is part of the Jemalong Station, a 15,478 ha rural property managed for agricultural production (Figure 3 1).

Note: The Proposal Site has been defined in a precautionary manner, in that it is a 'worst case' area; some areas within it may not be required to be impacted during construction. This is to ensure this assessment is robust to any minor changes that may occur to the layout during the detailed design phase.

The Proposal Site is mostly cleared and relatively flat farmland with a long history of cropping, with small remnants of Poplar Box woodland (approximately 9.44ha in Proposal Site) remaining.

Vast Solar proposes to develop approximately 50% of the Hallidays paddock. The western portion of the site would be utilised and the project layout has been designed to avoid more sensitive natural and heritage features. The woodland to the north of the Hallidays paddock follows a watercourse (Thurumbidgee Lagoon), occasionally flooding to form a lagoon. The Proposal would connect the West Jemalong Substation, approximately 3.2 km to the north of the site, adjacent to the Lachlan Valley Way.

Figure 3-2 illustrates the general layout of the Proposal.

The properties surrounding Jemalong Station share a history of agricultural production and are similarly mostly cleared. They are predominantly large holdings engaged in rural activities with low population density.

Directly north of the Proposal Site is the 'Hallidays' farm house, owned and maintained by the owner of Jemalong Station, Twynam Pastoral Co Pty Ltd. The farm house was used in the past by contract farm workers during sowing and harvesting operations. Once the proposed project commences construction the house will be left vacant for the duration of the lease agreement between the Proponent and Landowner. As such, the nearest residential dwelling is approximately 1.7 km from the Proposal boundary, to the north.

Thurumbidgee Lagoon is the nearest waterway to the site, filling intermittently when there is good rain, located approximately 400 m to the north of the Proposal Site. The Lachlan River is located approximately 3.7 km to the north (Figure 3-1).

A small air strip, within a cleared flat paddock area, is located about 500 m to the east of the Proposal Site. The air strip comprises an east-west and north-south runway within a fenced off grassed paddock. The air strip is not used often, and is privately operated by the property owner Twynam Pastoral Co Pty Ltd. The proposed PV Plant's infrastructure meets Civil Aviation Authority: Guidelines for Aeroplane Landing Areas obstacle clearances with PV and underground power cabling.

Jemalong Station also contains a polo complex and other residences for farming contractors employed or engaged by Twynam Pastoral Co Pty Ltd.



Plate 3-1 View looking south to south east across the Proposal Site

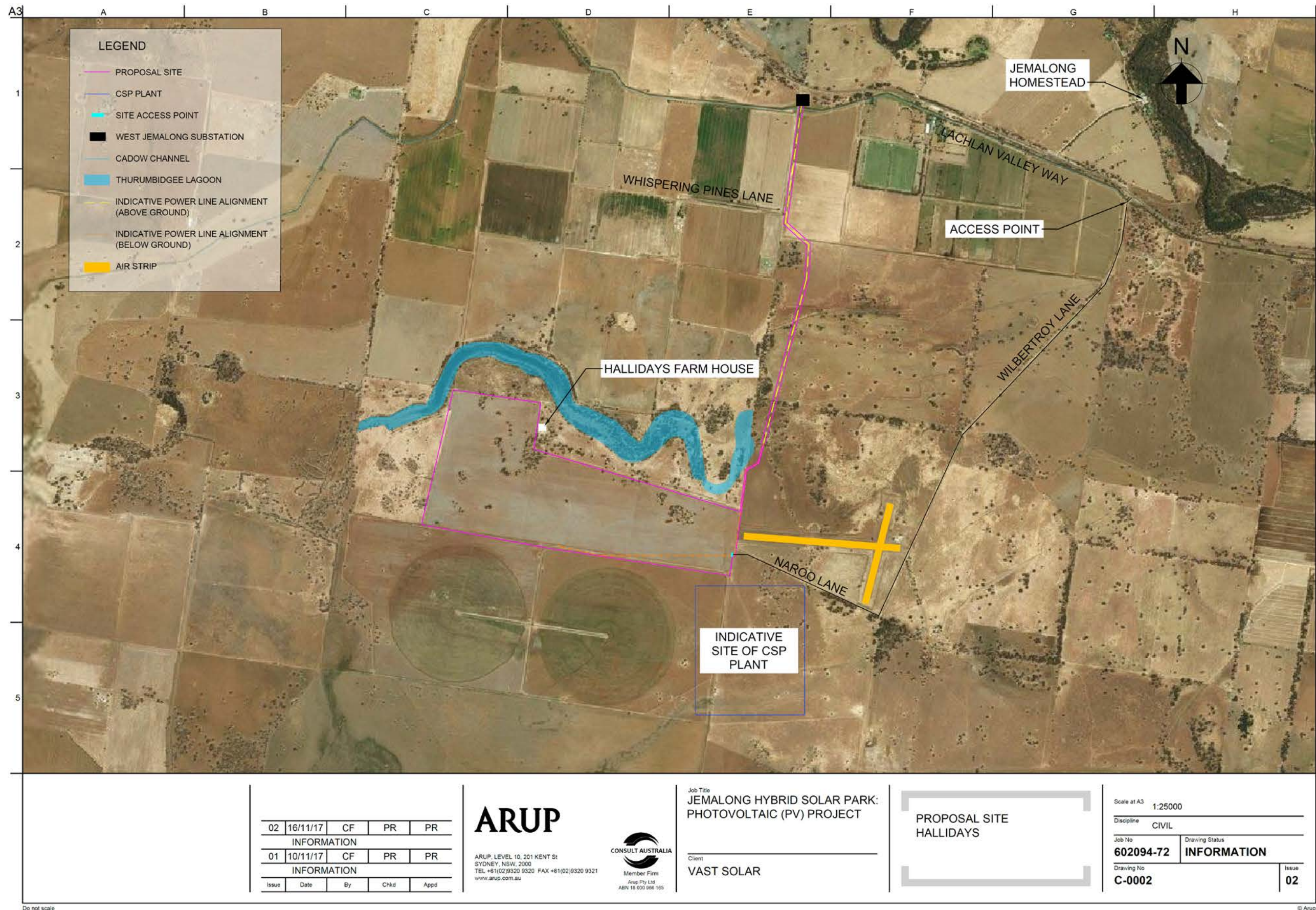


Figure 3-1 Proposal Site – ‘Hallidays’

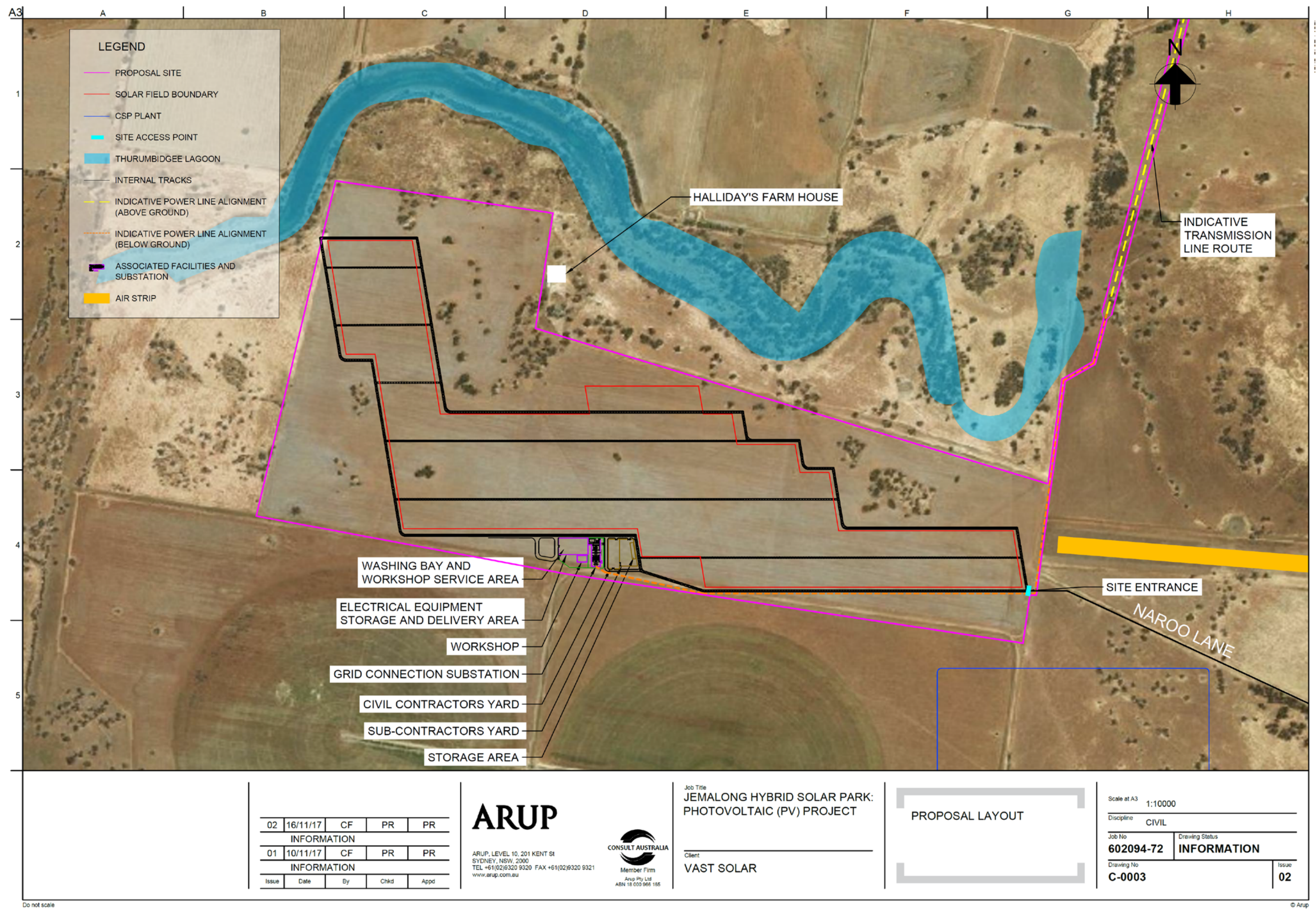


Figure 3-2 Proposal Layout

3.2 THE LOCALITY

Forbes LGA occupies around 4,700 km² of land in the Central Tablelands of NSW, with Forbes as its main town centre containing 95% of the population. Smaller villages within Forbes include Bedgerabong, Corinella, Ootha and Wirrinya.

The Forbes LGA has a population of approximately 10,500 as recorded in the 2016 census (idcommunity 2017), which has been rising since 2011 (FS 2017). The population density is 0.02 persons per ha, reflecting its predominantly undeveloped, rural setting (idcommunity 2017).

The region was originally inhabited by the Wiradjuri peoples, who inhabited a widespread area from the Great Dividing Range west to the Macquarie, Lachlan and the Murrumbidgee rivers (Co ,1989). European settlement of the area dates from 1817 (idcommunity 2017). The population in the district boomed when gold was discovered in the 1860s, and by the end of decade gold had become secondary to the pastoral and developing agricultural wealth of the district (FS 2017).

Agriculture is a significant land use in the local area today, with over 679, 000 ha of land dedicated to agriculture within the Council area (AB 2011). Agriculture is the largest industry in the LGA in terms of output, and is valued at \$183 million (FS 2017).

The Proposal Site is located within the South Western Slopes Bioregion, which is dominated by a sub-humid climate with hot summers and no dry season (NSW National Parks and Wildlife Service 2003). As recorded by the closest Bureau of Metrology (BoM) Automatic Weather Station at Forbes Airport over the period 1995 to 2017 (BoM 2017), the mean annual minimum temperature is 9.6°C and the mean maximum temperature is 24.4°C. The mean annual rainfall is 499.1 mm, with 55.8 days being the mean annual number of rain days (rain ≥ 1 mm) (BoM 2017).