Environmental Impact Statement

JEMALONG SOLAR STATION 30MW CONCENTRATING SOLAR THERMAL POWER PLANT

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TERMS AND DEFINITIONS

AADT	Annual Average Daily Traffic
ACHA	Aboriginal Cultural Heritage Assessment
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ANZECC	Australian and New Zealand Environment and Conservation Council
AoS	Assessments of Significance
Applicant	Entity applying for development consent under the EP&A Act (refer also proponent)
ARENA	Australian Renewable Energy Agency
ARI	Average Recurrence Interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AUSTELA	Australian Solar Thermal Energy Association
AWS	Automatic weather station
BOM	Australian Bureau of Meteorology
BREE	Bureau of Resources and Energy Economics
BRMP	Bush Fire Risk Management Plan
CEMP	Construction environmental management plan
CSP	Concentrating Solar Thermal Power
Cwth	Commonwealth
dB	Decibel
dB(A)	A measure of A-weighted *(c.f.)* sound levels.
DECC	Department of Climate change
DECCW	Refer to OEH
DEMP	Decommissioning environmental management plan
DOE	Department of the Environment
DPE	Department of Planning and Environment
DPI	(NSW) Department of Primary Industries
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EIA	Environmental impact assessment
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* (Cwth)
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
ESD	Ecologically Sustainable Development
FMP	Flood Management Plan
ha	hectares
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
Heritage Act	*Heritage Act 1977* (NSW)
HTF	Heat Transfer Fluid
Hz	Hertz
ILUA	Indigenous land use agreement
INP	*NSW Industrial Noise Policy*
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
JSS1	Jemalong Solar Station 30 Megawatt (MW) Concentrating Solar Thermal Power Plant
Kg	Kilograms
kL	kilolitre
km	kilometre
KV	K
L	Litre
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
LCU	Landscape character units – areas similar in terms of landform, vegetation patterns, water form and land use patterns
LEP	Local Environment Plan
LGA	Local Government Area
m	metres
mG	Milligauss, multiples of a unit of magnetic field Gauss unit
ML	Megalitres
MLVBMC	Mid Lachlan Valley Bush Fire Management Committee
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory Renewable Energy Target
MW	Megawatt
MWh	Megawatt hours
MWth	Megawatt thermal

NHMRC	National Health and Medical Research Council
NOW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NTNDP	National Transmission Network Development Plan
NW Act	*Noxious Weeds Act 1993* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
OEMP	Operational environmental management plan
PCT	Plant community type
PHA	Preliminary Hazard Analysis
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Proponent	The person or entity proposing a development, in this instance, Vast Solar
PV	Photovoltaic
RBL	Rating Background Level - the level of background noise
RD&D	research, development and demonstration
RDA	Regional Development Australia
RE Act	*Renewable Energy (Electricity) Act 2000* (Cwth)
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
Roads Act	*Roads Act 1993* (NSW)
Roads and Maritime	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
SEPP (Infrastructure)	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
SHI	NSW State Heritage Inventory
SIS	Species Impact Statement
Sound pressure level	The noise at a given distance from plant or equipment
sp/spp	Species/multiple species
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SRZ	Structural Root Zone
SSD	State Significant Development, as defined by section 89C of the EP&A Act *(c.f.)*
The proposal	Construction, operation and decommissioning of Jemalong Solar Station 30 Megawatt (MW) Concentrating Solar Thermal Power Plant
TPZ	Tree Protection Zone
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

µT	Microtesla , multiples of a unit of magnetic field
V	Volts
VIA	Visual Impact Assessment
WAPC	Western Australian Planning Commission
WHO	World Health Organisation
WMP	Waste Management Plan
WRC	Water Resources Commission
YFBS	Forbes aerodrome

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Jemalong Solar Station 30 Megawatt (MW) Concentrating Solar Thermal Power (CSP) Plant (JSS1) ('the proposal'). NGH Environmental has prepared the EIS on behalf of the proponent, Vast Solar Pty Limited (Vast Solar).

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 structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DPE) on 26 August 2014.

PROPOSAL DESCRIPTION

The proposal site is 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. The site is part of a 165 ha lot known as 'Hallidays', which in turn is part of the 15,478 ha Jemalong Station, a rural property managed for agricultural production. The site is mostly cleared and relatively flat farmland with a long history of cropping with small remnants of Poplar Box woodland (ranging from 0.1 to 0.5 ha) remaining.

There is no existing infrastructure on the proposal site. Directly north of the proposal site is the 'Hallidays' farm house, owned and maintained by the owner of Jemalong Station, Twynam Agricultural Group. The closest waterway to the site is Thurumbidgee Lagoon, 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.

The proposal comprises the construction, operation and eventual decommissioning of a 30MW CSP plant with at least four hours thermal energy storage.

Key infrastructure components include:

1. Fields of dual-axis tracking mirrors or 'heliostats' that track the sun (collectively called 'solar arrays').
2. Thermal energy receivers, mounted on the top of 27 m towers, which capture the thermal energy reflected from the heliostats.
3. Large scale thermal energy storage (usually though not universally a component of such projects), which enables the system to generate steam and produce electricity at any time, night or day.
4. Heliostats grouped in 'modules', with each module having its own thermal energy receiver.

The construction and commissioning phase of the proposal would take approximately 22 months. Approximately 30 employees would be required during the first month of construction, rising to approximately 500 employees during the peak construction period (approximately nine months).

The proposal is the culmination of Vast Solar's CSP technology development and commercialisation. While it is designed to have a 25 year operating life, the proposal is first-of-its-kind, and is therefore likely to involve continuing refinement of technology and operations. Once operations are established,

between five and twenty maintenance personnel would be employed at the site to support routine plant operations and maintenance.

At the end of its operational life, the proposal site would be either reconditioned or decommissioned. Decommissioning would remove all above ground infrastructure, rehabilitating the site to allow for a return to agricultural or other land use for the majority of the site.

NEED FOR THE PROJECT

The Australian national electricity market is undergoing a period of massive and accelerating change, in which solar photovoltaic (PV) and wind power are driving fundamental changes in established power generation, transmission and retailing businesses. It is now generally accepted in the electricity sector that solar and wind power will become major parts of the energy mix over the period to 2030. Projections range widely, but there are few commentators today who would argue that by 2020 the electricity market will have undergone fundamental change.

In this environment, variability of renewable energy supply from solar PV and wind power will be a critical factor. To balance the variability of solar PV and wind power generation while increasing the proportion of renewable energy in the system, and maintaining reliability and stability in the electricity system, large-scale solar power with energy storage will be required.

This is the critical role that CSP will need to play in Australia's electricity system. CSP is not a competitor of wind of solar PV; rather, CSP is a vital complement to these technologies, providing the dispatchable renewable energy output needed to deliver a stable, reliable electricity system in which solar PV and wind power become increasingly dominant.

Current internationally deployed CSP systems are too expensive for the Australian market (and in most other markets). Internationally, Government and institutional funding bodies have supported the deployment of large-scale CSP, but these programs are not available in Australia (and will not last indefinitely in offshore markets either); costs must be reduced dramatically for CSP to deliver on its potential.

Demonstration of high-efficiency, low-cost CSP with integrated thermal energy storage is therefore critical at this point in the evolution of Australia's energy system.

The proposal is intended to demonstrate the ability of Vast Solar's CSP system to meet these market needs, in Australia and, over time internationally.

KEY ENVIRONMENTAL ASSESSMENT ISSUES

Prior to detailed environmental investigations, a risk assessment was carried out to identify key environmental risks of the proposal, to guide the depth of investigation in this EIS. The risk assessment identified six environmental aspects as key risks, and specialist investigations were subsequently undertaken in these areas as part of this EIS:

- Biodiversity
- Aboriginal heritage
- Hazard and risk
- Hydrology, including flooding
- Glare and glint
- Visual amenity

These issues are discussed in Section 5 of this EIS. Lower risk issues are discussed in Section 6, primarily by desktop assessment.

Summary of results

HIGHER RISK ISSUES

Biodiversity

Biodiversity (flora and fauna) investigations included searches of relevant databases and field survey. A separate specialist report was commissioned to investigate operational risks to birds during operation. A total of 1.83 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. A further 59.1 ha of exotic-dominated vegetation would be impacted. Western Grey Box – Poplar Box – White Cypress Pine open woodland is listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995* (TSC Act), occurs nearby but would not be impacted. 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. An offset plan would offset the residual impacts, including the removal of eight hollow-bearing trees.

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 km^2 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 in the vicinity of the proposal site. No Aboriginal objects or survey units with potential conservation value have been identified to have a high probability of being present and impacted by the works. Areas situated in close proximity (with 100-200 m) to Thurumbidgee Lagoon have been assessed to be of greater archaeological potential and significance and it has been recommended that impacts be largely avoided in this area.

Hazard and risk

Operation of the Solar Thermal Power Plant requires the use and storage of a number of hazardous materials. These include sodium, molten salt, LPG, thermal oil, various fuels and lubricants, and possibly Argon. Due to the quantity of sodium that would be present on site, the facility would be designated as a Major Hazards Facility.

A range of technical safety studies addressing the risks associated with hazardous materials have been undertaken. These include;

- Hazard Identification Study (HAZID).
- Hazard and Operability Study (HAZOP).
- Preliminary Hazard Analysis (PHA)

The results of these have collectively provided recommendations on how to reduce hazards within the design and operation of the project.

During construction and decommissioning sodium and molten salt would require transportation and installation at the proposal site. Fuels and lubricants would be required during construction and decommission for the operation of machinery. Soda-ash would be stored on site for use in the event of a sodium leak to extinguish and contain combustion. LPG would be delivered by road tanker to gas storage tanks in a manner similar to re-stocking of automotive service stations. All materials that would be utilised would be transported by licensed contractors in accordance with Dangerous Goods regulations.

During operation sodium and molten salt would be used at high temperatures, the former, within insulated pipes and the thermal receivers, the latter within the storage tanks within the power island. Extensive engineering design precautions and safety systems result in low potential for leaks. Fuels and lubricants would be used for operation and maintenance of vehicles and equipment.

Management of hazardous materials will be achieved via engineering design, and implementation of rigorous risk, emergency and safety policies, plans and practices that are compliant with AS 4801:2001 (Occupational health and safety management systems) and consistent with best practice management of a Major Hazards Facility. Further, as the facility is receiving Commonwealth funding, there is a requirement for the developed facility to comply with the requirements of the Federal Safety Commissioner.

During operation, Electro Magnetic Fields (EMF) sources would include a 66kV transmission line, switchgear, and the solar array incorporating underground cabling. An assessment of risks associated with EMF has identified that adverse health impacts from EMFs are unlikely.

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 vast area of the floodplain for prolonged periods. The proposal site however is outside the floodway. Modelling found that the proposal would not have significant change in flood levels during flood events. While flooding impacts on the proposal would be minimised by either raising infrastructure above a selected flood level or flood proof infrastructure below the 0.5 per cent Annual Exceedance Probability (AEP) flood level.

Glare and glint

It has been identified there are two potential sources for the proposal: reflections from the heliostat surface and reflected radiation from the receiver on top of the tower. The diffuse glare due from approximately 90 towers provides no significant eye hazards to the nearby points of interest considered. If viewed as a group, multiple heliostats could potentially produce a temporary ‘after-image’ however the tracking algorithms and physical obstructions make this scenario unlikely to occur for any observers at ground level. In all cases modelled, even with the conservative assumptions applied, the predicted potential for the after-image is no stronger than looking directly at the sun.

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, 22 viewpoints were considered to have low impact significance. The other four viewpoints included two viewpoints identified as a significant visual impact and two identified as significant impact due to potential glare impacts from the proposed heliostats. 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, the 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.

LOWER RISK ISSUES

Eleven lower risk issues were investigated, primarily using desktop assessment, in Section 5.1 of this EIS.

- Noise
- Climate and air quality
- Land use
- Socioeconomic and community
- Traffic, transport and road safety
- Resource use and waste generation
- Fire and bush fire issues
- Historic heritage
- Soil
- Water use and water quality (surface and groundwater)

These impacts were assessed as highly manageable.

MANAGEMENT OF IMPACTS

Impact avoidance and minimisation measures have been incorporated into the design of the proposal. These measures are considered practical and achievable by the proponent. They are set out for each area of investigation in Sections 5 and 6 and summarised in Section 7.2 of this EIS.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan (PEMP), consisting of a Construction Environmental Management Plan (CEMP), an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). These plans would be prepared sequentially, prior to each stage of works.

CONCLUSION

This EIS identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Jemalong Solar Station JSS1 30 MW Concentrating Solar Thermal Power Plant, in accordance with Part 4 of the NSW EP&A Act and Schedule 2 of the EP&A Regulation.

The proposal would comply with relevant Commonwealth, State and local planning requirements. It would:

- Be sympathetic to landscape and potential environmental impacts.
- Contribute to greenhouse gas emission reduction and the move towards cleaner electricity generation.
- Assist to meet Commonwealth and NSW Governments reach Australia's renewable energy target (RET) and other energy and carbon mitigation goals.
- Demonstrate the value of large-scale, dispatchable renewable electricity generation (renewable energy with large-scale energy storage) and supply into the Australian electricity grid.
- Provide social and economic benefits during construction and operation of the solar plant.
- Provide a high value added land use to the host property, where the proposal would be operated.
- Meet the requirements of all relevant health and safety policy and satisfy the DPE's requirements for Land Use Safety Planning for potentially hazardous industry.

In light of the benefits of the proposal, its low level of expected environmental impacts and their reversibility, the proposal is considered to be ecologically sustainable and justified.

1. INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Jemalong Solar Station 30 Megawatt (MW) Concentrating Solar Thermal Power (CSP) Plant (JSS1). NGH Environmental has prepared the EIS on behalf of the proponent, Vast Solar Pty Limited (Vast Solar).

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 structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DPE) on 26 August 2014.

1.2 PROJECT OVERVIEW

A 30 MW concentrating solar thermal power generation plant with thermal energy storage is proposed to be constructed and operated at Jemalong Station, a rural property in central NSW ('the proposal').

Vast Solar has incorporated a special purpose entity, Jemalong JSS Project No.1 Pty Limited (JSS1 Project Pty Limited), to own the JSS1 development.

1.2.1 The proponent

Vast Solar is an Australian company developing low-cost, high-efficiency CSP plant generation technology.

Vast Solar is committed to improving the commercial competitiveness and growing the marketability of renewable energy, and specifically to providing competitively priced concentrating solar thermal power. Vast Solar has developed innovative designs for a high efficiency/low cost solar thermal central receiver CSP power plant system, with integrated large-scale energy storage for a fraction of the cost of battery storage.

In addition to achieving significant cost reductions as compared with the leading CSP systems available commercially today, Vast Solar's CSP system is also designed to blend more effectively with rural and regional landscapes, enabling development of concentrating solar power generation facilities in a wide range of locations.

Vast Solar's innovative designs have been developed through several pilot and demonstration facilities in regional NSW (discussed in Section 1.3.3) with ongoing funding from private investors – particularly Twynam Agricultural Group - and from the Australian Renewable Energy Agency (ARENA). The performance demonstrated by these projects has generated a great amount of interest in Australia and internationally and has enabled Vast Solar to secure finance, project investment and further significant funding support from ARENA.

Vast Solar is a founding member of the Australian Solar Thermal Energy Association (AUSTELA), the industry body established for the purpose of providing education and access to resources about CSP technology, and related renewable energy and solar policy and investment in Australia and internationally.

Vast Solar has made a substantial investment over nearly five years, through AUSTELA and directly, towards improving awareness of the value and importance of CSP technology in Australia's future energy system.

After more than six years' research, development, demonstration, knowledge sharing and contribution to industry development, Vast Solar seeks approval for the proposal, with the support of its private investors and ARENA. The proposal would be Australia's first commercial-scale, grid connected CSP project.

1.2.2 CSP technology benefits

CSP technology uses the thermal energy of the sun to produce power. The thermal energy captured from the sun is used to create steam in a boiler. For electricity generation, the steam drives a traditional steam turbine and electricity generator. The generator is connected to the electricity grid, delivering electricity into the main electricity market.

CSP is unique in its versatility as a renewable energy source as it is able to provide large utility scale solar power capable of displacing coal and gas-fired power generation in the electricity network and in off-grid power applications. CSP can provide:

- Solar-powered electricity generation, at a wide range of scales from 5MW to large utility scale.
- Thermal energy storage, providing the ability to deliver utility-scale solar energy day or night, as required, and at times when the energy is most needed and most valuable.
- Highly efficient heat or steam generation for industrial processes including (for example) oilseeds and grain processing, meatworks, dairy sterilisation, chemical processes, and mining and minerals processing, in addition to electricity generation. Industrial processes make up more than 60% of Australia's total energy demand; the ability to address these industrial energy needs outside of the electricity system is a significant benefit of CSP technology.
- Dispatchable power output - available as and when required, day or night - by combining concentrating solar thermal and other renewable thermal energy sources (such as biomass, bagasse, or waste-to-energy processes), or combining CSP and fossil fuel sources.

A series of studies has confirmed the importance and high value of CSP in Australia's future energy mix (IT Power (Australia) Pty Ltd, 2012; AEMO, 2012; Rutovitz *et al*., 2013). International studies have confirmed the high potential of CSP to contribute to regional economic development and employment (Caldes *et al*., 2009). Further studies have confirmed the potential of CSP to reduce electricity network costs (NREL, 2013).

1.2.3 The location

The proposed site is located approximately 36 km west of Forbes (refer to Figure 1-1) within the Forbes Local Government Area (LGA). The site is accessed from the Lachlan Valley Way to the north, via, Wilbertroy Lane and Naroo Lane.

The proposal site is part of a 165 ha lot known as 'Hallidays' which in turn is part of the 15,478 ha Jemalong Station, a rural property managed for agricultural production.

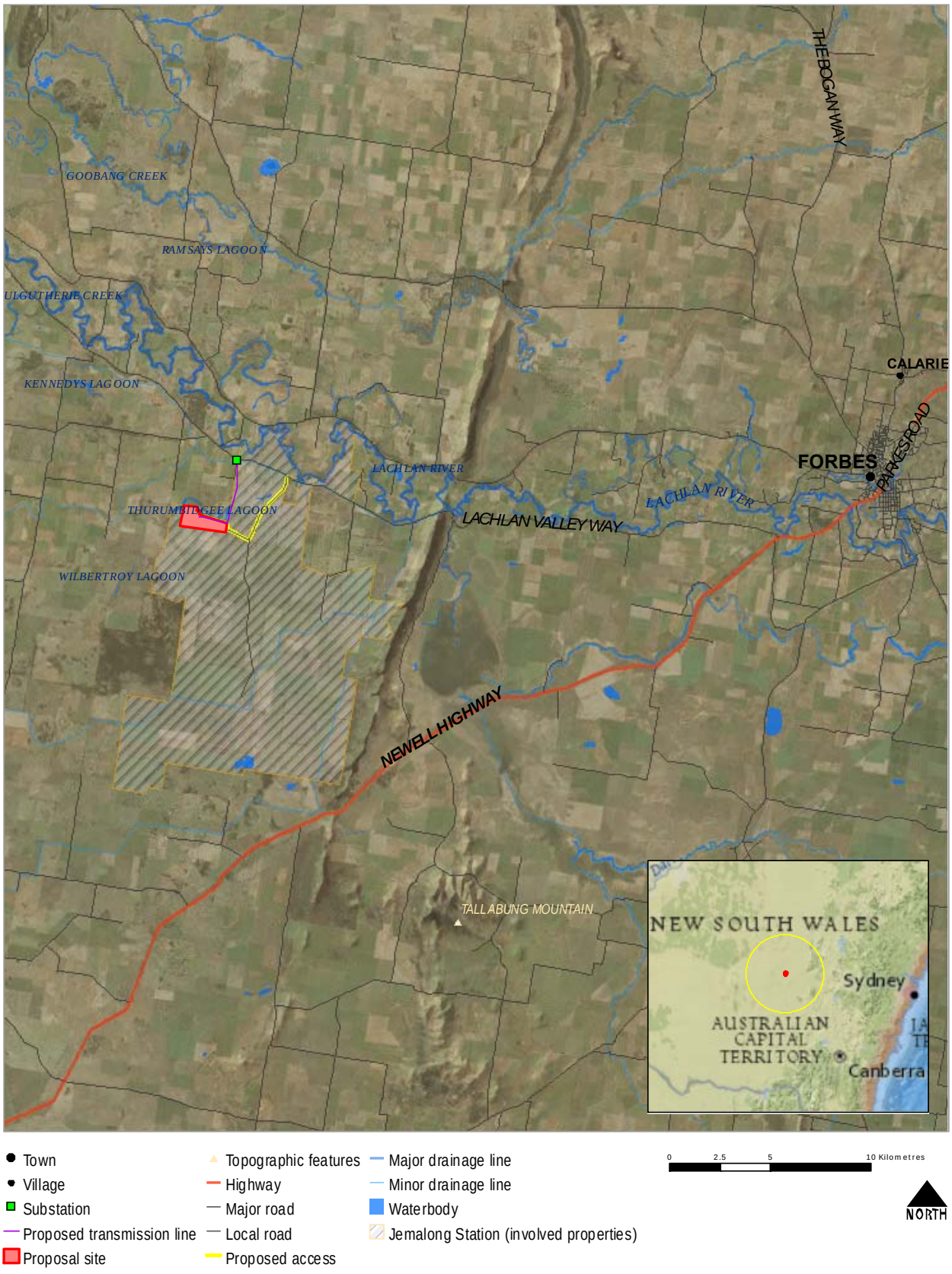

Figure 1-1 Regional location of proposal site

1.2.4 Key components of JSS1

The proposal comprises the construction, operation and eventual decommissioning of a 30MW CSP plant with at least four hours' thermal energy storage.

Key infrastructure components include:

1. Fields of dual-axis tracking mirrors or 'heliostats' that track the sun (collectively called 'solar arrays').
2. Thermal energy receivers, mounted on the top of 27 m towers, which capture the thermal energy reflected from the heliostats.
3. Large scale thermal energy storage (usually though not universally a component of such projects), which enables the system to generate steam and produce electricity at any time, night or day.
4. Heliostats grouped in 'modules', with each module having its own thermal energy receiver.

The proposal would comprise of approximately 90 modules. Each module comprises of approximately 700 heliostats and one 27 m tower with a thermal receiver mounted at its top. The heliostats would each stand approximately 2 m high at the upper edge; each heliostat would be 1.5 m high x 2.4 m wide. On-board computer and communications technology coordinated by a central tracking system, would drive the heliostats to direct solar energy to the receiving towers during daylight hours.

The construction and commissioning phase of the proposal would take approximately 22 months. Approximately 30 employees would be required during the first month of construction, rising to approximately 500 employees during the peak construction period (approximately nine months).

The proposal is the culmination of Vast Solar's CSP technology development and commercialisation. While it is designed to have a 25 year operating life, the proposal is first-of-its-kind, and is therefore likely to involve continuing refinement of technology and operations. Once operations are established, approximately five to twenty maintenance personnel would be employed at the site to support routine plant operations and maintenance.

At the end of its operational life, the proposal site would be either reconditioned or decommissioned. Decommissioning would remove all above ground infrastructure, rehabilitating the site to allow for a return to agricultural or other land use for the majority of the site.

Vast Solar's CSP system requires virtually no civil works across the solar array area – which comprises the largest part of the proposal site by area – rehabilitation therefore involves for the most part simple removal of piled heliostat foundations, towers and above-ground thermal piping. Civil and heavy engineering works rehabilitation would be limited to the power island area of the site (turbine, generator, electrical switch-yard, cooling systems, and related infrastructure).

1.3 JUSTIFICATION AND BENEFITS OF THE PROJECT

1.3.1 Current cost challenges for commercially available CSP systems

The major impediments to broad adoption of CSP renewable energy internationally are cost and the comparatively high visual impacts of existing CSP systems available commercially.

Recent developments have seen significant advances in a form of CSP technology known as 'power tower' or central receiver configuration, where the heliostats reflect the sun's energy onto a thermal receiver at the top of a tower. 'Power tower' CSP has high solar concentration efficiency, capable of delivering very high temperatures. This allows higher performance from the steam turbine and higher efficiency in energy storage, increasing capital efficiency. These attributes have strong potential to reduce the cost of solar energy generation while also delivering 'dispatchability' – the ability to store and deliver solar energy at the times when it is most valuable and most needed in the electricity market.

In overseas markets such as the US, Spain, South Africa and Chile, the quest for cost reduction through greater economies of scale has led to very large-scale CSP power tower systems, with towers up to 240 m tall and single, massive solar arrays as large as 2.8 km in diameter and cylindrical thermal receivers 30 m in height. These systems, while very impressive in terms of engineering and construction, present a range of aesthetic, operational, cost and environmental challenges.

The cost of CSP systems deployed internationally to date, even using modern 'power tower' technology, is such that subsidies such as feed-in tariffs are still required for commercial viability. The challenge is to rapidly reduce the cost of 'power tower' systems and evolve their design to reduce aesthetic impacts, while maintaining the high temperatures and resultant high performance they offer.

1.3.2 Scope for innovation: modular arrangements

Vast Solar has developed innovative designs for high efficiency/low cost solar thermal central receiver power plant systems, with integrated energy storage. These innovations have delivered not only greater economic efficiency, but also significant improvements in biodiversity protection and preservation, and in visual amenity.

Vast Solar's innovative CSP design achieves the same economies of scale as the huge monolithic power tower systems constructed in Europe, the US, South America and South Africa, but in contrast to their centralised tower arrangements, uses a modular approach. This modular approach achieves the following key benefits:

- Significantly faster and simpler to manufacture, enabling mass-manufacture and assembly similar to that which has driven down the cost of photovoltaic solar energy.
- Significantly faster and simpler to install, with installation capable of automation to deliver further efficiencies in the form of reductions in construction cost and time.
- Significantly more sympathetic to regional and natural landscapes, capable of blending more effectively into a typical regional agricultural landscape populated by equipment sheds, silos, grain holding facilities and water-pumping windmills, with sparse residential development.
- Significantly less expensive to construct.
- Easier to maintain, with much of the maintenance and cleaning capable of automation.

Smaller towers (heights of 27 m) and smaller solar array modules (measuring 70 m x 110 m) are used in Vast Solar's modular CSP approach.

Along with the aesthetic benefits of this approach, and much lower capital costs, the Vast Solar CSP design also achieves higher average optical efficiency of the solar array area. This is a critical factor in CSP plant economics; higher optical efficiency means in essence that more energy is delivered to the thermal receiver for a given surface area of heliostats. As the solar arrays are the largest capital cost in a CSP plant, this translates directly into greater capital efficiency and lower cost of delivered electricity.

Vast Solar's CSP system achieves higher optical efficiency than 'monolithic' comparator power tower systems because:

- The maximum focal distance for the heliostats (the distance over which they must project an image of the sun onto the thermal receiver) is less than 150 m, as compared with up to 1.4 km in the largest monolithic power tower system so far constructed.
- The manufacturing process developed by Vast Solar means that heliostats can each be made with a concave shape (a parabola), providing a highly concentrated and accurate image of the sun on the receiver.
- The heliostats are all close to the receiver and on one side of the receiver, the geometry of each module relative to the receiver is more efficient – the angles at which the sun's image is reflected are more acute (rather than obtuse), resulting in lower cosine losses than in large, round solar arrays used with monolithic power tower systems.

The combination of these factors together with the low cost of materials and manufacturing used in Vast Solar's heliostats, provides compelling cost efficiencies that flow directly through to deliver a lower cost of energy.

The end result is a CSP system that is lower in cost, higher in efficiency, and more suited to deployment in the rural and regional areas of New South Wales and Australia (and internationally) where large-scale solar energy development can deliver employment, education, skills and economic benefits while driving down reliance on carbon-intensive power generation.

1.3.3 Demonstration of the technology

In the Forbes LGA Vast Solar has developed two previous research and development projects:

- A 1.2 Megawatt thermal (MWth) CSP research and development plant

  Constructed in 2011/12 and operated from December 2012 until 2014, this project comprised a demonstration plant consisting of 200 heliostats, 25 m tower and thermal receiver and heat transfer system. This project did not include an electricity generator and was not connected to the electricity grid.

  In 2012, a further 500 heliostats were added to this demonstration plant, expanding the 200 heliostat system to full single module scale. This enabled Vast Solar to undertake a range of development tests and field trials, gathering data and information to validate the expected performance of the Vast Solar system, and providing valuable information and insights for refinement of components and systems.

- A 6 MWth CSP research and development pilot plant

  In late 2013, Vast Solar received funding from ARENA and private investors to construct a larger research, development and demonstration (RD&D) plant at another location at Jemalong. This project is referred to as the Jemalong Solar Station pilot. Construction of this 6MWth plant is currently nearing completion, will include three hours' thermal energy storage and be connected to the Essential Energy electricity network. On commissioning in late 2016, this project will demonstrate the Vast Solar system, from sun-to storage-to grid.

1.3.4 Objectives

To develop a 30MW CSP proposal:

- Sympathetic to landscape and potential environmental impacts.
- Contributing to greenhouse gas emission reduction and the move towards cleaner electricity generation.
- Assisting to meet Commonwealth and NSW Governments reach Australia's Renewable Energy Target (RET) and other energy and carbon mitigation goals.
- That demonstrates the value of large-scale, dispatchable renewable electricity generation (renewable energy with large-scale energy storage) and supply into the Australian electricity grid.
- That provides social and economic benefits during construction and operation of the solar plant.
- Provides a high value added land use to the host property, where the proposal would be operated.

1.3.5 Alternatives considered

The key objective of the proposal is to demonstrate the viability of commercial scale CSP technology using Vast Solar's proprietary CSP system. Consequently, no alternative technologies were considered.

However, a number of alternatives were considered as to plant size and location. Environmental considerations, particularly visual impact, formed a key aspect of project planning from project inception.

Size of plant

Economies of scale and efficiencies available from different sizes of steam turbine dictate that CSP plants are typically not financially viable under 30MW. The optimal scale, as demonstrated by the majority of built CSP plants globally, is 50MW and greater.

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. 50MW scale was ultimately ruled out due to constraints in available capital funding. 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 30MW with 4 hours thermal energy storage was determined as an acceptable compromise of scale, having regard to capital cost and potential sources of capital, and achievable delivered cost of energy.

Location of plant

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 Agricultural Group, to determine locations which would have acceptable impact on farming operations. The selection of the location considered potential impacts on native vegetation, visual amenity (as noted above, a key factor), 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 lot 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 Hallidays lot, 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.

A key aspect of Vast Solar's CSP system design is its low profile tower system; towers are 27m high, about the same height as a mature gum tree in many rural locations across Australia. The Hallidays lot provides natural screening from established tree-lines to the north, west and (at a distance) south; no such screening was available at the alternate site straddling Wilbertroy Lane.

Ultimately the Hallidays lot was selected as the preferred site. Development of the proposal on the Hallidays lot would demonstrate the minimal impact of Vast Solar's design on visual amenity in rural and regional locations, where CSP projects of 30-100MW scale are most likely to be developed.

The Hallidays site 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.

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. It also builds a social licence for CSP technology and would contribute to community awareness that CSP projects can be built at scale close to regional communities without impacting on rural character and amenity.

The 'do nothing' option

Doing nothing would avoid environmental impacts associated with the development and operation of the proposed plant, which include temporary impacts such as construction noise, traffic and dust, and limited visual impacts. Doing nothing would not meet the proposal objectives and would maintain the land for relatively low-value agricultural production at the site.

The consequences of not proceeding would be to forgo the benefits of the proposal, resulting in:

- Loss of opportunity to reduce greenhouse gas emissions and move towards cleaner electricity generation.
- Loss of a renewable energy supply that would assist the Commonwealth and NSW Governments to reach Australia's Renewable Energy Target (RET) and other energy and carbon mitigation goals.
- Loss of demonstration value of large-scale, dispatchable renewable electricity generation (renewable energy with large-scale energy storage) and supply into the Australian electricity grid.
- Loss of social and economic benefits through the provision of direct and indirect employment opportunities during construction and operation of the solar plant.
- Loss of demonstration value of the Vast Solar system to support its commercial deployment in Australia and internationally, and loss of export potential as a result.
- Loss of opportunity to demonstrate the cost structure of the Vast Solar CSP system and in so doing to inform the economic understanding of costs and benefits of CSP technology in Australia and elsewhere (such as via the Australian Energy Technology Assessment).
- Loss of a high value added use of a small portion of the Jemalong Station property.

1.3.6 Jemalong Solar Station - JSS1 project benefits

The proposal, the subject of this EIS, would be the first commercial scale demonstration of Vast Solar's CSP technology. Key project benefits include:

Broad project benefits

- Reduced greenhouse gas emissions and move towards cleaner electricity generation. Based on 84,000 MWh, the proposal would offset the equivalent of 99 kilotonnes per annum of CO_2 emissions for Brown Coal, 75 kilotonnes per annum of CO_2 emissions for Black Coal and power the equivalent of 14,000 NSW homes (emission calculation based on 2013 NTNDP, National Transmission Network Development Plan, emission intensity values averaged across the power stations).
- Provision of a renewable energy supply that would assist the Commonwealth and NSW Governments to reach Australia's Renewable Energy Target (RET) and other energy and carbon mitigation goals.
- Demonstration of the value of the Vast Solar system to support its commercial deployment in Australia and internationally.
- Demonstration of the value of large-scale, dispatchable solar electricity generation (renewable energy with large-scale energy storage) and supply into the Australian grid. Specifically, the proposal would demonstrate that the Vast Solar's modular CSP technology is:
    - Significantly faster and simpler to manufacture, enabling mass-manufacture and assembly similar to that which has driven down the cost of photovoltaic solar energy.
    - Significantly faster and simpler to install, with installation capable of automation to deliver further efficiencies in the form of reductions in construction cost and time.
    - Significantly more sympathetic to regional and natural landscapes, capable of blending more effectively into a typical regional agricultural landscape populated by equipment sheds, silos, grain holding facilities and water-pumping windmills, with sparse residential development.
    - Significantly less expensive to construct.
    - Easier to maintain, with much of the maintenance and cleaning capable of automation.

Using Vast Solar's modular CSP technology, costs of renewable energy delivered are forecast to reduce to levels comparable with wind generated energy (under $100 per MWh) with the significant advantage of energy storage.

The significant advantage of energy storage allows the energy to be 'dispatchable', meaning it is available for delivery into the electricity network when needed, at times of highest demand or need in the network, or in off-grid applications (such as mining, minerals processing or other industrial and food processing applications) to allow 24-hour around the clock operation from solar energy.

Local project benefits

These include the provision of social and economic benefits through the provision of:

- Direct and indirect employment opportunities during construction and operation of the solar plant; this includes approximately 500 construction employees during peak construction and five to twenty operational staff for the life of the project.
- 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 the entire LGA.

Furthermore, the proposal would reflect the environmental constraints of the site appropriately. It would be designed to:

- Have low water use

  The proposal is designed to reduce operational water consumption; the plant would be dry cooled using an air-cooled condenser. There would be minimal water consumed for the cooling of the plant. Specialised demineralised water would be required in a closed loop in the steam generator and for heliostat cleaning (where water would be captured and re-used). The turbine feed-water, which is heated by the solar energy to generate steam for the steam turbine, would be specialised demineralised water in a closed loop contained circuit. Minimal top-up demineralised water is consumed over the long-term operation of the plant. Water used for cleaning heliostats would be sourced largely from rainwater - a 220 kL rainwater tank would be included in the plant design to this end - supplemented as necessary from an existing 20ML allocation under the water extraction licence held by Twynam Agricultural Group. Water usage during operation would be minimal; less than 20 ML per year.

- Have low visual impact

  The low profile tower system (27 m) and site selection, which provides natural screening from established tree-lines, would demonstrate the minimal impact of Vast Solar's design on visual amenity in rural and regional locations where CSP projects of 30-100MW scale are most likely to be developed.

- Preserve higher value biodiversity features

  The module arrangement of the plant means that areas identified with higher environmental values, such as hollow bearing trees that provide habitat in the locality, can be retained in the proposal layout.

- Provide a high value added use of a small portion of the Jemalong Station property.

  The value of energy produced from the proposal for each hectare of land used would be many multiples of the value produced from grazing or cropping uses; value that can be achieved without materially affecting the agricultural viability of Jemalong Station or the overall productivity of the property for food production.

As the proposal is a first-of-kind plant, using CSP technology not deployed previously at this scale, technical execution performance risks are present in the proposal. Performance of the proposal would be

assessed and refined in the initial phases of operation of the plant, after which the plant would enter into commercial service.

1.3.7 Electricity demand

Australia stands at a cross-roads in its energy future. Australia has a highly carbon-intensive, aging electricity generation fleet (mainly comprising coal-fired power generation developed between the 1970s and 1990s) and an electricity grid designed to carry electricity from the coastal and near-inland coal basins of the eastern States to urban load centres in the major cities.

Sustained electricity demand growth through the 2000's led to projections of ongoing demand growth at around 2 per cent, with projections of significantly higher growth in relation to peak demand periods. These projections led to major expansion in the national electricity network in the five years to 2015 – essentially increasing the capacity of the network to carry large peaks of power delivery to meet large peaks of demand for short periods of time – much of this demand driven by a massive increase in air-conditioning usage.

Over this period, electricity system forecasts (by organisations such as the Australian Energy Market Operator (AEMO), major utilities and government resources and energy economic bureaux) consistently overstated demand growth and understated the rate at which renewable energy costs, and solar PV costs in particular, would fall.

The result has been over-investment in the centralised power generation and distribution system built in the 1980s -2000's, falling demand and an excess of power generation capacity. This is now the generally accepted position in eastern Australia's national electricity market.

These market dynamics have already contributed to the closure or suspension of operations of a number of coal-fired power generators including, in the Central Western region of NSW, the Wallawerang plant between Lithgow and Bathurst. More such closures and suspensions can be expected.

The topic of ongoing debate in the electricity sector in Australia is whether the over-capacity is the result of excessive support for solar PV and wind-power, or excessive ongoing support for redundant coal-fired power generation and associated centralised network investment. Views on this debate typically divide parties into anti-renewable and pro-renewable camps.

Views as to external factors are significant in this analysis, particularly views as to the likelihood of significant global action to curb carbon emissions in order to constrain climate change, and the impact of such actions on Australia's coal, gas and electricity industries.

Regardless of partisan views on these highly complex issues, the preponderance of opinion (including that of the Bureau of Resources and Energy Economics (BREE, 2012) is that solar PV electricity generation and wind power generation are likely to be – if they are not already – the lowest cost forms of new power generation in Australia. Installation of solar PV has continued apace, as consumers see the opportunity to insulate themselves from electricity price increases and reduce energy expenses paid to the major utilities by installing solar PV. Finance facilities with low or zero-upfront payments are accelerating these trends.

Since its adoption, the Renewable Energy Target has underpinned investment in large-scale renewable energy, despite the current oversupply of electricity generation capacity in the national market. During 2014 and 2015, political partisan debate caused a major pause in large-scale renewable energy development, but solar PV residential installations continued at a robust pace. The recent (June 2015) passage of legislation reducing but re-affirming the Renewable Energy Target will now underpin new

investment in wind and solar power capacity, further undermining the economic case for continued operation of the aging coal-fired power generation capacity. Rising gas prices have combined with these market dynamics to force out of operation much of the installed capacity of gas-fired electricity generation in Australia.

In summary, the national electricity market is undergoing a period of massive and accelerating change, in which solar PV and wind power are driving fundamental changes in established power generation, transmission and retailing businesses. It is now generally accepted in the electricity sector that solar and wind power will become major parts of the energy mix over the period to 2030. Projections range widely, but there are few commentators today who would argue that by 2020 the electricity market will have undergone fundamental change.

In this environment, variability of renewable energy supply from solar PV and wind power will be a critical factor. To balance the variability of solar PV and wind power generation while increasing the proportion of renewable energy in the system, and maintaining reliability and stability in the electricity system, large-scale solar power with energy storage will be required.

This is the critical role that CSP will need to play in Australia's electricity system. CSP is not a competitor of wind of solar PV; rather, CSP is a vital complement to these technologies, providing the dispatchable renewable energy output needed to deliver a stable, reliable electricity system in which solar PV and wind power become increasingly dominant.

Current internationally deployed CSP systems are too expensive for the Australian market (and in most other markets). Internationally, Government and institutional funding bodies have supported the deployment of large-scale CSP, but these programs are not available in Australia (and will not last indefinitely in offshore markets either); costs must be reduced dramatically for CSP to deliver on its potential.

Demonstration of high-efficiency, low-cost CSP with integrated thermal energy storage is therefore critical at this point in the evolution of Australia's energy system.

The proposal is intended to demonstrate the ability of Vast Solar's CSP system to meet these market needs, in Australia and, over time, internationally.

2. PROJECT DESCRIPTION

2.1 PROPOSAL SITE

The proposal site covers a 165 ha lot known as 'Hallidays' which in turn is part of Jemalong Station, a 15,478 ha rural property managed for agricultural production. The proposal site is mostly cleared and relatively flat farmland with a long history of cropping (Figure 2-1 illustrates the proposal site), with small remnants of Poplar Box woodland (ranging from 0.1 to 0.5 ha) remaining.

Vast Solar proposes to develop approximately 50 percent of the proposal site. 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 lot 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 2-2 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.

Figure 2-1 View looking south to south east across the proposal site

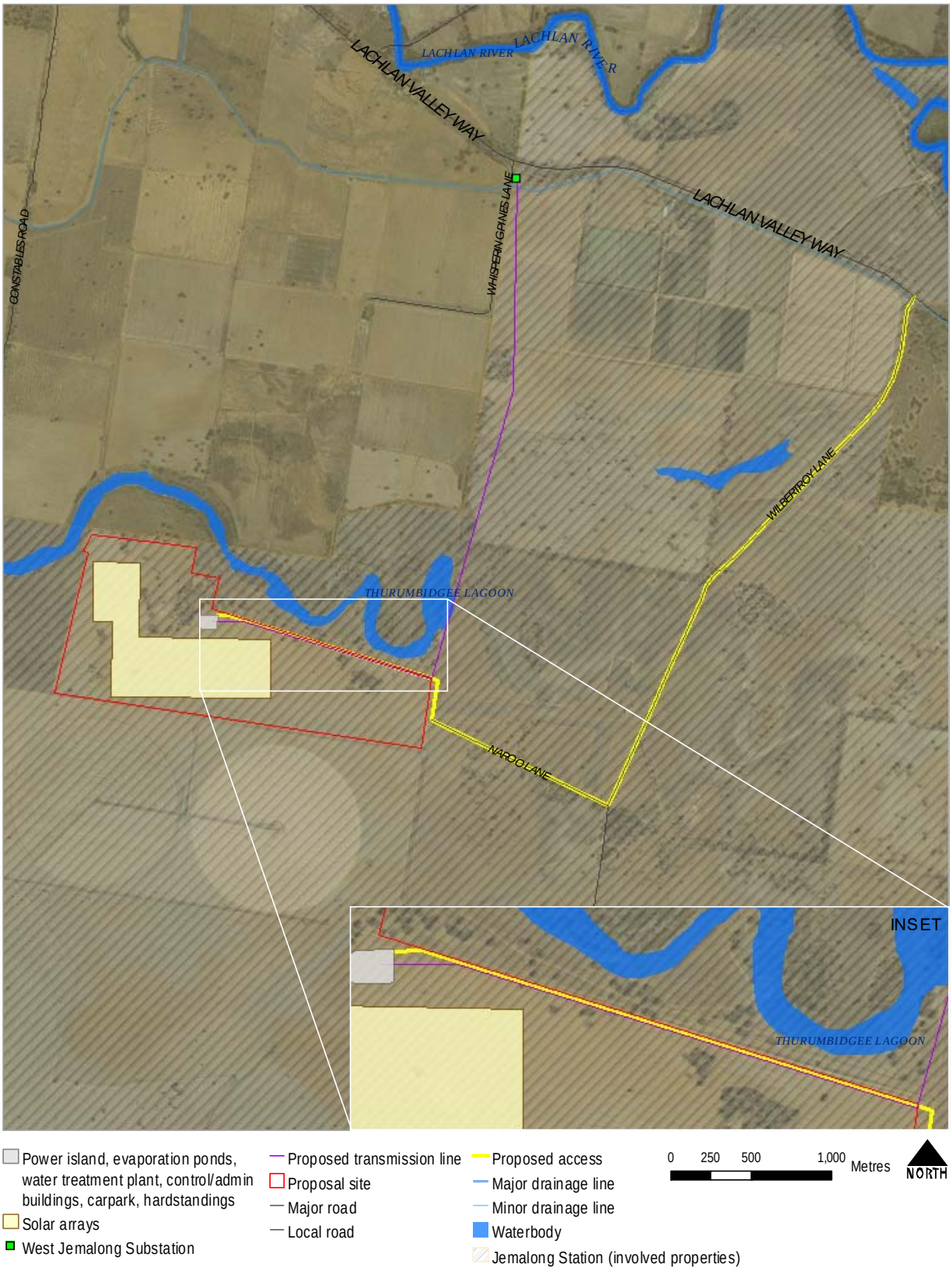

Figure 2-2 Proposal site

Directly north of the proposal site is the 'Hallidays' farm house, owned and maintained by the owner of Jemalong Station, Twynam Agricultural Group. (The farm house is utilised by contract farmers during sowing and harvesting operations). 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 2-2).

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 utilised often, with only one to two flights per year operated by the property owner and Vast Solar investor, Twynam Agricultural Group.

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

2.2 KEY INFRASTRUCTURE COMPONENTS

A 30 MW concentrating solar thermal power plant with four hours' thermal energy storage is proposed to be constructed and operated at Jemalong Station.

The key elements of the proposal that would be located within the site include (refer Figure 2-3):

- A solar field comprised of approximately 90 solar array modules. Each module would contain approximately 700 tracking heliostats directed at a thermal receiver mounted at the top of a 27 metre lattice-steel style tower. The thermal receivers face downwards and southwards. The solar field would also include:
    - Field piping mounted on piled metal-frame stands approximately 600mm above ground level and connecting each of the 90 towers with the thermal storage tanks.
    - 15 control kiosks (one for every six solar array modules), each housing 55kV electrical services, communication equipment and software systems. The kiosks would be typical 40 foot (5885 x 2350 x 2403 mm) storage containers.

- A central 'power island' within a fenced compound, to be located at the northern end of the site. The power island would contain:
    - One 'hot' and one 'cold' thermal storage tank, with associated pumps, valves and piping.
    - An air-cooled condenser.
    - A steam generator and heat exchanger.
    - Steam turbine and electrical generator with relevant ancillary systems such as lubrication and control systems.
    - A noise hood to limit noise from the electricity generator and steam turbine.
    - A weatherproof kiosk containing control and communications equipment.
    - A second weatherproof kiosk, housing 415V to 55V transformers and batteries.
    - A 66 kV transformer station and switchgear in a separate, smaller fenced enclosure.
    - Minimal flood levy earthworks, comprising a bund approximately 300 mm in height, installed around the central power island and transformer station. It is to be installed as a precaution against greater than 1:100 year flood events.

- Internal access tracks to allow for site maintenance vehicles, and gravel access road and parking for staff and visitors.
- Two x 2,400m^2 evaporation ponds, each 1.5 m deep and located to the east of the power island.
- Perimeter security fencing, approximately 2.3 m high.

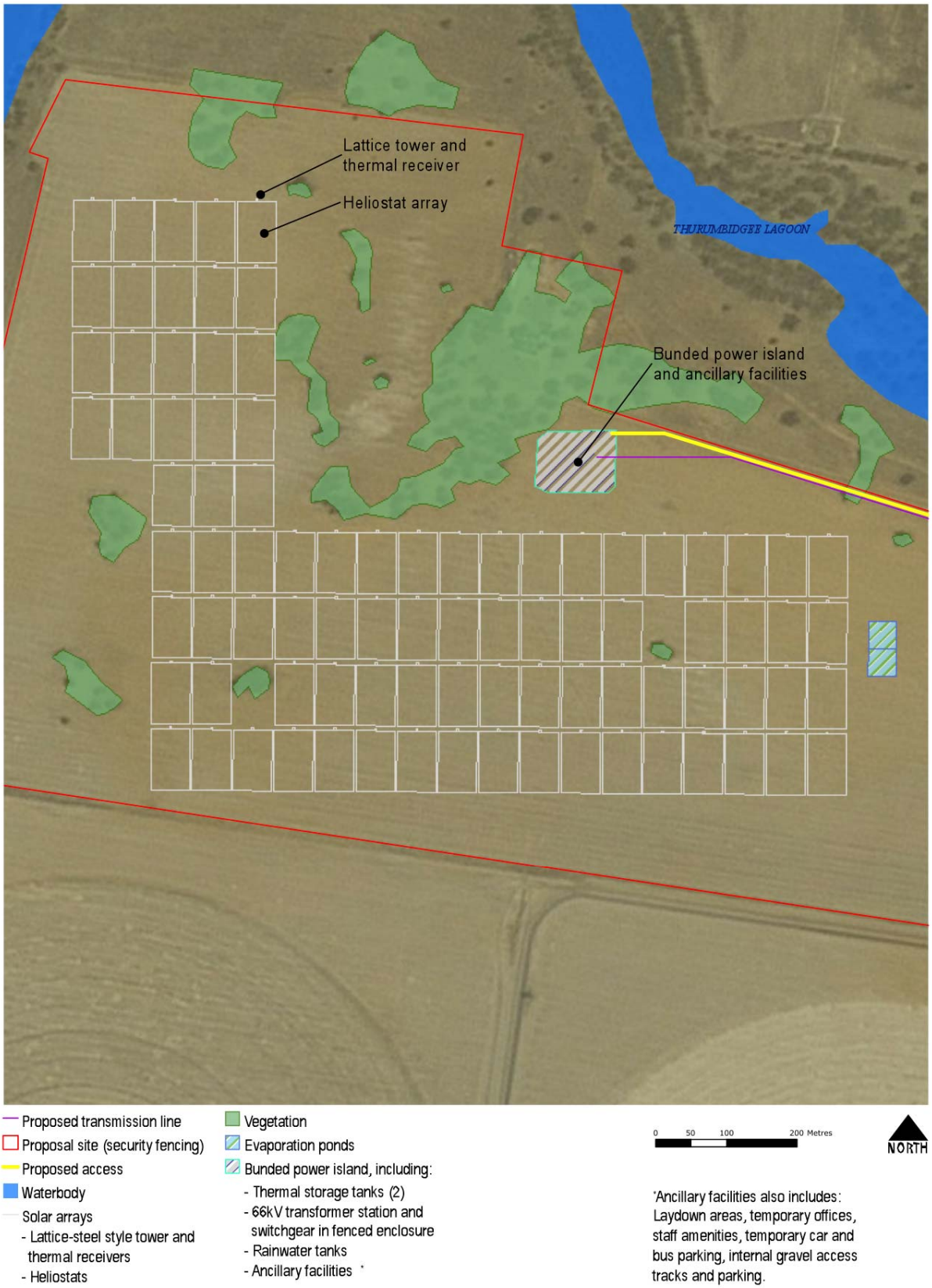

Figure 2-3 Infrastructure layout

The following elements would connect to the site:

- A 66kV overhead power line would be installed to connect into the existing Essential Energy substation at the junction of Whispering Pines Lane and Lachlan Valley Way, approximately 3 km north of the site (Figure 2-2).
- An unsealed all weather access track, within Jemalong Station, along the route of the existing farm gravel road access (Naroo Lane, refer to Figure 2-2). This existing road was constructed and is maintained to carry large grain-trucks during harvest, and would need only minimal upgrading.

Ancillary facilities would be located within the site boundary and would include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction workers transportation. Once the plant has been commissioned a small car park would remain for the minimal staff required and occasional visitors.
- Basic staff amenities. Once constructed, the plant would be monitored and operated remotely and would therefore require a minimum number of maintenance personnel (five to twenty staff) to be onsite.

The annual output of the proposal would be approximately 84,000 Megawatt hours (MWh), with a capacity factor of over 30 per cent. The proposal's thermal energy storage would be at least four hours. The construction phase of the project would be 24 months with a capital cost of $99.8 million. The proposal is expected to have a 25 year operating life.

2.2.1 Solar array modules

The proposal contains approximately 90 solar array modules, each covering an area of approximately 70 m x 110 m. Typical infrastructure images are provided in Figure 2-4 and Figure 2-5. Each module has approximately 700 heliostats and a 27 m galvanised lattice steel tower with a thermal receiver at its top. The tower is located to the north of the heliostats with the thermal receiver facing downwards (towards the heliostats) and to the south (example in Figure 2-6). The south facing thermal receivers would glow during daylight hours.

The heliostats face north and are approximately 2 m high. Each heliostat is 1.5 m x 2.4 m (3.6 m^2). A solar tracking system rotates the heliostats on two axes so that they would constantly reflect sunlight to the face of the south-facing thermal receiver. The heliostats are mounted on a steel foundation comprising of vertical steel posts driven approximately 1.5 m into the ground, using a post driver. No site preparation, no levelling, and no clearing of vegetation is required for the installation of these foundations.

The foundation posts are linked laterally by lighter gauge galvanised steel piping. The foundation piping system and connectors use a proprietary design that is subject of a patent application by Vast Solar. Electrical cabling is attached beneath the heliostats and fixed to the horizontal galvanised steel piping. This allows the free passage of small animals through the fields, and enables convenient maintenance of low vegetation from the bases of the heliostats.

Figure 2-4 Tower and thermal receiver at Vast Solar's demonstration site (taken from the north, facing south)

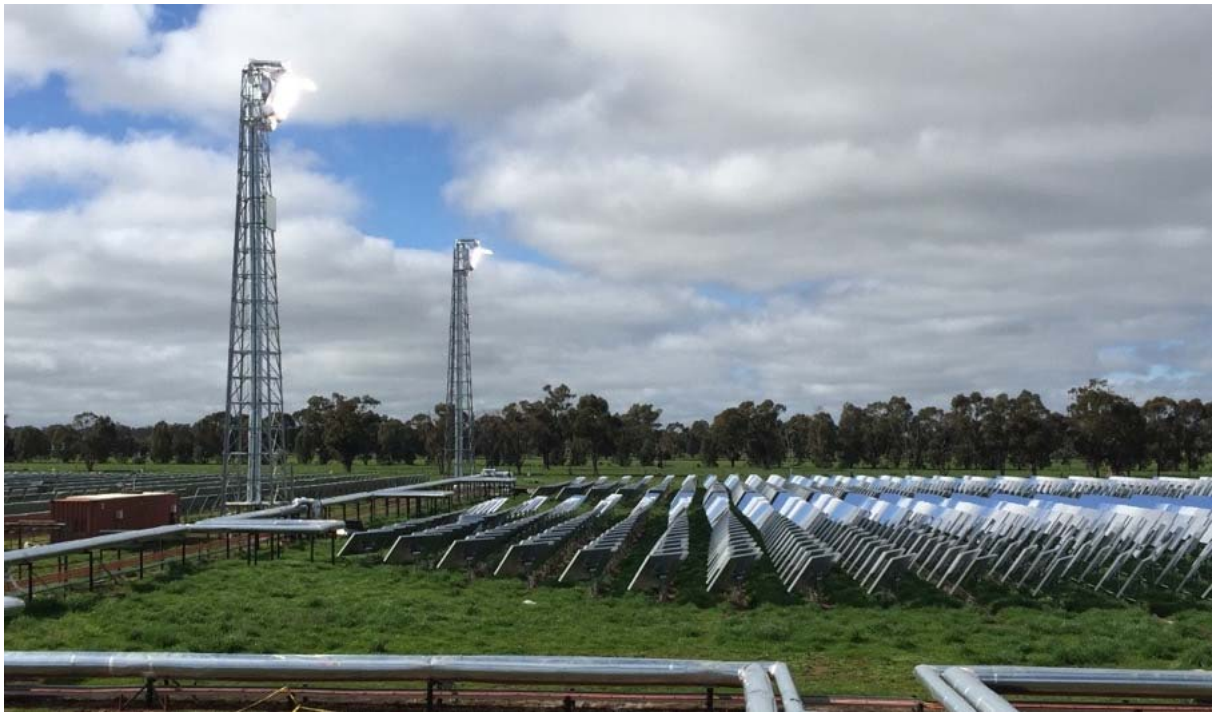

Figure 2-5 Two solar fields showing installed heliostats, at Vast Solar's 6MW pilot plant, Jemalong NSW

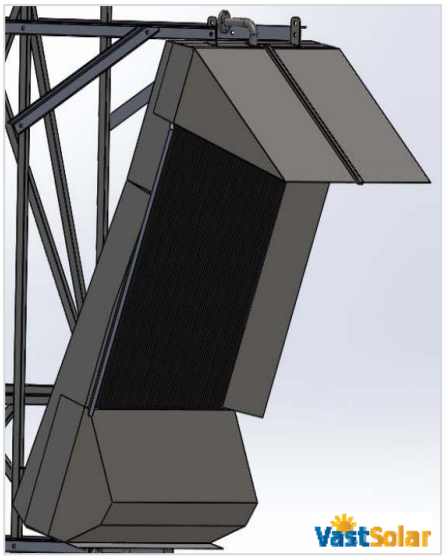

Figure 2-6 Vast Solar thermal receiver

The solar field is arranged in clusters of six solar array modules. For each cluster of six modules, a control centre (storage container) is located centrally. This control centre houses the communication system, calibration systems and low-voltage power supply required for the cluster.

2.2.2 Underground cabling

Underground cabling is installed in trenches, approximately 800 mm deep by 300 mm wide. Trenches are backfilled with soil to approximate the existing soil profile.

All cabling in the solar field is low voltage, so does not pose danger to persons or animals.

2.2.3 Thermal piping network

The heat transfer fluid used in the majority of CSP plants internationally is an oil solution. Vast Solar's CSP system does not use oil, instead it uses sodium. Sodium has favourable heat transfer properties and is ideally suited to CSP applications.

Each thermal receiver (one atop each tower) is serviced by two pipes; one conveying 'cold' sodium (130˚C) to the receiver, the other returning hot sodium (550˚C+) from the receiver to a central heat exchanger. Within each of the towers, insulated vertical pipes are fixed to connect the thermal receiver into the field piping network.

The field piping network conveys hot liquid sodium from the thermal receivers back to a single central heat exchanger in the central power island. Here the thermal energy (stored in the hot sodium) is transferred to the molten salt system. An example of the field piping system can be seen in Figure 2-7.

Piping would be installed on piled metal stands approximately 600 mm above ground level. Piping material would be predominantly stainless steel (insulated with Rockwool and clad in aluminium sheet), with some carbon steel pipes. The aggregate length of piping is approximately 29 km.

Figure 2-7 Piping prior to being insulated during construction at Pilot Plant

Once the hot liquid sodium has passed through the central heat exchanger, the colder liquid sodium is then directed into the liquid sodium collection tank, where two pumps are installed that recirculate the cold sodium back to the solar arrays for reheating in the thermal receivers. Approximately 506 tonnes of sodium would be present in the 30 MW system that is comprised of the 29 km of field piping and the sodium collection tank. This tank is an expansion tank in which the level of sodium present will vary as the sodium is respectively heated, cooled and is recirculated. When all fields are operating virtually all of the sodium would be located within the 29 km of field piping.

A specialised molten salt is used as the thermal storage material. This molten salt is held in a 'cold' storage tank, which is always maintained at a temperature above 240˚C to prevent the salt solution from solidifying. The 'cold' salt solution is pumped through the central heat exchanger, through which the heated sodium from the solar array is passed, raising the temperature of the molten salt to approximately 550˚C before it is returned to the hot thermal storage tank. Within the hot thermal storage tank the hot salt solution can be held for hours, days or even weeks with minimal thermal loss. When steam generation is required, the heated molten salt is pumped through a boiler, where water is heated to create steam. The steam is used to drive the steam turbine.

The thermal piping network is designed as a closed system. The overall site design, that incorporates the thermal piping network, will include armouring of the piping and associated infrastructure to prevent potential of flood debris impacting the thermal piping network in the unlikely event of flood water flowing through the site.

2.2.4 Thermal storage and heat exchangers

The thermal storage system contains two thermal storage tanks each filled with molten salt:

- A 'cold' tank, maintained at a minimum temperature of 240˚C.
- A 'hot' tank, maintained at a minimum temperature of 550˚C.

Each storage tank has a total height of approximately 12 m, with 9 m high sides and an additional 3 m domed cap. The external cladding is aluminium. Specialised pumps are mounted on a steel frame on the top of the tanks. They are fitted with long shafts reaching the bottom of the tanks.

Vast Solar intends to deploy additional design innovations involving the use of small 'sump tanks', fed by gravity from the main molten salt storage tanks. If successful, this design would allow the mounting of smaller pumps on smaller tanks, significantly reducing the length of the pump shafts and simplifying their installation and maintenance.

Figure 2-8 shows a typical layout for the heat exchangers. In this example they are mounted on a steel supporting structure between the two storage tanks, at tank-roof level (approximately 12 m) resulting in a total height of approximately 20 m.

Note that this example (in a parabolic trough CSP plant in Spain) uses a thermal oil as the heat transfer fluid in which thermal energy is captured in the solar field. This thermal oil can only be used to a temperature of approximately 380˚C; this is not suitable to high-performance 'power tower' CSP. Vast Solar's CSP system uses molten sodium as the Heat Transfer Fluid (HTF) for this reason. Sodium can be heated to over 800˚C without compromising the integrity of the material.

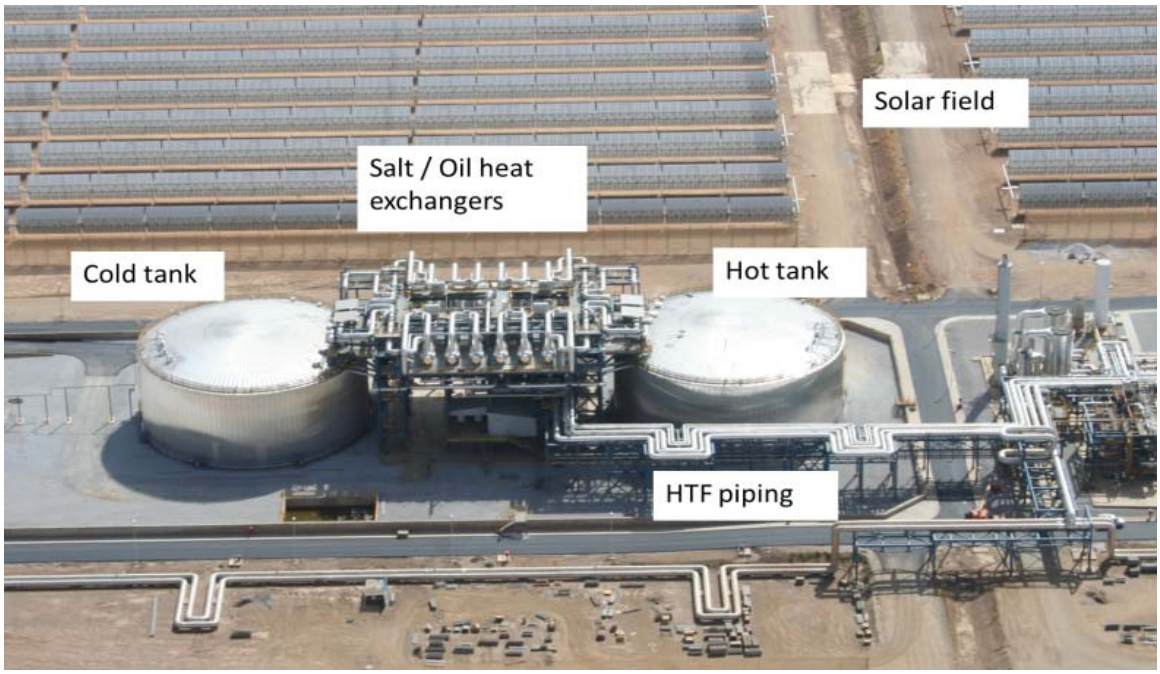

Figure 2-8 Typical molten salt thermal storage tanks, with heat exchangers and steam generators mounted on a steel frame between the tanks

2.2.5 Condenser

The proposed four-cell, air-cooled condenser would be mounted on a steel stand, within sheet-metal clad housing. The condenser structure would be approximately 30 m wide x 30 m long x 20 m high. The colour of the exterior would be off-white, similar to that shown in the example, Figure 2-9.

Figure 2-9 Air-cooled condenser at the Vast Solar 6MW pilot plant at Jemalong

2.2.6 Turbine and generators

The steam generator is proposed to be a traditional tube-style vessel. It would be located on concrete foundations. The proposed location of the steam generator is relative to the thermal storage tanks and steam turbine as shown in the infrastructure layout, Figure 2-3.

The steam turbine, electricity generator and auxiliary equipment would be housed in a noise hood. This is a light noise containment structure clad in powder-coated or painted corrugated steel sheet in a woodland grey or other colour minimising its visual impact. The supporting galvanised steel frame would be approximately 13 m in height.

Equipment would be specified to produce less than 85dBA at 1 m under normal operating conditions.

2.2.7 Transformer station and switchgear

The 66kV transformer station and switchgear area would be approximately 20 m wide x 10 m long. It would contain a small number of typical switchyard components (Figure 2-10). It would also be fenced. Gravel substrate would be maintained to prevent vegetation regrowth in this area.

Figure 2-10 Typical fenced transformer station showing transformer and switchgear

2.2.8 Control and amenities kiosk

The plant is designed for minimal operational personnel requirements. It would be operated remotely to the extent permissible under relevant regulations. Therefore, significant offices, control room facilities and staff amenities are not proposed.

Control and communications equipment would be located in a weatherproof and temperature-controlled kiosk, approximately 15 m x 15 m. It would be constructed on a steel frame, with brick or metal wall cladding and metal roof cladding. The kiosk would be painted woodland grey or other colour, considerate to the surrounding environment, to minimise visual impacts.

The kiosk would also include basic staff amenities including a septic toilet, handwash and safety facilities including a sick-room.

2.2.9 Perimeter security fencing

The perimeter of the site would be fenced with 1.8 m high chain link wire, topped with barbed wire (refer to Figure 2-11).

Figure 2-11 Fence at the demonstration plant at Jemalong

2.2.10 Evaporation ponds

Based on a preliminary site water balance, two 2,400 m^2 evaporation ponds, excavated to a depth of 1.5 m, would be required. These are proposed to be located to the east of the power island. The evaporation ponds would be used for non HTF and non-molten salt site drainage and blow down operations (see below) for the steam generator.

Pond inflow would be directed into both ponds to maximize the evaporation. The evaporation pond sizing also allows temporary operation with single evaporation pond if one is out of service.

A wet surface air cooler uses make up water sourced from steam generator blowdown and raw water for cooling. As water is converted into steam, it leaves behind dissolved solids (carbonates and sulphates) and suspended solids (minerals) in the water. Increased concentration of these impurities form deposits that eventually cause corrosion and reduce heat transfer rates. A 'blowdown' is performed to reduce the concentration of these impurities. Blowdown involves removing a small percentage of the water and replacing it with cleaner water. Blowdown can occur continuously through operation and/or manually depending on the build-up of impurities. The removed water from the wet surface air cooler is transported to the evaporation ponds for evaporation. The sediment and water quality in the evaporation ponds would be monitored for remediation or disposal.

2.2.11 Flood levy

A 0.3 m high compacted earthen bund is proposed to be constructed around the central power island, as a precaution against floodwater incursion in the event of a 1:100 year flood event. The soil would be sourced from the evaporation pond excavation or where insufficient or unsuitable, clean fill would be imported. The size of the bund ensures the soil required would be minimal.

2.2.12 Transmission line

A new overhead 66kV transmission line would be constructed to connect the proposal to the existing West Jemalong Substation at the junction of Whispering Pines Lane and Lachlan Valley Way, located approximately 3.2 km to the north of the site (Figure 2-1). It would be similar in design to the 66kV transmission line recently installed by Essential Energy from the West Jemalong Substation to Forbes with steel poles approximately 22 m high and spaced approximately 200 m apart (Figure 2-12). The transmission line would be located within an easement approximately 20 m wide. The easement location has been selected to minimise visual impacts to residents on Whispering Pines Lane.

Figure 2-12 66kV transmission line recently installed by Essential Energy in the vicinity (in foreground)

The transmission line from the West Jemalong Substation to the proposal site would terminate at a connection and metering point within the fenced switchyard enclosure adjacent to the central power island.

2.2.13 Access tracks and parking

The proposal would involve minor upgrades to Wilbertroy Lane and Naroo Lane and the intersection of Wilbertroy Lane and Lachlan Valley Way. Generally, access tracks to and around the site would remain unsealed (Figure 2-13) but may be re-sheeted with gravel to maintain their condition during the construction phase.

Parking areas for maintenance vehicles are proposed near the generation facilities and the control and amenities kiosk, within the project site as indicated on Figure 2-3.

Figure 2-13 Typical unsealed access track on Jemalong Station

2.3 PROJECT PHASES

2.3.1 Indicative timeline

An indicative timeline for the proposal is outlined in Table 2.1.

Table 2-1 Indicative timeline

Phase	Approximate commencement	Duration
Construction	June 2017	18 months
Commissioning	December 2018	4 - 6 months
Operation	June 2019	25 years
Decommissioning	2044	6 months

Activities specific to each phase of the project to be carried out in each phase are discussed below.

2.3.2 Construction and commissioning

The construction and commissioning phase is expected to take approximately 24 months. The main construction activities would include:

- Site establishment and preparation for construction (fencing, preliminary civil works and drainage – required only for the power island - access road construction, construction services and offices).
- Installation of pile-driven steel post foundation system for the solar array modules.
- Installation of underground cabling (trenching), location of control centres (containers) for communications, connection of communications equipment including software for each solar array cluster of six modules.
- Installation of thermal piping network, lattice towers and thermal receivers, valving, heat tracing and insulation. (Heat tracing is in the form of a stainless steel electrical element wrapped around thermal transfer system piping underneath the insulation material to warm the piping and prevent the fluid inside from solidifying).
- Civil and construction works for foundations for the thermal storage tanks, heat exchanger and steam generator.
- Assembly and installation of thermal storage tanks, heat exchangers, air-cooled condenser, steam piping, steam turbine and other power island components.
- Construction of the 66kV transmission line, switch gear and equipment, and interconnection of the generator to the existing Essential Energy electricity substation.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Resourcing requirements

Key resourcing requirements would include labour, machinery and equipment, steel, electrical components, water, gravel and landscaping materials.

Labour, machinery and equipment

It is anticipated that approximately 500 construction personnel would be required on site during the peak construction period (approximately nine months). Construction supervisors and the construction labour force, made up of construction labourers and technicians, are intended to be hired locally (in the Forbes and Parkes areas), where possible.

It is anticipated that most workers would be accommodated at existing accommodation within the local area. It is proposed that bus transfers would be provided from Forbes and Parkes to minimise traffic volumes and transit risks during construction.

Equipment used during construction would include earth-moving equipment for the power island civil works, diesel generators, trucks and cranes with similar noise outputs to farm machinery such as tractors.

Pile driving of the solar array heliostat foundations would be undertaken using a machine which hammers poles into the ground similar to that used for driving farm fence poles into the ground.

Traffic volumes and requirements

Traffic management would be undertaken during the construction phase to manage haulage traffic. Preliminary plans for the site propose parking for approximately 30 vehicles. The proposed timeline for the project indicates that approximately 30 employees would be required during the first month rising to 500 employees during the peak construction period (approximately nine months) while the power island and solar array modules are erected and commissioned concurrently.

Traffic volumes and requirements are discussed in detail in Section 6.5.

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.

Materials

Resource requirements include steel, thermal transfer fluid (sodium), thermal storage fluid (molten salt), water, gravel and landscaping materials.

Specifically it is noted that:

- Steel components are readily available. Supply of steel and steel components would be the subject of tenders issued for supply, with the goal that price-competitive local supplier and manufacture would be used where possible. Some steel (and potentially a large proportion, depending on pricing) may be sourced in China or India.
- Water requirements would be met by:
  - Onsite rainwater tanks and access to water (with Office of Environment and Heritage (OEH) approval) under existing water licences held by Twynam Agricultural Group; water sourced from a nearby bore; no new water entitlements or licences would be required
  - Specialised demineralised water for the turbine cycle would be produced on site.
- Molten salt sourced from one of the international suppliers of this product (molten salt is not produced in Australia).
- Sodium, to be used as the HTF, likely to be supplied by MSSA s.a of France, the world's leading sodium supplier. Sodium is not produced at significant volume in Australia.
- Minor excavation and bank formation/compaction would be required for footings, trenches and evaporation ponds and the earth bund proposed for the power island.

2.3.3 Operation

Operation of the proposal is anticipated to commence in 2019. Once operational, activities would include:

- A wide array of testing, monitoring and performance assessment activities. This will include a range of tests to be undertaken according to criteria agreed with research collaborators, grant fund providers, financiers and investors.
- Daily operations and maintenance. This would include:
    - Routine visual inspections, general maintenance and cleaning operations of the solar arrays, heliostats, heliostat drives, piping and insulation by a team of one to two personnel via quad-bike or 4WD vehicle. (Current research is investigating the potential for use of 'drone' technology to enhance maintenance operations, including heliostat cleaning).
    - Equipment inspection in the power island, thermal storage and transmission connection areas, carried out on foot.
- It is anticipated between two and five vehicles would be parked at the site during normal operation. During major outages, this number could increase to 20-30 vehicles at any one time.
- Site security.
- Replacement of equipment and infrastructure, as required.

Approximately five to twenty maintenance personnel would be employed at the site to support routine plant operations and maintenance. Standard work hours would be maintained for standard operational activities.

The existing groundcover would be retained onsite (or re-established during site rehabilitation at the end of construction). Controlled grazing may be used to maintain groundcover.

2.3.4 Decommissioning

During decommissioning, all above ground infrastructure would be removed. Key elements of project decommissioning would include:

- The plant's generator would be disconnected from the Essential Energy metering point.
- The solar array modules would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse. Much of the solar array modules would be recyclable. A key benefit of the Vast Solar's solar array design is that once the heliostat system (heliostats and mountings) is dismantled and foundation posts removed, the site would be largely returned to its former state, without the need for civil works.
- Lattice towers would be dismantled and packaged for removal from the site for recycling or reuse.
- All buildings and equipment would be removed and materials recycled or reused, wherever possible.
- Posts and cabling would be removed and recycled.
- Fencing would be removed.
- Equipment such as the steam turbine and generator, steam generator, heat exchanger, tanks, condenser, valves, vessels, pumps, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.
- Chemicals would be removed from site and recycled or disposed of in accordance with applicable regulations.

Concrete foundations for the power island would be retained in place, these comprise a small portion of the site area.

Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase.

3. STAKEHOLDER CONSULTATION

3.1 AGENCY CONSULTATION

3.1.1 Secretary's environmental assessment requirements (SEARs)

As the proposal is a State Significant Development (SSD), Secretary's environmental assessment requirements (SEARs) were requested and were provided by DPE on 26 August 2014 (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 a cross reference to where they are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice. This additional consultation is also summarised below.

Department of Planning and Environment

Issue summary	Addressed in EIS
The (EIS) must be prepared in accordance with, and meet the minimum requirements of, Part 3 of Schedule 2 of the EP&A Regulation and include the following: • Description of the development for the solar farm • Summary of the EIS • Statement of objectives of the development • Analysis of feasible alternatives • An analysis of the development, including an assessment, with a particular focus on the requirements of the listed key issues, in accordance with clause 7(1)(d) of the EP&A Regulation (where relevant); • Mitigation measures • Justification of the development • Principles of ecologically sustainable development	Proposal description is in Section 2.2; an executive summary is at the beginning of the EIS; objectives and alternatives in Section 1.3.4 and 1.3.5.
The EIS must address the following specific matters: **Flora and fauna** • Include an assessment of the impacts of all development components on flora and fauna (both terrestrial and aquatic, as relevant) and their habitat. • The assessment must take into account: o the *Threatened Species Assessment Guidelines* (DECC, 2007); o the *Threatened Species Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC, 2004); and o Lachlan Catchment Management Plan including details on the existing site conditions and likelihood of disturbance (including quantifying the worst case extent of the impact on the basis of vegetation type and total native vegetation disturbed); • Specifically consider impacts on threatened species and ecological communities listed under both State and Commonwealth legislation that have the potential to occur on the site and surrounding land, impacts on riparian and/ or instream habitat in the case of disturbance of waterways, and on biodiversity corridors; • Provide an assessment of the likely impacts on bird species, bats and	Appendix C and Section 5.2

Issue summary	Addressed in EIS
flying invertebrates considering the results of targeted survey techniques, actual or likely flight paths in the vicinity of the project, an assessment of the potential impact of birds and bats coming into contact with the heliostats, receiving towers, heat envelopes and path of solar energy between heliostats and receiving towers, and the potential for bird and/or strike; • Include details of how flora and fauna impacts would be managed during construction and operation including adaptive management and maintenance protocols (including the mitigation and/or management of weeds); and • Any steps taken to mitigate or offset any identified impacts to the environment should also be detailed in the EIS. Current OEH offsets policy should be used in assessing and determining the adequacy of offsets. Note that a draft Biodiversity Offsets Policy for Major Projects is in the process of being finalised.	
Visual impacts • Provide an assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the development. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the development based on surveys and consultation; • Include a full assessment of the visual impacts associated with the solar farm, including identification and documentation of all key viewing points and corridors particularly from identified sensitive lands. Alternative pole designs should be presented and assessed and the potential for undergrounding in sensitive locations should also be assessed; • Provide an assessment of the potential for reflectivity from the panels, receiving towers and associated infrastructure, and any safety impacts for motorists or aircraft; • Include photomontages of the development taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for the solar farm; and • Provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.	Landscape characters, visual impacts, photomontages and mitigation measures are provided in Appendix C and Section 5.7 Reflectivity is discussed in Appendix C and Section 5.6
Noise Impacts • Include a noise assessment of all phases and components of the development including, but not limited to the operation of the project, construction noise (focusing on high noise-generating activities and any works proposed outside of standard construction hours, traffic noise, and vibration generating activities). The assessment must identify noise/vibration sensitive locations (including approved but not yet developed dwellings), baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness etc.) generated by noise sources, noise/vibration criteria, modelling assumptions and worst case and representative noise/vibration impacts; • Include monitoring to ensure that there is adequate background noise data that is representative for all sensitive receptors; • Provide justification for the nominated average background noise level used in the assessment process, considering any significant difference between daytime and night time background noise levels if there are noise generating activities at night; and • Clearly outline the noise mitigation, monitoring and management measures that would be applied to the development. This must include an assessment	Section 6.1

Issue summary	Addressed in EIS
of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been incorporated. • The assessment must take into account the following guidelines (as relevant): o Site Establishment and Construction – *Interim Construction Noise Guidelines* (DECC, 2009); o Traffic Noise – *NSW Road Noise Policy* (DECCW, 2011); o Vibration – *Assessing Vibration: A Technical Guideline* (DECC, 2006; and o Operation – *NSW Industrial Noise Policy* (EPA, 2000).	
Heritage • Include an assessment of impacts on Aboriginal heritage. The EIS must demonstrate the likely impacts of the development to Aboriginal heritage (including cultural and archaeological significance). Where impacts are identified the assessment shall: o Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the measures) generally consistent with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Environment and Conservation, 2005); o Be undertaken by a suitably qualified heritage consultant(s); o Demonstrate effective consultation with Aboriginal communities in determining and assessing impacts and developing and selecting options and mitigation measures (including the final proposed measures); and o Demonstrate that an appropriate archaeological assessment methodology, including research design (where relevant) has been undertaken, to guide physical archaeological test excavations of areas of potential archaeological deposits. The full spatial extent and significance of any archaeological evidence shall be established and results of excavations included.	Appendix C and Section 5.3 Consultation is discussed in Section 3.2
Traffic and transport • Assess the construction and operational traffic impacts of the development in accordance with Section 2 of the RTA's Guide to Traffic Generating Development 2002 and include: o Details of the nature of traffic generated, transport routes, traffic volumes, oversize and over mass vehicles for the transportation of materials to the site, and potential impacts on local and regional roads, bridges and intersections, including any proposed road upgrades and repairs; o Details of measures to mitigate and/or manage the potential impacts, including measures to control soil erosion and dust generated and noise impacts of traffic volumes; o Details of the need for any road improvements including widening and intersection treatments to cater for and to mitigate the impact of project-related traffic; and o Details of site access roads including how these would connect to the existing road network and any operational maintenance or handover requirements.	Section 6.5
Hazards/Risks • An assessment of potential hazards and risks associated with electric and magnetic fields (EMFs) (with reference to Australian Radiation Protection and Nuclear Safety Agency standards) and demonstrate the application of the Principles of Prudent Avoidance in relation to EMFs;	Section 5.4

Issue summary	Addressed in EIS
• Detail measures to contain any chemical and hazardous materials, storage, use and management requirements (including molten salt); and • An assessment of aviation safety including the potential for glare from reflective surfaces to impact aviation safety and outline any measures to mitigate aviation risks;	
Water Supply, Water Quality, Hydrology and Flooding • An assessment of the likely impacts to the waterways and measures to minimise impacts including details of the design of water crossings; • An assessment of soil erosion issues and the potential for clearing to create salinity risks; • Details of water supply demands and an assessment of whether an adequate and secure water supply is available for the project, including the statutory (licensing) context of the water supply sources, and assess potential environmental impacts associated with the use of identified sources including impacts on surface and groundwater sources and implications for existing licensed users (including the impact on the ability of Jemalong Irrigation Corporation to comply with the requirements of EPL 5102); • An assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of the impact on neighbouring properties and the associated watercourse and floodplain (including a review of the proposed levees in accordance with the requirements of the *Lachlan River Jemalong Gap to Condobolin Floodplain Management Plan 2012*); • An assessment of the potential for groundwater to be intercepted; and • An appropriate assessment of potential flooding impacts, undertaken generally in accordance with the principles, processes and guidelines as outlined in the NSW Government *Floodplain Development Manual, 2005*. The study shall consider a full range of potential flood events up to and including the probable Maximum Flood (PMF) and any local floodplain risk management planning processes.	Section 5.5
Consultation program must be part of the environmental assessment process, including consultation with, but no necessarily limited to the following parties: • Forbes Shire Council	See below.
• Central West Local Land Services	See below.
• Office of Environment and Heritage	See below.
• Environment Protection Authority	See below.
• Department of Primary Industries (NSW Office of Water)	See below.
• NSW Department of Trade and Investment (DTI) (NSW Mineral Resources and Crown Lands Division)	There are no current exploration licence applications or mineral titles held for the proposal site (Section 6.4). The proposal site does not impact Crown Land. Therefore DTI was not consulted.

Issue summary	Addressed in EIS

Issue summary	Addressed in EIS
• NSW Roads and Maritime Service	Traffic, transport and road safety issues are address in Section 6.5. Roads and Maritime Services would be consulted regarding prior to construction of the proposal.
• NSW Rural Fire Service (RFS)	See Section 6.7. RFS would be consulted regarding the preparation of a Bush Fire Management prior to construction of the proposal.
• Transgrid	Consultation with Transgrid is not required for the EIS. The 66kV connection to the West Jemalong Substation is not relevant to Transgrid. Essential Energy would communicate with Transgrid regarding the 66kV line from West Jemalong to Forbes.
• Local Aboriginal Land Council	See Section 5.3.
• Relevant mineral stakeholders and the local community and landowners	No mineral stakeholders were identified (see Section 6.3). See Section 3.2 for details of consultation with the local community and neighbouring landowners.

In addition to the SEARS, NGH Environmental contacted DPE to seek further advice regarding the scope of the Aboriginal heritage assessment and requirement for subsurface testing. DPE responded on 7 November 2014 and 17 November 2014 (see Appendix B) that:

- The issue of whether investigations should include archaeological sub-surface testing can only be determined by the specialist undertaking the assessment and this would involve consideration of the land use history, the types of landforms within the site relative to the footprint and the results of the field survey. OEH views the project SEARs as allowing sufficient scope to carry out test excavations if it is considered necessary to do so to reach an informed decision.
- The need to conduct subsurface testing would be dependent on the outcomes of the initial assessment based on consultation with Aboriginal groups, background research and site surveys.

Section 5.3 of the EIS assesses the need for subsurface testing.

NGH Environmental also contacted DPE to request that photo diagrams were used as part of the visual impact assessment for the proposed heliostats rather than photomontages. DPE responded on 17 November 2014 (see Appendix B) that:

- The Department is not able to determine whether photo diagrams would adequately demonstrate the visual impact of the development from potentially affected residences as an example of a photo diagram has not been provided. Therefore, the Department will assess the adequacy of the visual assessment when a draft EIS is received.

Section 5.7 of the EIS assesses the visual impact of the proposal. Photomontages were prepared for the assessment.

Office of Environment and Heritage

Issue summary	Addressed in this EIS
The EIS must include an assessment of the impacts of all development components on flora and fauna (both terrestrial and aquatic, as relevant) and their habitat. The assessment must take into account the: • Threatened Species Assessment Guidelines (DECC, 2007); • Threatened Species Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004); • Department of Planning & Environment Guidelines for Threatened Species Assessment	Section 5.2 summarises survey effort. Appendix C contains the full Biodiversity Assessment.
The EIS must specifically consider impacts on threatened species and ecological communities listed under both State and Commonwealth legislation that have the potential to occur on the site and surrounding land, impacts on riparian and/ or instream habitat in the case of disturbance of waterways, and on biodiversity corridors;	Section 5.2
The EIS must provide an assessment of the likely impacts on bird species, bats and flying invertebrates considering the results of targeted survey techniques, actual or likely flight paths in the vicinity of the project, an assessment of the potential impact of birds and bats coming into contact with the heliostats, receiving towers, heat envelopes and path of solar energy between heliostats and receiving towers, and the potential for bird and/or strike;	Section 5.2. Consultation with a specialist was undertaken specific to operational risks to birds.
The EIS must include details of how flora and fauna impacts would be managed during construction and operation including adaptive management and maintenance protocols (including the mitigation and/or management of weeds); and	Section 5.2
The EIS must include any steps taken to mitigate or offset any identified impacts to the environment should also be detailed in the EIS. Current OEH offsets policy should be used in assessing and determining the adequacy of offsets. Note that a draft Biodiversity Offsets Policy for Major Projects is in the process of being finalised.	Section 5.2
The EIS must assess cumulative impacts.	Section 6.11
The EIS must include an assessment of impacts on Aboriginal heritage. Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (Department of Environment and Conservation 2005)	Section 5.3

Biodiversity

OEH was consulted throughout the biodiversity assessment process. NGH Environmental provided a draft Biodiversity survey plan to OEH on 27 October 2014 (by email), to seek OEH's endorsement that the proposed approach met the SEARs, in advance of the field survey. OEH provided suggested changes to the approach and David Geering (OEH) advised (by email) on 6 November 2014 that the revised survey plan reflected discussions with NGH Environmental.

Andrew Want (Vast Solar) met with relevant staff from OEH in Dubbo on 14 November 2014 to provide information about the key infrastructure components of the proposal, the solar thermal technology and in particular risks to birds. OEH staff advised at the meeting that they would like to be informed of the outcome of biodiversity survey work.

After the survey work was completed in November 2014 and results considered, NGH Environmental provided a summary of findings to OEH (by email) on 10 February 2015. OEH was invited to visit the site and to provide further input into the environmental assessment process and in particular whether additional survey work was required prior to submission of the EIS.

A meeting with David Geering (OEH), Dr Stephen Ambrose (ornithology specialist), Andrew Want (Vast Solar) and Jenny Walsh (NGH Environmental) was held on 19 January 2015 in conjunction with a proposal site visit and visit to the 6MW plant. As a result of the November 2014 survey findings, advice from Stephen Ambrose and the January 2015 site visit and meeting, OEH advised:

- It was appropriate to base the Biodiversity Assessment on November 2014 survey data, previous local records of species, knowledge of relevant species behaviour and information gathered from international literature (with no further field work proposed as part of the BA).
- Ensure Sloane's Froglet has been considered in the assessment.
- The assessment should give further thought to the value in retaining the small patches of Bimble Box on the site or removing them.
- The BA should propose survey/monitoring once the proposal is constructed to understand more about potential risks raised (particularly to birds). For example, the BA would describe a general methodology for surveying Bogong Moth and insectivorous bird concentrations at the solar plant (impact site) and in natural habitat areas close by (control sites) during the moth's migratory and breeding periods.

Section 5.2 of the EIS considers impacts to Sloane's Froglet and mitigation measures (including ongoing monitoring) are provided in Section 5.2.5. Appendix C contains the full Biodiversity Assessment.

Stephen Ambrose (ornithology specialist) subsequently advised that studying insect aggregations at the proposal site should be considered if bird mortality is high after one year of the proposal being operational.

Department of Defence

Issue summary	Addressed in this EIS
In the interests of aircraft safety, due to the high number of proposed receiving towers located with 30km of Forbes Airport, Defence requests that the applicant provide RAAF Aeronautical Information Service (RAAF AIS) with 'as constructed' details of towers. A form is located on the RAAF AIS website.	Vast Solar would provide RAAF AIS with 'as constructed' details of towers upon approval.
Request obstacle lighting is designed in accordance with the requirements of the Civil Aviation Safety Authority Manual of Standards 139.	Obstacle lighting would be designed upon approval, as required.
Glare from reflective surfaces can affect the visibility of pilots during daylight hours. Defence requests that the solar panels are to be comprised of non-reflective materials. If the solar panels cause a glare problem for pilots Defence may request these surfaces be suitably modified to extinguish the glare.	Section 5.6 of the EIS addresses glare impacts from the proposal. See below for further consolidation results.

NGH Environmental contacted the Department of Defence on 16 March 2014 (by email) to provide further information about the proposal and advise that the heliostats would comprise reflective surfaces. The draft report addressing glint and glare issues related to the proposal, noting mitigations which could be put in place, was provided to Defence.

Nick Parker from the Department of Defence advised on 18 March 2015 (by email, see Appendix B) that:

- Provided the recommendation to further reduce glare by staggering is employed, the glare impacts on pilots from the proposal should be minimised a to level which will not impact upon pilots.
- Defence will need to review the full EIS once available and advise whether Defence is absolutely satisfied.

Vast Solar will provide a copy of the full EIS to Defence when available.

Environment Protection Agency

Issue summary	Addressed in this EIS
EA includes a determination of the potential effect/impact of the proposed solar station on the ability of Jemalong Irrigation Corporation to comply with the requirements of EPL 5102.	The pollution control measures (Section 6.10.3) ensure that the proposal would generally comply with requirements of EPL 5102.
Air issues - Dust generation and management EIS should include a detailed air quality impact assessment that should: • Risks associated with potential discharges of fugitive and point source emissions for all stages of the proposal. • Justify level of assessment undertaken on basis of risk factors. • Describe the receiving environment in detail. • All processes that could result in air emissions must be identified and described including characteristics and quantity of all emissions. • Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.	Section 6.2 assesses impacts to air quality. NGH Environmental contacted the EPA 28 November 2014 (by email) to advise that, due to the nature of the proposal, dispersion modelling is not considered to be required and requested confirmation that a qualitative approach was satisfactory. Sheridan Ledger (EPA) advised on 4 December 2014

Issue summary	Addressed in this EIS
• Account for cumulative impacts. • Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigours numerical impact assessment. To be conducted in accordance with Approved Methods for the Modelling Assessment of Air Pollutants in NSW (2005) • Demonstrates the proposal's ability to comply with the relevant regulatory framework specifically *Protection of the Environment Operations (POEP) Act 1997* and *POEO* (Clean Air) *Regulation 2010*. • Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan Action for Air. • Detail emission control techniques/practices that will be employed. Actions that will be taken to avoid or mitigate impacts or compensate impact.	that justification for the level of assessment undertaken is required (Appendix B).
Noise (construction) EIS should include assessment of construction noise and reference relevant guidelines: • Interim Construction Noise Guideline (DECC 2009)	Section 6.1.4.
Noise (operation) EIS should include assessment of operation of the activities on the premises. The assessment should consider relevant guidelines: • NSW Industrial Noise Policy (EPA 2000) • NSW Road Noise Policy (DECCW 2011) • Assessing Vibration: A Technical Guideline (DEC 2006).	Section 6.1.5.
Blasting EIS should include reference relevant guidelines: • Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC 1990)	There would be no blasting required.
Chemical and hazardous materials, storage, use and management requirements including but not limited to, sodium and molten salt. Should include: • Identify and provide the approximate quantities of all chemical and hazardous materials to be stored or utilised at the solar station. • Potential impact/risk to human health and the environment from the use of all chemicals and hazardous material to be sorted and utilised. • Assess and determine the potential environmental impact/risk of the transport, storage and utilisation of all chemical and hazardous materials associated with the proposal located on a floodplain and the management techniques to be utilised to eliminate the determined impact/risk. • Identify the storage methodology and maintenance requirements for storage facilities. • Outline contingency plans for any event that affects operations at the solar station that may result in environmental harm.	Sections 2, and 5.4.
Waste management	Section 6.6.

Issue summary	Addressed in this EIS
• Waste classification. • Handling and management of waste during transport. • Procedures and protocols for waste transport. • Actions that will be taken to avoid or mitigate impacts or compensate impact. • Statements on EPA's requirement for notification and tracking of waste and legislative requirement for waste disposal.	
Water and soils • Soil and water quality issues (surface and groundwater) – erosion and sediment control. • Flooding. • Mitigation and management options. The following guidelines should be considered: • Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom 2004), • Managing Urban Stormwater Soils and Construction, Volume 2A, Installation of Services and 2C Unsealed Roads (DECC 2008), and • National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).	Sections 5.5, 6.9 and 6.10.

Department of Primary Industries

Issue summary	Addressed in this EIS
Water supply, use and management: • Adequate and secure water supply. • Assessment of any water licensing requirements. • Impact assessment on adjacent licensed water users (surface and groundwater), riparian ecosystems and groundwater dependent ecosystems. • Identification of site water demands, water sources (surface and groundwater), water balance and management. • Assessment of any proposed modification to surface water management including modelling of redistribution of waters and an assessment of impact on neighbouring properties and the associated watercourse and floodplain. This will also require a review of the proposed levees in accordance with the requirements of the "Lachlan River Jemalong Gap to Condobolin Floodplain Management Plan (2012)". • Adequate mitigating and monitoring requirements to address surface and groundwater impacts.	Sections 5.2, 5.5 and 6.10.
Consultation would be required with Crown lands if Vast Solar Pty Limited purchase Lot 13 DP 753118.	Vast Solar would not purchase the site. No impacts are proposed on Crown land.

Roads and Maritime Services

Issue summary	Addressed in this EIS
A traffic impact study prepared in accordance with section 2 of the RTA's Guide to Traffic Generating Developments 2002 and include: • Traffic volumes and description • Routes • Description of oversize and over mass vehicles and materials to be transported • Impacts on public road networks • Need for improvements on roads • Assess requirements • Traffic noise and dust • Traffic Management Plan (TMP) is to be developed in consultation with the Forbes Shire Council and Roads and Maritime.	Traffic and transport impacts are assessed in Section 6.5.

Forbes Shire Council

Andrew Want (Vast Solar) met with representatives from Forbes Shire Council on 12 November 2014 and provided a briefing on the project, and the planning process. The meeting was attended by several Councillors, including the Mayor and Deputy Mayor, the General Manager (Brian Steffen), Director of Planning (Paul Bennett) and Matt Teale of the Environment and Planning Department.

On 17 November 2014, NGH Environmental wrote to Forbes Shire Council requesting environmental assessment requirements for the proposal and also requested via email advice as to whether Roads and Maritime Services is the road authority for the Lachlan Valley Way and the extent of Naroo Lane which is a public road (Appendix B).

Forbes Shire Council responded by email on 8 December 2014 that:

- The Lachlan Valley Way (Forbes to Condobolin) is a Regional Roads and Maritime Services Classified road and noted that Roads and Maritime Services will likely need to be consulted during the assessment process.
- Council mapping system identifies Naroo Lane as a public road running from Wilbertroy Lane to Lot 13 DP 753118 (which includes the proposal site).
- Council requests that a dilapidation survey be undertaken of the Lachlan Valley Way and Naroo Lane pre and post construction, with the developer to make good any damage as a result of the development.

Section 6.5.3 includes safeguards that:

- The proponent would consult with Roads and Maritime Services in regard to use of the Wilbertroy Lane / Lachlan Valley Way intersection and requirement for upgrades, if any.
- An assessment of road condition prior to construction on all local roads that would be utilised.
- A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic.
- 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.

Central West Local Land Services

On 19 November 2014, NGH Environmental contacted Central West Local Land Services requesting environmental assessment requirements for the proposal environmental assessment requirements in addition to the SEARs and those from OEH.

Central West Local Land Services responded via email on 25 November 2014 noting the key areas of concern for the Central West Local Land Services (Appendix B). The table below provides a list of the key areas of concern and a cross reference to where they are addressed within this EIS.

Issue summary	Addressed in EIS
• Native Vegetation (and biodiversity values)	Section 5.2.
• Water (surface and ground water)	Section 6.10.
• Biosecurity	Section 5.2.
• Emergency management	Section 5.4.
• Cultural Heritage and engagement with the Aboriginal community	Section 5.3.
• Community engagement in an ongoing capacity	Section 3.3

3.2 ABORIGINAL COMMUNITY CONSULTATION

Local Aboriginal Land Council and Registered Aboriginal Parties

In order to identify, notify and register Aboriginal people who may hold cultural knowledge relevant to determining the cultural significant of Aboriginal objects and/or places in the area of the proposed project, NSW Archaeology undertook a consultation procedure where correspondence dated 7 October 2014 was sent to:

- NSW OEH Dubbo office.
- Condobolin Local Aboriginal Land Council (LALC).
- The Registrar, *Aboriginal Land Rights Act 1983*.
- The National Native Title Tribunal, requesting a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements.
- Native Title Services Corporation Limited (NTSCORP Limited).
- Forbes Shire Council.

In addition an advertisement was placed in the local newspaper (*Forbes Advocate*) on 11 October 2014. Section 5.3 and Appendix C of the EIS provide detailed information regarding this consultation.

Responses were received from the Office of the Registrar *Aboriginal Land Rights Act 1983* indicating that there does not appear to be Registered Aboriginal owners for the project area. The Native Title Services Corporation responded, indicating that due to their privacy guidelines they would forward our correspondence to any parties who may have an interest in the area in question. The National Native Title Tribunal responded indicating that because the area in question was freehold land, they were unable to action the request. Correspondence was received from OEH furnishing a list of six Aboriginal parties who may have an interest in the area and correspondence dated 13 October 2014 was sent to

these groups. A response was received from Forbes Shire Council with a list of four Aboriginal parties who may have an interest in the area and correspondence dated 27 October 2014 was sent to those parties.

There are two Registered Aboriginal Parties (RAPs) in the formal process of consultation:

- Joy Russell
- Aileen Allen.

Section 5.3 and Appendix C of the EIS provide details of this consultation process and results.

Representatives of the Condobolin LALC participated in field investigations. A cultural heritage and archaeological survey for Aboriginal areas, objects and places was conducted over two days in December 2014 by archaeologists Julie Dibden and Tom Knight, NSW Archaeology Pty Ltd. Richard Coe, representing the Condobolin LALC, was involved in the field survey.

3.3 COMMUNITY CONSULTATION

Vast Solar has undertaken extensive consultation with the local community in developing the proposal, in line with DPE's *Guidelines for Major Project Community Consultation* (October 2007). The following section describes the consultation undertaken.

3.3.1 Community consultation plan

A Community Liaison Plan was developed early in the planning stages of the proposal and has been updated during the development of the proposal. The Community Liaison Plan remains in draft form as it is a live document and is provided in Appendix B.

Aims and structure of the plan

The aim of the Community Liaison Plan is to provide a framework for positive ongoing relationships with the local community. The plan has been developed for the early planning and assessment stages of the project. If the project is approved, the plan will be updated and augmented to incorporate further consultation activities that will be undertaken during the pre-construction, construction and operational phases of the project.

Vast Solar aims to provide a meaningful and inclusive approach for community consultation activities and ensure that community issues are identified and addressed appropriately prior to the construction and operation of the proposal. The plan aims to:

> **Inform the community** – Ongoing communications to provide balanced and objective information to assist the understanding throughout the proposal's planning approval process and delivery.
>
> **Consult with the community** – Provide ongoing opportunities for open communications between Vast Solar and stakeholders in order to obtain public feedback about ideas on rationale, and alternatives in order to demonstrate influence into the decisions.
>
> **Involve the community** - Identify issues and views to ensure that concerns and aspirations are understood and considered in the proposal's planning approval process and delivery.
>
> **Collaborate with the community** - Work together to develop understanding of all issues and interests to work out alternatives and reflect these preferred solutions.

Empower the community – Where possible, provide a variety of opportunities and resources for stakeholders to contribute to solutions to the proposal's planning approval process and delivery.

Key aspects of the Community Liaison Plan include:

- A list of the key objectives of planned consultation activities.
- A list of relevant stakeholders which include:
  - Neighbours - three adjoining properties to the proposal site including three residences
  - Residences within five km of the proposal site
  - Local community and businesses - the nearest towns (primarily Forbes)
  - Local council - Forbes and Parkes Shire Councils
  - Local media - Local newspapers, television networks and local radio stations – *Forbes Advocate* newspaper, ABC Regional Radio Orange, Channel 7/Prime Orange
  - Special interest groups - Including Indigenous representative groups, country fire services and medical services, engineering interest groups, seniors groups such as Probus, wildlife/conservation groups and sporting groups.
- A summary table of issues, including risks and opportunities and the strategies to effectively address these.
- A summary table of the consultation activities and aims specific to each project stage. The community consultation reflects the seven key project stages:
  - Early site investigation
  - Detailed assessment and refinement of project description
  - Environmental assessment on public display
  - Submission Report on public display.

As noted above, if the project is approved further community consultation and engagement activities will be scheduled and undertaken for the following project stages:

- Pre-Construction
- Construction
- Operation.

The Community Liaison Plan is considered a 'live' document, in that it is intended to be updated and revised in close relationship with the more detailed development of the project.

Consultation activities

The community consultation process will employ a range of consultation activities as set out below.

Table 3-1 Consultation activities for JSS1 Activity

Consultation activity	Details	Target audience	IAP2 Spectrum *
Community forums and information sessions	Community forums/information sessions to be held over the course of the proposal's life.	All stakeholders	Inform/Consult
Feedback form	Feedback forms to be made available at community information sessions.	All stakeholders	Consult
Face to face meetings	Direct meetings with directly affected stakeholders (nearby residents) to discuss and address issues.	Directly affected community members including nearby residents	Consult/Collaborate
Media release	Issue as relevant such as advertise project information session, invitations to tender for local businesses and updating community on proposal.	All stakeholders	Inform
Website updates	Update website with project information as required. Ensure contact details and complaints and enquiries procedure available. List website on all communications.	All stakeholders	Inform
Presentations	Targeted presentations may be developed for specific stakeholders groups where required.	Key service and agency personnel	Inform/Involve/Collaborate
Site tours	Arrange tours of the proposal site and/or existing sites.	Nearby residents ARENA Media Council	Inform
Telephone information line / email address	Ready access to information channels for people to enquire/lodge complaints about the proposal.	All stakeholders	Inform/Consult
Complaints and enquiries procedure	Phone and email based procedures to respond to enquiries about Vast Solar and the proposal (emails and phone).	All stakeholders	Consult
Project news updates/ fact sheets provided and updated	Provided at Community Forums / Information Sessions and available at website to keep community informed as project progresses.	All stakeholders	Inform

* IAP2's Public Participation Spectrum is designed to assist with the selection of the level of participation that defines the public's role in any community engagement program. The Spectrum show that differing levels of participation are legitimate depending on the goals, time frames, resources and levels of

concern in the decision to be made. The Spectrum is widely used and is quoted in most community engagement manuals.

3.3.2 Community consultation activities to date

In accordance with the Community Liaison Plan, several activities were undertaken prior to the lodgement of the public exhibition of the EIS.

Formal consultation for the proposal commenced in late 2014. The JSS1 project would be the first commercial scale CSP facility built by Vast Solar. It would be constructed using knowledge gained from over seven years of Australian research and development. These activities include the construction of Vast Solar's 6 6 MWth CSP pilot facility, also located at Jemalong.

The decision to submit this EIS in 2016, rather than 2015 was made following some technical and construction delays that were experienced at the Jemalong 6 MWth CSP pilot facility in mid 2015. These experiences have added value to the overall proposal design and planning process and have provided further time to consult and engage with stakeholders in the local community, Council and regulators.

The following community consultation activities were undertaken between late 2014 and mid 2016:

- Information sessions and community forums.
- Feedback forms.
- Face to face meetings.

Information presentations

Two information presentations were hosted by Vast Solar, in the lead up to a formal community consultation session seeking feedback.

An information presentation was made to the Forbes Probus Club on 24 January 2014. This session was attended by a large combined group of the Men's and Women's Probus groups.

A similar information session was held with the Dubbo Seniors Group at Dubbo Workers Club in November 2014. While outside the Forbes/Parkes region, Dubbo has become a centre for solar power development and there is strong interest from stakeholders in Western NSW in large-scale solar development.

The strong interest shown by these groups and the positive feedback received provided reassurance for Vast Solar that the proposal is likely to receive good and broad support across the spectrum of ages and community interests, even among traditionally very conservative community bodies.

Community consultation session November 2014

The Community Consultation session for the proposal was held in Forbes, on 12 November 2014. The event was advertised in the *Forbes Advocate* newspaper and invitations sent to Forbes and Parkes Shire Councils. It was held at the Jemalong Regional Education Centre over 2.5 hours with over 2 hours being questions and answers and interaction between stakeholders present and the Vast Solar team.

Attendees included Vast Solar presenters, who introduced the project and answered questions, as well as 12 participants from the community that included a representative from local media. Several participants were from the business community in Forbes and Parkes and were interested in exploring opportunities that might exist for their businesses as part of project delivery. In addition to the public community meeting held on the 12 of November, an additional Vast Solar update briefing meeting was also held on

the same day with Forbes Council at Council Chambers. This meeting was chaired by the Mayor and attended by the Deputy Mayor and several other councillors, along with senior Council executives.

Materials distributed at the event included:

- A fact sheet (provided in Appendix B), setting out information on:
    - The proponent, Vast Solar
    - Concentrating solar technology including thermal storage benefits
    - The 6MWth pilot plant
    - The 30MW proposal and its proposed location
    - The business case for the 30MW proposal and proposed project timelines
    - The ability of the project to avoid flora and fauna constraints
- A consultation feedback sheet (see Appendix B), was provided to:
    - Gauge the level of understanding about the proposal (particularly the look of the project and technology employed)
    - Gauge the level of understanding about the proposal's potential benefits and compatibility with other regional industries
    - Seek general feedback from the public.
- The Community Liaison Plan as of November 2014.

  (Note: The Community Liaison Plan as at November 2014 was a living Draft document that indicated it would be updated as the project developed. The updated plan, as at June 2016, is provided in Appendix B).

Attendees were encouraged to provide feedback that would be utilised in the assessment of the proposal and further refinement of the project design and development. Feedback was received in the form of completed consultation feedback sheets and verbal statements of interest in and support for the project.

Completed consultation feedback forms

Five feedback forms were returned. All feedback was positive with regard to the potential development of the project.

Distribution of attendees

The list of attendees included residents from:

- Canowindra
- Parkes
- Forbes.

Understanding of the proposal and CSP technology

The feedback demonstrated that attendees already had some understanding of the concentrating solar thermal energy and of the project itself (four out of five). Most stated that the event had given them a greater understanding of how the plant would look and work and that the materials and information presented were clearly presented and relevant.

Expected benefits of the project were listed by attendees as:

- Potential to create a hub for renewable energy in the area.
- Financial benefits for local suppliers.
- Future power generation to the local area.
- Employment, through construction and operation.
- Creation of an image of sustainability that would be linked to the area.
- Demonstration of the areas suitability for other similar projects.
- Tourism.
- Environmental benefits for the broader society.

Compatibility with existing industry

All respondents noted that the proposal appeared to be compatible with existing industry in the area, including agriculture and mining.

Further feedback

Asked to provide any additional feedback or questions that could be addressed in the EIS, attendees listed:

- Interesting project.
- Better than wind energy project.
- Efficient project for our climate.

  The relationship of the proposal to the local and broader climate is discussed in Section 6.2.

- General support for renewable energy project's while noting the value of coal to economy is high, despite environmental damage it causes.

  The environmental impacts of the project are set out and assessed in Section 5 and 6 of this EIS.

- Requires a guarantee of purchase of the power to be generated.

  The requirements of the project, regarding electricity purchase and connection are discussed in Section 1.3 of this EIS.

Face to face meetings: near neighbours

In the lead up, and subsequent to the public community consultation session (November 2014) described above, Vast Solar representatives have met with (and/or corresponded with) all the near neighbours of the proposal. This includes three neighbours whose properties immediately border the proposal site boundary and those who live within three km of the proposal site boundary. Personal communications by phone and in person were also undertaken with neighbours located within a broader radius of the proposal site. Without specifically identifying neighbours and their comments, it is noted that all neighbours at this time either confirmed support for the project or were disinterested in the development. None raised any objection to the development proposal.

Contact and consultation with neighbours was maintained throughout 2015 to update them about the proposal and associated project developments at Jemalong. Communications were by further face to face meetings and phone calls to neighbours by Vast Solar personnel. Some of these communications related to the incident of a small fire at the 6 MWth pilot facility in June 2015 and were undertaken with the intention to notify, consult and reassure neighbours that there were no offsite risks or damage to persons or adverse implications for the pilot project and this proposal.

Further liaison with neighbours has been undertaken as part of ongoing community consultation. During 2016 this has included further face to face morning tea meetings with near neighbours and invitations were extended to meet in person by phone to all neighbours whose properties border on the Jemalong property (some 12 – 15 neighbours) which contains the proposal site. These in-person meetings and discussions by phone have enabled neighbours to receive friendly project updates and further opportunities to ask questions about the project and associated Vast Solar activities occurring in their local community.

Strategic presentations.

Vast Solar personnel have undertaken person to person consultation with senior staff from key agencies who have an interest in understanding the proposal project and technology. Several site visits to the proposal site and related Vast Solar facilities by senior NSW departmental and agency staff were conducted in 2016.

Craig Wood, Vast Solar CEO, made a presentation to Forbes Shire Councillors and senior staff on May 2 2016 to provide an update on the JSS1 project and to provide a further opportunity to Councillors to ask questions about the proposal and associated social and economic benefits for the community. The Mayor and Councillors expressed strong interest in and support for the proposal.

In early July 2016 Vast Solar provided support for and input into a Fire Training and Demonstration Day that was hosted by Vast Solar research partners at the Australian National University in association with ACT Fire and Rescue Services. The purpose of this day was to share information and build industry and strategic stakeholder understanding, knowledge and confidence in the management of sodium – an industrial material that is used widely overseas but is quite novel in the Australian context and is integral to Vast Solar's CSP technology. The day delivered i) training to researchers and fire and rescue professionals in the ease of extinguishment of sodium fires and management of sodium in industrial applications and ii) the opportunity for strategic stakeholders to observe, learn and ask questions. The day was well attended and valued by diverse attendees.

4. PLANNING CONTEXT

This section sets out the strategic planning framework relevant to the proposal.

4.1 ASSESSMENT CONTEXT

The proposal to construct and operate JSS1 requires development consent under Part 4 of the EP&A Act. *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) declares the proposal to be State significant development (SSD) as it is development for the purpose of electricity generating works with a capital cost of greater than $30 million (clause 20, Schedule 1). Section 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 Regulations. The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DPE) on 26 August 2014 (refer Appendix A).

4.2 EVALUATION OF THE DEVELOPMENT

Section 89H of the EP&A Act provides that section 79C applies to the determination of development applications for SSD. Under section 79C of the EP&A Act, the consent authority is required to consider a number of matters when determining a development application under Part 4. These matters are listed below and assessed in terms of their relevance to the proposal.

Table 4-1 Matters of consideration

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant environmental planning instruments (EPIs) are discussed in Section 4.3.
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;	Forbes Shire Council has prepared a *Forbes Shire Council Development Control Plan 2013*, however Clause 11 of the SRD SEPP provides that development control plans do not apply to State significant development.
Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F;	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration);	Clause 92 of the EP&A Regulation requires consideration of: • the Government Coastal Policy, for development applications in certain local government areas; and • the provisions of AS 2601 for development applications involving the demolition of structures.

Provision	Relevance to the proposal
	Neither of these provisions is relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates;	Coastal zone management is not applicable to the proposal.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in Sections 5 and 6 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have been avoided or minimised 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 6.3. Characteristics that make it suitable for development of a solar plant are identified and justified.
Any submissions made in accordance with this Act or the regulations; and	Public submissions would be sought and responded to as part of the EIS determination process. Vast Solar would consider and respond to any submissions made in relation to the proposal.
The public interest.	A number of public benefits are relevant to the proposal as discussed in Section 1.3.6. Specifically, they relate to: Reducing fossil fuel emissions that that contribute to climate change. Meeting State and Australian Government policies to increase renewable energy supply in Australia. Providing local employment and regional development opportunities. Developing the solar power industry and supply chain in Australia.

4.3 NSW LEGISLATION

The EP&A Act and the EP&A Regulation establish the legislative planning framework for NSW. Environmental Planning Instruments is the collective name for Local Environmental Plans and State Environmental Planning Policies (SEPPs) in NSW.

The EPIs relevant to the proposal and the NSW legislative framework in relation to the permissibility of the proposal are discussed below.

4.3.1 Forbes Local Environmental Plan 2013

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

a) *to encourage and manage ecologically sustainable development in Forbes,*

b) *to reinforce the existing urban character of Forbes as the urban focus,*

c) *to reinforce the rural character of Forbes while promoting sustainable development,*

d) *to protect the agricultural land of Forbes for continued agricultural production while allowing for planned expansion at the urban fringe,*

e) *to promote Forbes as a premier tourist-destination building on its unique heritage and environmental attributes as well as sporting and leisure facilities,*

f) *to protect, enhance and conserve the natural environment, including the Lachlan River, Lake Forbes, wetlands, native vegetation, environmentally sensitive land and other natural features that provide habitat for fauna and flora, provide scenic amenity and that may prevent or mitigate land degradation,*

g) *to provide a range and variety of housing choices to cater for the different needs and lifestyles of residents.*

This EIS takes into account the proposal's compatibility with ecologically sustainable development, rural character, agricultural land use and other alternative land uses and the natural environment. The proposal is permissible with development consent in the RU1 - Primary Production zone. Permissibility of the proposal is discussed in Section 4.3.17 below.

Land zoning

The LEP states that the consent authority must have regard to the development objectives of planning zones identified in the LEP when determining development applications. The proposal site is located on land zoned RU1 - Primary Production under the Forbes LEP.

The objectives of this zone are:

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

b) *to encourage diversity in primary industry enterprises and systems appropriate for the area*

c) *to minimise the fragmentation and alienation of resource lands*

d) *to minimise conflict between land uses within this zone and land uses within adjoining zones*

e) *to provide opportunities for intensive and extensive agriculture in appropriate locations consistent with the environmental capability of the land*

For the life of the proposal, the proposal site would harness a natural resource (solar energy). While the activity would impact on land availability for primary production, the land would meet the second and third objects as identified above; it would allow for diversity in land use, appropriate to the area and it would not fragment resource lands. Being fully reversible and involving limited ground disturbance, it would not remove the potential to use the land for primary production in the medium to long term.

Permissibility of the proposal is discussed in Section 4.3.17 below.

4.3.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (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 land in a prescribed zone. 'Electricity generating works' are defined in Clause 33 as:

> *'a building or place used for the purpose of making or generating electricity.'*

And a 'prescribed rural zone' is defined in Clause 33 as:

> *any of the following land use zones or a land use zone that is equivalent to any of those zones:*
>
> *a) Zone RU1 Primary Production,*
>
> *b) Zone RU2 Rural Landscape,*
>
> *c) Zone RU3 Forestry,*
>
> *d) Zone RU4 Rural Small Holdings.*

Clause 34(1) of the ISEPP provides that development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed residential zone). The proposal is located within the RU1 Primary Production zone and is therefore considered permissible with consent under the ISEPP. Permissibility of the proposal is further discussed in Section 4.3.17 below.

Traffic generating development

Clause 104 of the ISEPP requires certain developments (identified in Column 1 of the Table in Schedule 3 and known as traffic generating development) to be referred to Roads and Maritime Services (Roads and Maritime). The consent authority would then be required to take into account any submission made by Roads and Maritime in relation to the development.

Power generation is not included in column 1 in the table. Section 104 of the ISEPP applies to other development where there are 200 or more motor vehicles. Since the project would result in the generation of fewer than 200 vehicles per day during construction or operation, the requirements under clause 104 of the SEPP do not apply. Section 6.5 of the EIS assesses the impact of the proposal on traffic and transport.

4.3.3 State Environmental Planning Policy (State and Regional Development) 2011

The aims of the SRD SEPP are to identify development that is SSD, and Critical State Significant Infrastructure and to confer functions on joint regional planning panels to determine development applications.

State significant development

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 is a development for the purpose of electricity generation and would have a capital investment value in excess of $30 million. Accordingly, the proposal is declared to be SSD for the purposes of the EP&A Act.

SSDs are major projects which require approval from the Minister for Planning and Environment. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.

4.3.4 State Environmental Planning Policy No. 55 - Remediation of Land

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

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

A search of the NSW EPA contaminated land public record (NSW Government, 2015a) was undertaken for contaminated sites within the Forbes LGA on 5 June 2015. There was one record returned, Forbes Gas works. This contaminated site is located within the Forbes township, approximately 36 km east of the proposal site. The online *List of NSW contaminated sites notified to EPA* (NSW Government, 2015b) was also searched on 5 June 2015. There are no sites listed in the Jemalong area, however there were seven sites found in the Forbes area, these are all located within the Forbes township.

There is a risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site however, given no contaminated sites are recorded on or adjacent to the proposal site. The proposal site contains an area where waste has been placed including scrap metal. There was no evidence of contamination observed during the site visit or mentioned during conversations with the proponent, it is considered highly unlikely that significant contamination exists in areas that would be affected by the proposal. Furthermore, the construction activities would not significantly disturb soil or groundwater at the site.

4.3.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

Potentially Hazardous Development

Under *State Environmental Planning Policy No. 33 – Hazardous and Offensive* Development (SEPP 33), ***potentially hazardous*** industry refers to a development which, if it were to operate without employing any measures to reduce or minimise its impact, would pose a significant risk to human health, life or property or to the biophysical environment. If a proposed development is *potentially* hazardous according to SEPP33, the safety risks and associated controls must be assessed within the EIS (in the form of Preliminary Hazard Analysis (PHA) as provided in Appendix C).

The PHA aims to evaluate whether or not the risks are acceptable according to the risk tolerability criteria enunciated in the DPE's Hazardous Industry Planning Advisory Paper No.4, *Risk Criteria for Land Use Safety Planning* (HIPAP4). If those criteria are not satisfied, then the development is deemed hazardous (i.e. *actually* 'hazardous', not just *potentially* hazardous) and development approval is likely to be denied. If the HIPAP4 criteria are satisfied, as is the case for this proposed development (as demonstrated in section 6.3 of this EIS), then the development is not deemed hazardous (albeit *potentially* hazardous) and approval would not normally be refused on the grounds of safety risk.

The PHA in Appendix C investigates the safety risks associated with the proposed station, focusing on risks that could affect existing and future neighbouring land uses. A series of mitigation measures have been developed to address identified risks. The proposed plant would be designed, constructed and operated to avoid or mitigate these risks, employing a range of safeguards such as engineering controls, emergency protective systems and operational procedures as outlined in the PHA. Whilst the facility stores a sufficient quantity of hazardous material for SEPP 33 to apply, the PHA demonstrates that the HIPAP4 risk criteria are easily satisfied and the development can therefore be treated as permissible in respect of safety hazards.

Potentially Offensive Development

A *potentially offensive* industry is a development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact, would emit a polluting discharge in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land. SEPP33 provides criteria defining what types of development are considered potentially offensive, the predominant criterion being whether or not a DECCW licence is required.

The proposed Jemalong Station is not deemed potentially offensive according to SEPP33, since it does not involve significant potential for polluting discharges, does not need an Office of Environment and Heritage Licence or Office of Water (formerly DECCW) licence, and is not in an area of particular environmental sensitivity. SEPP33 applies to this development by virtue of its potentially *hazardous* nature, not because it is potentially offensive.

4.3.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) encourages the conservation and management of natural vegetation that provides habitat for Koalas. Koalas are listed under the TSC Act as a vulnerable species. The Forbes LGA is subject to this SEPP and cannot approve development in an area affected by the policy without an investigation of core koala habitat. SEPP 44 aims to identify areas of potential and core Koala Habitat. These are described as follows:

- Potential Koala Habitat: areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and
- Core Koala Habitat: an area of land with a resident population of Koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

This Biodiversity assessment (Appendix C) and it summary in Section 5.2 consider address SEPP 44. While "potential Koala habitat" as defined by SEPP 44 occurs in the study area, the fragmented nature of habitat in the locality, the lack of primary feed tree species, and the lack of local records of Koala suggest that the proposal site is unlikely to provide habitat that would be utilised by Koalas.

4.3.7 Environmental Planning and Assessment Act 1979

Development in NSW is subject to the requirements of the EP&A Act and its associated regulations. 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 taken into account. 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 such that it would avoid protected areas and generally minimise the use of natural and artificial resources while still considering the social and economic welfare of the local community.

The proposal is not in conflict with any of the remaining objects of the EP&A Act. Given the proposal would support a number of the objects of the EP&A Act, and is consistent with the remaining objects of the Act, the proposal is considered appropriate in the context of the EP&A Act.

4.3.8 Environmental Planning and Assessment Regulations 2000

Division 6 of the EP&A Regulation addresses public participation in SSD. Vast Solar would comply with Division 6 of the EP&A Regulations, including the specific provisions of clauses 84 and 85 regarding placing notices in local newspaper and on the website of the DPE and the form that notice must take. The Development application and accompanying information (including this EIS) would be placed on public exhibition for a period not less than 30 days.

4.3.9 Protection of the Environment Operations Act 1997

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

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

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

The works would not generate more than net 30 MW of electrical power and being electricity generation from solar power are not considered a scheduled activity. Accordingly, an EPL is not required under the POEO Act for the proposed solar plant.

It is noted that should pollution events result from the proposed development they would still constitute a breach of the Act under section 120. Under section 148 of the Act, the proponent would be required to notify the EPA of any pollution incidents that occur as a consequence of the construction or operation of the proposed development.

4.3.10 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.

Lachlan Valley Way is a classified Road. Any works such as intersection upgrades cannot be undertaken with respect to a classified road except with the concurrence of Roads and Maritime.

Wilbertroy Lane, Naroo Lane and Whispering Pines Lane are public roads. Any works, such as upgrades that interfere with the structure of the road, require consent of the appropriate roads authority. The appropriate roads authority is Forbes Shire Council.

4.3.11 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation. Clearing is defined as cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation including native grasses and herbage.

An authorisation to clear native vegetation is not required for SSD (section 89J EP&A Act). Native vegetation clearing is addressed in Section 5.2 including the requirement for biodiversity offsets, in consultation with the Office of Environment and Heritage (OEH).

4.3.12 Water Act 1912

Works that are managed through the *Water Act 1912* are known as 'controlled works', which are generally earthworks, embankments or levees or other works that are likely to affect the flow of water. The Lachlan River, Jemalong Gap to Condobolin, Floodplain Management Plan (OEH 2012) declares 'controlled work' to be:

> *any work that is situated, or proposed to be constructed on land that is, or forms part of, the bank of a river or lake, or, is within a designated floodplain.*

Modifications in and around floodways in the western rural areas of NSW are managed through Part 8 of the *Water Act 1912*. The *Water Act 1912* requires that all flood control works within a designated floodplain be assessed for approval. The proposed development site is located within a designated floodplain area.

Controlled works within the floodplain are either considered complying, or non-complying works under the *Water Act 2012*. The definition of 'complying' generally refers to where the NSW Office of Water (NOW) are satisfied that the work complies with the floodplain management plan for the area in which the work is situated or proposed to be constructed. The key consideration for proposed development is whether the possible 'impact on overall flood behaviour could be significant and therefore far-reaching.'

The proposed development is located adjacent to zone A and zone B (discussed in detail in Section 5.5). In general, works within the floodway of these areas would not be approved. No works within these areas are proposed.

4.3.13 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. The TSC Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.

The potential to impact threatened species, populations and ecological communities listed under this act has been considered in Section 5.2 of this EIS (and in full, Appendix C), including the requirement for biodiversity offsets.

4.3.14 National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act 1974* (NPW Act), the Chief Executive 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 Chief Executive 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 site is not in or in the vicinity of any protected areas as defined in the Act.

An assessment of impacts to Aboriginal Heritage is provided in Section 5.3 of the EIS (and in full, Appendix C). An Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for State Significant Development (section 89J EP&A Act).

4.3.15 Crown Lands Act 1989

The objective of the *Crown Lands Act 1989* (Crown Lands Act) is to ensure that Crown land is managed for the benefit of the people of New South Wales. The Crown Lands Division, Department of Primary Industries (DPI) is responsible for the sustainable and commercial management of Crown land. This involves the management of state-owned land, linking with other agencies, local government, the private sector and communities to provide social and economic outcomes for NSW.

The proposal site is not located on Crown land. However, it is noted that land located to the west and south-west of the proposal, Lot 13 DP753118, is Crown Land. If Vast Solar proposes to have any impact on this land, consultation and potentially a licence from Crown Lands would be required.

4.3.16 Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights Act 1983* provides a mechanism for compensating Aboriginal people of NSW for loss of their land. The role of the Department of Aboriginal Affairs is to administer the Act on behalf of the Minister for Aboriginal Affairs.

As above, the proposed works are not located on Crown land. However, if Vast Solar proposes to have any impact on Crown land, an Aboriginal Lands Claims search should be undertaken.

4.3.17 NSW planning approval pathway

The proposal is permissible with development consent under the ISEPP and therefore assessed under Part 4 of the EP&A Act with the Minister for Planning and Environment the consent authority.

4.4 COMMONWEALTH LEGISLATION

4.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of the Environment (DoE). Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minister.

The EPBC Act identifies eight MNES:

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

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

A search of the Commonwealth Protected Matters Search Tool on 29 September 2014 indicated that there are no World Heritage Properties or National Heritage Places within the proposal site. Search results listed three Wetlands of International Importance that are either known to occur or have potential to occur in the area, however these are not relevant to the site or proposal. The proposal is not likely to have a significant impact on the environment of Commonwealth land. Section 5.2 discusses the results of searches in relation to threatened species, ecological communities and migratory species. Tables 4-2 – 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	NA
National Heritage Places	NA
Wetlands of International Significance	NA
Great Barrier Reef Marine Park	NA
Commonwealth Marine Areas	NA
Threatened Ecological Communities	Section 5.2 and discussion below
Threatened Species	Section 5.2 and discussion below
Migratory Species	Section 5.2 and discussion below

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	Not applicable to site.
Commonwealth Heritage Places	Not applicable to site.
Listed Marine Species	Not applicable to site.
Whales and Other Cetaceans	Not applicable to site.
Critical Habitats	Not applicable to site.
Commonwealth Reserves	Not applicable to site.

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

Extra Information	Addressed in this EIS
Place on the RNE	Not applicable to site.
State and Territory Reserves	Not applicable to site.
Regional Forest Agreements	Not applicable to site.
Invasive Species	Section 5.2
Nationally Important Wetlands	Not applicable to site.

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in Section 5.2.

A significant impact 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.

4.4.2 Native Title Act 1993

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

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

Native title may exist in areas such as:

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

A native title search was undertaken for the area potentially impacted by the proposed development in November 2014 to determine whether it may be affected by a native title determination, application or indigenous land use agreement (ILUA). There were no results for the proposal site and surrounding land.

4.4.3 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 greenhouse gases 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 RET. This includes solar energy.

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

The proposal is the subject of application to the Clean Energy Regulator under the RE Act.

4.5 OTHER RELEVANT POLICIES AND MATTERS

4.5.1 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 impact. All potential impacts have been considered and mitigated where a risk has been identified. Mitigation is commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty.
b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
The majority of the 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.

Particularly, pollution risks have been addressed and decommissioning would see all above ground infrastructure removed, such that the majority of the site could be returned to primary production or other compatible land use. It is also noted that the proposal would address the need to minimise the risk of climate change to current and future generations by reducing carbon emissions that result for electricity generation. Proposals such as JSS1 are an important part of the transition to a low emission future.

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

The impacts of the proposal on biodiversity, including EPBC listed species, have been assessed in detail in the Biodiversity Assessment in Appendix C and are summarised in Section 5.2 This has included avoidance of areas of higher conservation value areas and management prescriptions to minimise, manage and offset residual impacts. The impacts have been deemed acceptable and justifiable by this assessment.

d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

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

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in Section 7.3 set out an auditable environmental management commitment by the proponent. Based on the social and environmental benefits accruing from the proposal at a local and broader 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.

4.6 SUMMARY OF LICENSES

The following licenses have been identified as relevant to the proposal.

Table 4-5 Summary of licenses required

Instrument	Licence or approval requirement
EP&A Act, Part 4	SSD consent - State Significant Developments require approval from the Minister for Planning and Environment. This (EIS) has been prepared in accordance with the requirements of the Secretary of the DPE.
Roads Act, section 138	Any works to public or classified roads require a permit under this act by the roads authority: • Lachlan Valley Way; Roads and Maritime. • Wilbertroy Lane, Naroo Lane and Whisperings Lane; Forbes Council.
Crown Lands Act	Any impact on Lot 13 DP753118 (Crown land) would require consultation and potentially a licence from Crown Lands

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

5. ENVIRONMENTAL IMPACT ASSESSMENT

5.1 IMPACT ASSESSMENT APPROACH

The environmental impact assessment below addresses all impacts likely to be attributed to the proposal (including the solar plant and transmission line). 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
    - Noise generated by equipment and traffic movements
    - Potential to impact on cultural features and values
    - Public and worker 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.

To guide the level of investigation within the EIS, a risk assessment was undertaken to characterise the likely environmental risks associated with the construction, operation and decommissioning of the proposal. This was based on;

1. the desktop Scoping Study (provided in application for the SEARs),
2. a site inspection, and
3. consideration of the internal Hazard Identification Study (completed by Vast Solar in March 2014)

The risk assessment is presented as both an initial high level assessment where risk is unmitigated risk, followed by an assessment of the mitigated risk. The mitigated risk has been informed by this assessment.

5.1.1 Environmental Risk Assessment Approach

The risk assessment methodology is consistent with AS/NZ ISO 31000:2009 (Risk management – Principals and guidelines). It utilises a risk rating ('consequence' x 'likelihood') by considering the **consequence** of an impact in combination with the **likelihood** of this impact occurring. High consequence in combination with high likelihood results in the highest risk rating.

Environmental aspects

Different risk criteria are required for the assessment of different environmental aspects. That is, the consequence and likelihood criteria will differ depending on what is being considered; impacts to soils and landforms, impacts to ecological systems, impacts to the community etc.

Therefore, each risk has been assessed using specifically developed **risk assessment criteria** for one of the following aspect classes:

1. Physical.
2. Ecological.
3. Socio-economic.
4. Health and safety (Hazard and risk).
5. Heritage (indigenous and non-indigenous).

Political environment and legal requirements are considered separately for each aspect and not as an environmental aspect.

Table 5-1 Risk assessment criteria example: physical aspect

Consequence criteria	
The consequence to: • Natural systems or processes, eg. hydrology, nutrient cycles, atmospheric properties or geomorphological processes; or • Places of extraordinary landscape diversity or rare or uncommon landscapes or physical (eg. geomorphological, geological or hydrological) features, or physical phenomena; or • Type examples of physical landscapes, physical features or phenomena; or • Places used as a research, teaching, reference or benchmark site due to physical characteristics; would be:	
Negligible	Negligible water, soil or atmospheric pollution, as defined by relevant guidelines, no medical treatment required.
Minor	Minor water, soil or atmospheric pollution, minor injury, medical treatment required, reversible.
Moderate	Soil, water or atmospheric pollution resulting in fines or infringement notices. Small scale but generally reversible damage to physical features or phenomena., moderate injury, irreversible disability or impairment.
Major	Medium term damage. May be reversed but would require significant effort and/or financial outlay. Potential for significant fines or legal action. Single fatality or severe irreversible injury.
Catastrophic	Permanent or long-term damage or destruction of features or processes, that could not be practicably reversed (definition of long term in accordance with relevant guidelines), multiple fatalities.
Likelihood criteria	
The likelihood of the impact occurring is considered:	
Remote	May occur in exceptional circumstances <1% chance of occurring
Unlikely	Not expected to occur under usual and exceptional circumstances 1-20% chance of occurring
Possible	Could occur under usual or exceptional circumstances 21-49% chance of occurring
Likely	High likelihood of occurring even under usual circumstances 50-85% chance of occurring
Almost certain or inevitable	Expected to occur >85% chance of occurring

5.1.2 The resulting risk rating matrix

Risk rating matrix

Depending on the combination of 'consequence' and 'likelihood', the overall risk rating could be low to extreme. The full risk assessment matrix is provided in Appendix A.3. Where the unmitigated environmental risk is assessed as high to extreme ('key risks'), these are the focus of Sections 5.2 to 5.7 as these are considered to have potential to generate a significant impact. Lower risk issues, where the unmitigated risk is low to medium, are assessed in Section 6.

Table 5-2 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

Environmental risks

Table 5-3 summarises the results of the risk assessment. The following six key risks were investigated in detail by way of specialist assessments (refer Section 5):

- Biodiversity.
- Aboriginal heritage.
- Hazard and risk.
- Hydrology, including flooding.
- Glare and glint.
- Visual amenity.

Eleven lower risk issues were investigated, primarily using desktop assessment, in Section 6 of this EIS.

- Noise.
- Climate and air quality.
- Land use.
- Socioeconomic and community.
- Traffic, transport and road safety.
- Resource use and waste generation.
- Fire and bush fire issues.
- Historic heritage.
- Soil.
- Water use and water quality (surface and groundwater).

Table 5-3 Risk analysis of environmental issues

Relevant EIS section	Environmental risk	Un-mitigated			Mitigated and assessed		
		Consequence	Likelihood	Risk rating	Consequence	Likelihood	Risk rating
5.2	Biodiversity	Major	Possible	Very high	Moderate	Possible	High
5.3	Aboriginal heritage	Major	Possible	Very high	Minor	Possible	Medium
5.4	Hazard and risk	Major	Possible	Very high	Major	Remote	Medium
5.5	Flooding	Moderate	Possible	High	Minor	Possible	Medium
5.6	Glare and glint	Moderate	Possible	High	Minor	Possible	Medium
5.7	Visual amenity	Moderate	Possible	High	Moderate	Possible	High
6.1	Noise	Minor	Possible	Medium	Minor	Possible	Medium
6.2	Climate and air quality	Minor	Possible	Medium	Minor	Possible	Medium
6.3	Land use	Minor	Possible	Medium	Minor	Possible	Medium
6.4	Socioeconomic and community	Minor	Possible	Medium	Minor	Possible	Medium
6.5	Traffic, transport and road safety	Minor	Possible	Medium	Minor	Possible	Medium
6.6	Resource use and waste generation	Minor	Possible	Medium	Minor	Possible	Medium
6.7	Fire and bush fire issues	Minor	Possible	Medium	Minor	Possible	Medium
6.8	Historic heritage	Minor	Possible	Medium	Minor	Possible	Medium
6.9	Soil	Minor	Possible	Medium	Minor	Possible	Medium
6.10	Water use and water quality (surface and groundwater)	Minor	Possible	Medium	Minor	Possible	Medium

5.2 BIODIVERSITY (FLORA AND FAUNA)

5.2.1 Approach

A Biodiversity Assessment was prepared to assess the potential impacts of the proposal on biodiversity, flora and fauna. The full report is appended, Appendix C, and summarised below.

The assessment report is provided in two parts. Part one assesses impacts associated with construction of the proposal, and associated operational impacts on all fauna *excluding birds*. Part two is a specialist assessment that focuses on the assessment of the operational impacts of the proposal on birds.

The scope and aims of the biodiversity assessment are to:

- Determine the biodiversity values of the study area including identifying protected and threatened flora and fauna species, populations and ecological communities and their habitats.
- Identify the ecological constraints of the proposal.
- Identify the potential impacts of the proposal on threatened flora and fauna species, populations, ecological communities and critical habitat.
- Address the requirements of the relevant legislation including the EP&A Act, the TSC Act and the EPBC Act.
- Assess the significance of the impact of the proposal on species, ecological communities and populations listed under the TSC Act and EPBC Act.
- Propose environmental management measures to minimise, mitigate and if necessary offset residual impacts.

5.2.2 Methods

The method of assessment included:

- Database searches and literature review.
- Targeted flora and fauna field survey.
- Characterisation of impacts, with reference to specialist input (regarding solar flux and operational bird risks).
- Development of mitigation measures to avoid, minimise and offset impacts of the proposal.

The field surveys were undertaken between 17 and 21 November 2014. The entire study area was traversed by two terrestrial ecologists, and inspected by car when able. Flora surveys where undertaken using random meanders (after Cropper 1993) and BioMetric Vegetation Plots (as per OEH 2014), and fauna surveys included point bird surveys, reptile searches, spotlight transects, Anabat recordings, hollow-bearing tree assessments and watches and habitat assessments. Opportunistic findings were recorded.

Additionally, bird surveys were developed in consultation with specialist ornithologist Dr Stephen Ambrose. Bird surveys were undertaken at 32 sites throughout the study area. In the proposal site, bird point survey sites were approximately 400 m apart. In the surrounding study area, bird survey sites were located to a distance of approximately 1000 m away from the proposal site.

Full details of survey effort and assessment personnel are included in Appendix C.

5.2.3 Results

Vegetation

Three native vegetation communities were observed during the surveys (not all would be impacted by the proposed development):

- Western Grey Box – Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregions.
- Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).
- River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.

Western Grey Box – Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregions is classified as an Endangered Ecological Community (EEC) under the NSW TSC Act and the Commonwealth EPBC Act.

Flora

Of the 54 species of plants recorded during the surveys, 17 (31%) were not indigenous to the region. One species (African Boxthorn) is declared as a Noxious Weed by Forbes Shire Council.

Database searches for threatened flora species revealed the potential for 16 species to occur within the study area. No threatened flora species were detected during any of the surveys. A risk based assessment, with reference to habitat attributes, considered it unlikely that any threatened flora species occur within the study area.

Fauna

Eighty-four fauna species were detected during the field survey including 59 bird, three amphibian, 16 bat and six other mammal species. No reptile species were recorded.

Database searches for threatened species listed on the NSW TSC Act identified 46 bird species, three reptile, two amphibian, and 13 mammal species with the potential to occur. The EPBC Act protected matters search tool revealed six bird, one reptile, two mammal, three fish, and 10 migratory bird species with the potential to occur.

Five threatened bird species were recorded during field surveys; the Superb Parrot (*Polytelis swainsonii)*, Grey-crowned Babbler *(Pomatostomus temporalis temporalis)*, Spotted Harrier (*Circus assimilis*), Brown Treecreeper (Eastern Sub-species) (*Climacteris picumnus victoriae*) and the Turquoise Parrot (*Neophema pulchella*). One of these species, the Grey-crowned Babbler was not recorded within the proposal site but is considered likely to occur there occasionally. Four threatened microbats are considered to potentially occur in the study area based on possible to probable identifications from Anabat recordings. These are the Little Pied Bat (*Chalinolobus picatus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Inland Forest Bat (*Vespadelus baverstocki*) and Corben's Long-eared Bat (*Nyctophilus corbeni*). No threatened reptiles or amphibians were recorded.

A risk based assessment, with reference to habitat attributes, considered 45 species have a moderate or higher likelihood of occurring within the proposal site.

Table 5-4 Summary of threatened, marine and migratory fauna species with the potential to occur within the proposal site

Species	Status *	Likelihood of occurrence
Magpie Goose	TSC-V	Moderate
Regent Honeyeater	TSC-CE, EPBC-E	Moderate
Fork-tailed Swift	EPBC-Migratory	High
Eastern Great Egret	EPBC-Marine, Migratory	Moderate
Cattle Egret	EPBC-Marine, Migratory	High
Common Sandpiper	EPBC-Marine, Migratory	Moderate
Sharp-tailed Sandpiper	EPBC-Marine, Migratory	Moderate
Pectoral Sandpiper	EPBC-Marine, Migratory	Moderate
Red-necked Stint	EPBC-Marine, Migratory	Moderate
White-throated Needletail	EPBC-Migratory	Moderate
Rainbow Bee-eater	EPBC-Migratory	Moderate
Glossy Ibis	EPBC-Migratory	Moderate
Common Greenshank	EPBC-Marine, Migratory	Moderate
Marsh Sandpiper	EPBC-Marine, Migratory	Moderate
Australasian Bittern	TSC-E, EPBC-E	Moderate
Bush Stone-curlew	TSC-E	Moderate
Curlew Sandpiper	TSC-V	Moderate
Pied Honeyeater	TSC-V	Moderate
Speckled Warbler	TSC-V	Moderate
Spotted Harrier	TSC-V	Recorded
Brown Treecreeper	TSC-V	Recorded
Varied Sittella	TSC-V	Moderate
White-fronted Chat	TSC-V	Moderate
Latham's Snipe	EPBC-Marine, Migratory	Moderate
Little Lorikeet	TSC-V	Moderate
Painted Honeyeater	TSC-V	Moderate
Brolga	TSC-V	High
Little Eagle	TSC-V	High
Swift Parrot	TSC-E, EPBC-E	Moderate
Black-tailed Godwit	TSC-V	Moderate
Hooded Robin	TSC-V	Moderate
Black-chinned Honeyeater	TSC-V	Moderate
Turquoise Parrot	TSC-V	Moderate

Species	Status *	Likelihood of occurrence
Barking Owl	TSC-V	Moderate
Blue-billed Duck	TSC-V	Moderate
Flame Robin	TSC-V	High
Superb Parrot	TSC-V, EPBC-V	Recorded
Grey-crowned Babbler	TSC-V	Recorded
Australian Painted Snipe	TSC-E, EPBC-V	Moderate
Diamond Firetail	TSC-V	High
Freckled Duck	TSC-V	Moderate
Little Pied Bat	TSC-V	Recorded
Corben's Long-eared Bat	TSC-V, EPBC-V	Recorded
Yellow-bellied Sheathtail-bat	TSC-V	Recorded
Inland Forest Bat	TSC-V	Recorded

TSC NSW Threatened Species Conservation Act

EPBC Commonwealth Environment Protection and Biodiversity Conservation Act

V Vulnerable; E Endangered

Threatened fish and amphibian species were considered unlikely to be utilising the available habitat at the proposal site.

Critical habitat

Neither the study area nor the surrounding region contain any areas that have been declared as critical habitat under either the TSC Act or EPBC Act.

Wildlife connectivity corridors

The riparian zone in the study area is generally well-vegetated, as is the fence line running north-south along the western side of the proposed transmission line (also running north-south). Remnant patches within the study area generally connect to these corridors. The canopy connectivity in these zones is good, however the ground and shrub layers are poor.

The width of the riparian and road/fence corridors within the study area varies, but are generally no wider than 260 m. Therefore, most of the linkage vegetation is considered 'edge' vegetation and not 'core' vegetation, however it is noted that it does connect to Wilbertroy State Forest to the south-west and the riparian zone of the Lachlan River to the north-east.

Groundwater dependent ecosystems

A number of groundwater dependent ecosystems occur within the study area. Vegetation communities observed during the surveys that are considered likely to be dependent on groundwater resources include the River Red Gum swampy woodland wetland and possibly the Poplar Box woodland to some extent. River Red Gum woodlands are usually associated with aquatic systems including rivers, creeks, drainage lines, and floodplains whilst Poplar Box woodland is usually found in lower parts of the landscape and can be found close to floodplain areas. The River Red Gum swampy woodland wetland species would rely on water inundations from time to time.

5.2.4 Potential impacts

Construction

Potential construction impacts include loss of native vegetation and the potential for follow on impacts to:

- Weed, pests and pathogens.
- Fauna habitat, including hollow bearing trees and potential koala habitat.
- Wildlife connectivity and habitat fragmentation.
- Local hydrology.
- Fauna (injury and mortality).
- Threatened species.

Loss of Vegetation

Approximately 1.83 ha of moderate to good condition native vegetation would be permanently removed as a result of the proposal, which accounts for a small amount of such vegetation in the study area. The two vegetation types that would be impacted include Poplar Box Woodland and River Red Gum swampy woodland wetland. Neither of these communities are threatened under the TSC Act or EPBC Act. The remainder of vegetation to be impacted is exotic crop species with scattered native grasses and forbs which do not constitute a native plant community type (PCT).

During the design phase, an 'avoid and minimise' approach to loss of native vegetation was adopted. All remnant patches of woodland within the solar station proposal site have been avoided for clearing and most of the remnant woodland along the proposed transmission line was also avoided by designing the transmission line to be constructed around these patches. Only minor areas of woodland could not be avoided for clearing.

One TSC Act listed vegetation community (Inland Grey Box Woodland) was recorded adjacent to the proposed transmission line but would not be impacted by the proposal.

Weeds, pests and pathogens

Spread of African Boxthorn observed on site may occur during vegetation removal and movement of machinery. Appropriate measures would be put in place to ensure this weed is not spread within or out of the proposal site.

The construction and operation of proposal have the potential to facilitate the dispersal of pest fauna species such as the feral European Rabbit (*Oryctolagus cuniculus*), European Red Fox (*Vulpes vulpes*), and Feral Cat (*Felis catus*). However, these species are already present within the proposal site and in the locality.

Several pathogens in NSW have the potential to impact on the environment and biodiversity. These may be introduced and spread during the construction of the proposal such as:

- Phytophthora (*Phytophthora cinnamomi*).
- Myrtle Rust (*Uredo rangelli*).
- Fusarium Wilt/Panama disease (*Fusarium oxysporum*).

Where risk of spread is apparent, mitigation measures should be followed to prevent their introduction or spread. Impacts due to these pathogens are unlikely.

Fauna habitat

Mature trees provide more flowers, nectar, fruit and seeds than younger trees, as well as a complex substrate that supplies diverse habitats for invertebrate populations (Recher 1996). Threatened bird species that are more likely to utilise the proposal site for these resources include Superb Parrots, Grey-crowned Babblers, Brown Treecreeper, Little Lorikeets, and Varied Sittellas. However, as only 1.83 ha of native woodland would be cleared due to the proposal and the majority of woodland within the proposal site would remain intact, these minor impacts are likely to be negligible to woodland dependent fauna species recorded or likely to occur within the proposal site.

The exotic crop and pasture grasses occurring within the proposal site can be used by native and exotic grazing herbivores, as well as reptiles and invertebrates for refuge and foraging. However, most of this ground cover would remain intact due to the proposed works. Furthermore, this habitat type is abundant throughout the study area, therefore the relative loss of this habitat type due to the proposal would be negligible.

Loss of Hollow-Bearing Trees

Two hundred and five hollow-bearing trees are located within or are very close to the proposal site. Eight of these trees would require removal for the proposal, and another two trees are located on the edge of the proposal and may require removal. Twenty-two hollows were recorded in these eight trees consisting of 13 small hollows, six medium hollows and three large hollows. The loss of these trees represents a proportional reduction of approximately 4% of all hollow-bearing trees and approximately 4% of all hollows observed within the proposal site. This loss is considered 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.

Koala Habitat

No scratches or scats attributable to Koalas were observed during the field surveys. There are no records of Koalas within 10 km of the proposal site. One primary feed tree was present within the proposal site being River Red Gum. Two secondary feed trees were also present within the proposal site, including Poplar Box and Inland Grey Box.

Most of the moderate to good condition native vegetation present within the study area consists of habitat considered critical to the survival of the Koala, and some of these patches consist of “potential Koala habitat” as defined by SEPP 44. Despite this, the fragmented nature of habitat in the locality, the lack of primary feed tree species to be impacted, and the lack of local records of Koala suggest that the proposal site is unlikely to provide habitat that is being or will be utilised by Koalas.

Wildlife Connectivity and Habitat Fragmentation

The removal of approximately 1.83 ha of native vegetation in moderate to good condition from the proposal site would reduce the extent of remnant vegetation in the local landscape to a minor level. This loss of habitat would only cause minor fragmentation between the proposal site and the lagoon/floodplain area directly to the north, and possibly to the north-south remnant vegetation along the proposed transmission line. Species utilising the proposal site as a habitat corridor are likely to already be tolerant of a certain level of fragmentation and are more likely to be highly mobile, wide-ranging species. It is unlikely that connectivity structures would be a suitable mitigation measure due to

limited overstorey vegetation in the surrounding landscape, and the suite of species that occur within the study area.

Injury and Mortality

Clearing of vegetation within the proposal site during construction has the potential to injure fauna due to the disturbance of habitat. Many smaller and more common species such as skinks and frogs are difficult to locate or remove during pre-clearing surveys. It is likely there will be some loss of individuals impacted during construction. There is also the potential for hidden hollows to be present in the forks of large trees, in which bats or birds may occur. Injuries or fatalities to native fauna during the clearing process may arise from such situations. Safeguards and management measures would be put in place during the construction phase to prevent and minimise such impacts.

Changed Hydrology

Impacts of changed hydrology on biodiversity include deteriorating water quality, reduced water availability, altered flow regimes in waterways, and the rising of water tables due to clearing of native vegetation and the movement of salts to surface layers of soil and waterways. Vegetation clearing would be of a minor level. Following construction, ground cover vegetation would be maintained.

Threatened species

Assessments of Significance (AoS) were conducted for species at risk of construction impacts to characterise the significance of potential impacts. Significant impacts are not considered likely as a consequence of construction. All AoS are provided in Appendix C.

Operation

Potential operational impacts that could be associated with the proposal include:

- Alteration to microclimate and erosion potential under the heliostats.
- Changes in rainfall distribution on the site.
- Loss of or alteration to grassland habitat.
- Effects on fire frequency.
- Weed introduction and spread.
- Fauna injury and mortality.
- Threatened species (injuries or mortality due to collisions with infrastructure or loss or modification of habitat).

Alteration to microclimate and erosion potential

Vegetation and ground habitats would likely be affected by reduced insolation and temperature and increased humidity underneath the heliostats modules. Wind speeds may also be reduced. In the grazed paddocks existing native and exotic pasture across the site may decline initially due to shading following installation of the heliostats. Areas of exotic pasture are of little importance in terms of biodiversity; however, 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. It is likely that a native groundcover would survive onsite under the heliostats in areas where a native groundcover currently exists.

Soil underneath the heliostats would likely receive less rainfall than surrounding soil. However, as these would be moved to a near horizontal angle at night, combined with reduce evapotranspiration losses 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 heliostats is unlikely to be reduced. Where higher rates are achieved, higher growth rate of groundcover may occur, reducing effects of shading that are discussed above.

There could be a concentration of rainfall runoff in a strip below the lower edge of the heliostats. This could increase rain-splash intensity and soil erosion potential in this area during heavy rainfall events. The erosion risks should be manageable using adequate site preparation, and responsive pasture and stock management.

Loss of or alteration to grassland habitat

As the heliostats would be located in modified grazing and cropping paddocks with few fauna habitat values, there is a low probability of fauna species, particularly threatened species, being impacted by any microclimate and associated vegetation changes that may occur in these areas.

Effects on fire frequency

With creation of thermal energy and utilisation of flammable chemicals there is an elevated risk of activities resulting in a grass fire. The proposal is unlikely to significantly affect wildfire frequency in the areas adjacent to the subject site. Fire frequency within the site boundary is already likely to be low given the high levels of modification and low fuel loads.

Weeds

Rehabilitation of disturbed areas and post-construction weed management would limit the establishment and spread of weed species during construction and operation of the proposed road alignment.

Injury and Mortality

Risk to fauna associated with operation relate primarily to birds. These were assessed in a specialist report (Part Two Biodiversity Assessment – Jemalong Solar Station: Potential Operational Impacts on Bird Populations and Recommendations for Bird Hazard Risk Management; included as an appendix of the Biodiversity Assessment, Appendix C).

The main operational impacts resulting from operation of the solar station relate to:

- Collision risks with infrastructure including heliostats, towers, cables and perimeter barbed wire fencing.
- 'Solar flux[1]' burns and related trauma to birds.
- Heliostats and reflected light perceived by birds as wetlands.
- Attraction of birds to bright lights at night.
- Attraction of birds to insects culls and live swarms due to solar flux.
- Stranding and predation of birds.

These effects would be increased where flocking or amalgamations of birds occur, potentially attracted to the site by infrastructure (perching opportunities), the nearby lagoon (when inundated) or if large numbers of prey species (moths) were found to be accumulating at the site. This underscores the importance of monitoring any injuries and adaptively managing unacceptable levels of impact.

[1] The region of elevated temperature in front of the thermal receivers, a result of the heliostats focusing on this area. Modelling of thermal flux informed this assessment.

The assessment considered:

- The numbers of bird mortalities and injuries at facilities using solar flux technology is relatively small compared with other anthropomorphic impacts.
- The solar flux zones would be diffuse (approximately 90 small areas in front of the thermal receivers.
- The proposed management of the plant could be used to reduce impacts.

The assessment has identified that it is unlikely that the proposal would significantly impact local populations of bird species, including threatened species and listed migratory species. Mitigation measures have been developed to assist in reducing impact to bird species.

Threatened species

AoS were conducted for species at risk of operational impacts to characterise the significance of potential impacts. Significant impacts are not considered likely as a consequence of operation. This conclusion is contingent upon monitoring and a program of adaptive management regarding injuries that result to birds onsite.

5.2.5 Safeguards and mitigation measures

Measures to avoid and minimise impacts associated with the proposed works include:

- Clear zone reductions in areas where vegetation is of conservation significance. Discussions with the proponent regarding the presence of EEC and hollow-bearing trees have resulted in a proposed transmission line design that avoids clearing of remnant patches of woodland, however some trees on edges may still be cleared due to the proposal. The remnant patches of Poplar Box Woodland within the proposal site will not be cleared as a result of the proposal.
- The proposal has been sited and designed to avoid or minimise the clearing of hollow-bearing trees. Only eight hollow-bearing trees of a possible 205 in the study area would be cleared.
- Design of the solar station has included the rotation of the heliostats angled 20 and 40 degrees downward from the vertical during night-time to avoid reflections that may cause aquatic birds to land on them nocturnally mistaking them for a 'lake'.
- Design of the solar station has ensured the solar heat flux range around the receiving towers is minimal, meaning birds are unlikely to be impacted due to solar heat flux.

The following management and mitigation strategies are recommended to manage biodiversity impacts associated with the development.

Table 5-5 Safeguards and mitigation measures for biodiversity

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Clearing impacts would be minimised by: • A CEMP would be prepared including an erosion sediment control plan, vegetation management measures, a revegetation and weed management program, fauna management measures, and Work	X		

Safeguards and mitigation measures	C	O	D
Methods Statements for all works within 10 m of the waterways occurring adjacent to the proposal site. All site workers should be inducted and made aware of the conservation issues and associated CEMP for the site. • Prior to the commencement of work, the clearing limit needs to be clearly demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar. • Pre-clearing surveys would be carried out by an ecologist and would include targeted surveys for nesting Superb Parrots, Grey-crowned Babblers, Brown Treecreepers and general tree hollow inspections where possible. They would include targeted searches for arboreal fauna and inspections of vegetation for other fauna occupancy. Habitat trees would be clearly marked with flagging tape. If active nests are found during clearing works, or hollows are being used by nesting birds or arboreal mammals, an ecologist or local wildlife carer should be contacted to remove the eggs, chicks or juvenile mammals to be hand-raised. • Trees would be removed in such a way as not to cause damage to surrounding vegetation. Root systems of trees and shrubs to be removed should be retained in-ground to ensure surrounding ground layer vegetation is undisturbed and to prevent soil erosion. • Where possible, trees to be removed would be mulched on-site and re-used to stabilise disturbed areas. • Where trees are to be retained, an adequate protection zone (TPZ) would be provided around each tree for the duration of construction. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. • If work cannot avoid encroaching into the TPZ, it would not impinge on the structural root zones (SRZ) of trees to be retained. Details for calculating the SRZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. • An unexpected threatened species finds procedure would be developed before clearing is begun.			
Hollow bearing tree impacts would be minimised by: • Staged habitat removal for the removal of hollow-bearing trees would be undertaken where non-habitat vegetation would be cleared initially following a pre-clearing inspection by a qualified ecologist. Habitat trees would be disturbed by	X		

Safeguards and mitigation measures	C	O	D
'knocking' at this time and cleared at least 24 hours after. • Clearing of hollow-bearing trees would not take place between September and February, where possible. If clearing during this period cannot be avoided, an ecologist would be present on site to check all hollows for animals. If a hollow is being used by a threatened species (e.g. Superb Parrot), an exclusion barrier of appropriate distance (e.g. 30 m from the base of the tree) would be installed to prevent disturbance. If a hollow is being used by a species not listed under the TSC Act or EPBC Act, any animals present will be caught and either released into appropriate alternative habitat or taken to a wildlife carer.			
Residual impacts would be offset: • An Offset Management Plan would be developed and implemented to offset the loss of native vegetation, including hollow-bearing trees. This may include direct offsets or other strategies to improve biodiversity outcomes commensurate with the impacts of the project on native vegetation.		X	
To minimise impacts native vegetation outside the impact zone, stockpile and compound sites would be located using the following criteria: • Within the proposal site. • At least 40 m away from the nearest waterway. • In areas of low ecological conservation significance (i.e. previously disturbed land). • On relatively level ground. • Outside the 1 in 10 year Average Recurrence Interval (ARI) floodplain.	X		
A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites. This would include: • Declared noxious weeds would be managed according to the requirements stipulated by the *Noxious Weeds Act 1993* during and post construction • Develop protocol for weed hygiene in relation to plant, machinery and importation and management of fill • All pesticides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation. • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated	X	X	X

Safeguards and mitigation measures	C	O	D
and reported.			
Disturbance to habitat features would be minimised by: • Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	X		
To minimise injuries to microbats and birds: • Use of barbed wire would be avoided.	X	X	
Implement feral animal management program, including species such as rabbits, rodents and starlings to reduce risk of attracting raptors.		X	
To manage risks to birds during operation, develop and implement an Adaptive Bird Hazard Management Plan to monitor and manage bird hazards during operation. The plan would include triggers to implement management actions, in response to unacceptable levels of impact or predictions of unacceptable impacts. It would include a set of feasible management actions that could be promptly implemented. A range of potential management actions are provided in Section 5.1 of Part 2 of the Biodiversity assessment and include: • Application of deterrents to dissuade use by birds of the site or sections of towers where monitoring identifies an unacceptable risk to target species • Restrictions on lambing near the site which could attract raptors • Tilting heliostats downwards at an angle from the vertical at night (between 20 and 40 degrees downward) to avoid their appearance as 'water bodies' • Use of reflective power line marking balls on transmission lines • Actions would be monitored and adapted to ensure their effectiveness. The program would operate until such time as risks are demonstrated to be low.		X	

5.3 ABORIGINAL HERITAGE

The ACHA sought to identify and record Aboriginal cultural areas, objects or places, to assess the archaeological potential of the proposal site, and to formulate management recommendations based on the results of Aboriginal community consultation, background research, field survey and significance assessment.

The ACHA was conducted in accordance with the Draft Guidelines for *Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005), the OEH *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b). The general approach of the ACHA included the following steps:

- Description of the land and history of peoples living on the land.
- A review of previous archaeological work and heritage listings on the NSW OEH Aboriginal Heritage Information Management System (AHIMS).
- A predictive model of Aboriginal site distribution relevant to the proposal site.
- A field inspection.
- Aboriginal community consultation.
- An analysis of background information.
- An assessment of the impact of the proposal on Aboriginal objects and places.
- Consideration of management and mitigation measures.

Aboriginal community consultation undertaken as part of the ACHA has been conducted in accordance with the guidelines set in the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005) and OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010a). Section 3 describes the Aboriginal community consultation process that took place in relation to the proposal.

A cultural heritage and archaeological survey for Aboriginal areas, objects and places was conducted over two days in December 2014 by archaeologists Julie Dibden and Tom Knight, NSW Archaeology Pty Ltd. Richard Coe, representing the Condobolin LALC, was involved in the field survey.

5.3.1 Background

The proposal site is situated within land which today is seen as having traditionally been occupied by the Wiradjuri peoples. The Wiradjuri inhabited a widespread area which extended from the Great Dividing Range west to the Macquarie, Lachlan and the Murrumbidgee rivers (Coe 1989). The area has undergone very high levels of prior disturbance associated with original land clearance and cultivation. Accordingly, the archaeological context of Aboriginal objects/sites is considered to be correspondingly disturbed, and lessens their value and significance.

Thurumbidgee Lagoon, north of the proposal site forms a part of an overflow drainage line which extends southwest from a bend in the Lachlan River. The land adjacent (within c. 200 m) to the lagoon is archaeologically sensitive given the presence of water and would likely have been targeted seasonally while people hunted and moved away from the main river. The lagoon would also have been targeted for the exploitation of flora and fauna, again, at least seasonally. As a result, the materials associated with this land use, such as stone artefacts, hearths and perhaps human interments, would remain present in

areas proximate to the lagoon. It is considered unlikely that these would occur in any significant density further than c. 100 - 200 m from the lagoon.

A search of the AHIMS was conducted on 29 September 2014 (AHIMS Reference: 149272) for a 400km^2 area encompassing the proposal site. Five Aboriginal object sites are listed for the search area, none of which occur in the proposal site.

Searches have also been conducted of the NSW State Heritage Inventory and the Australian Heritage database. No Aboriginal heritage sites for the area are listed in either database.

During the cultural heritage and archaeological survey, six low density stone artefact locales were recorded in the vicinity of the proposal site (refer to Figure 5-1). Four trees with scars were also recorded, none of which were considered to be of Aboriginal origin.

5.3.2 Potential impacts

Construction

An impact assessment of Aboriginal object locales in the vicinity proposal site is shown in Table 5-6. Figure 5-1 illustrates the proposal site in relation to the identified Aboriginal object locales.

Table 5-6 Aboriginal object locales within the proposal area

Aboriginal object site	Significance	Type of harm	Degree of harm	Consequence of harm
Jemalong Locale 1	Low local scientific significance.	nil	nil	nil
Jemalong Locale 2	Low/moderate local scientific significance.	Direct	Partial Installation of transmission line	Partial loss of value
Jemalong Locale 3	Low local scientific significance.	Direct	Partial Installation of transmission line	Partial loss of value
Jemalong Locale 4	Low local scientific significance.	nil	nil	nil
Jemalong Locale 5	Low local scientific significance.	nil	nil	nil
Jemalong Locale 6	Low local scientific significance.	nil	nil	nil

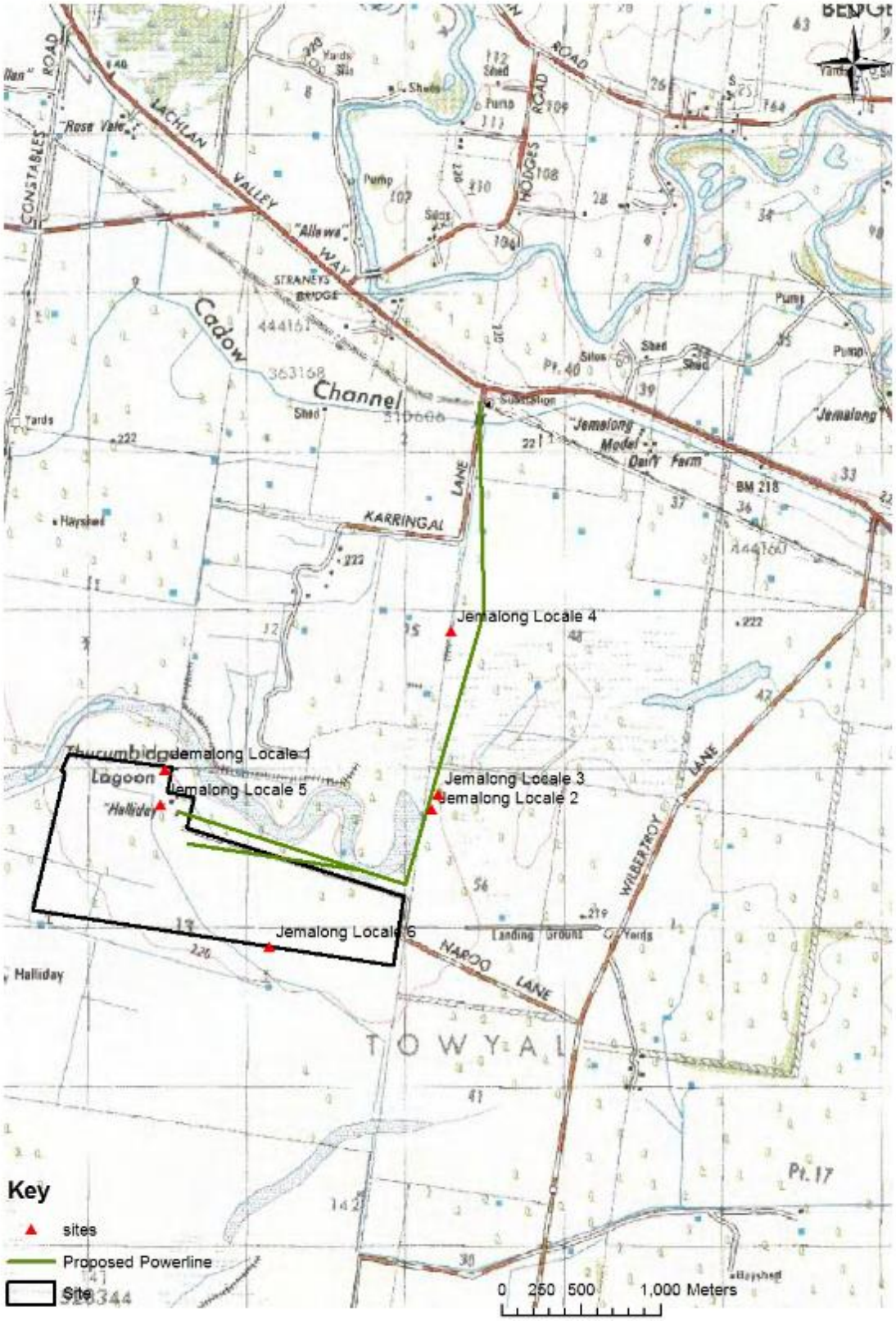

Figure 5-1 Location of Aboriginal object locales recorded during the field assessment (Source: NSW Archaeology 2014)

No Aboriginal objects or survey units with potential conservation value have been identified to have a high probability of being present and impacted by the works. No direct impact is expected within Locales 1, 4, 5 and 6. These areas are not likely to be impacted as a result of the works. There is potential for Locale 2 and Locale 3 to be directly impacted through the construction of the power line (refer Figure 5-2). Generally, these locales have been found to be of low archaeological sensitivity and significance and impacts to them are not considered to warrant further archaeological investigation or the implementation of avoidance or mitigation strategies.

Areas situated in close proximity (with 100-200 m) to Thurumbidgee Lagoon have been assessed to be of greater archaeological potential and significance and it has been recommended that impacts be largely avoided in this area. This is of most relevance to the powerline construction. The ACHA Report recommends selection of the southern route option for the powerline which would run east/west from the solar plant to the north/south powerline alignment to lessen impacts to areas close to the lagoon as well as the erection of the powerline south of the paddock (Lot 13 DP753118) boundary if feasible. Where avoidance cannot occur, salvage excavation works would be required prior to construction commencing to minimise impacts.

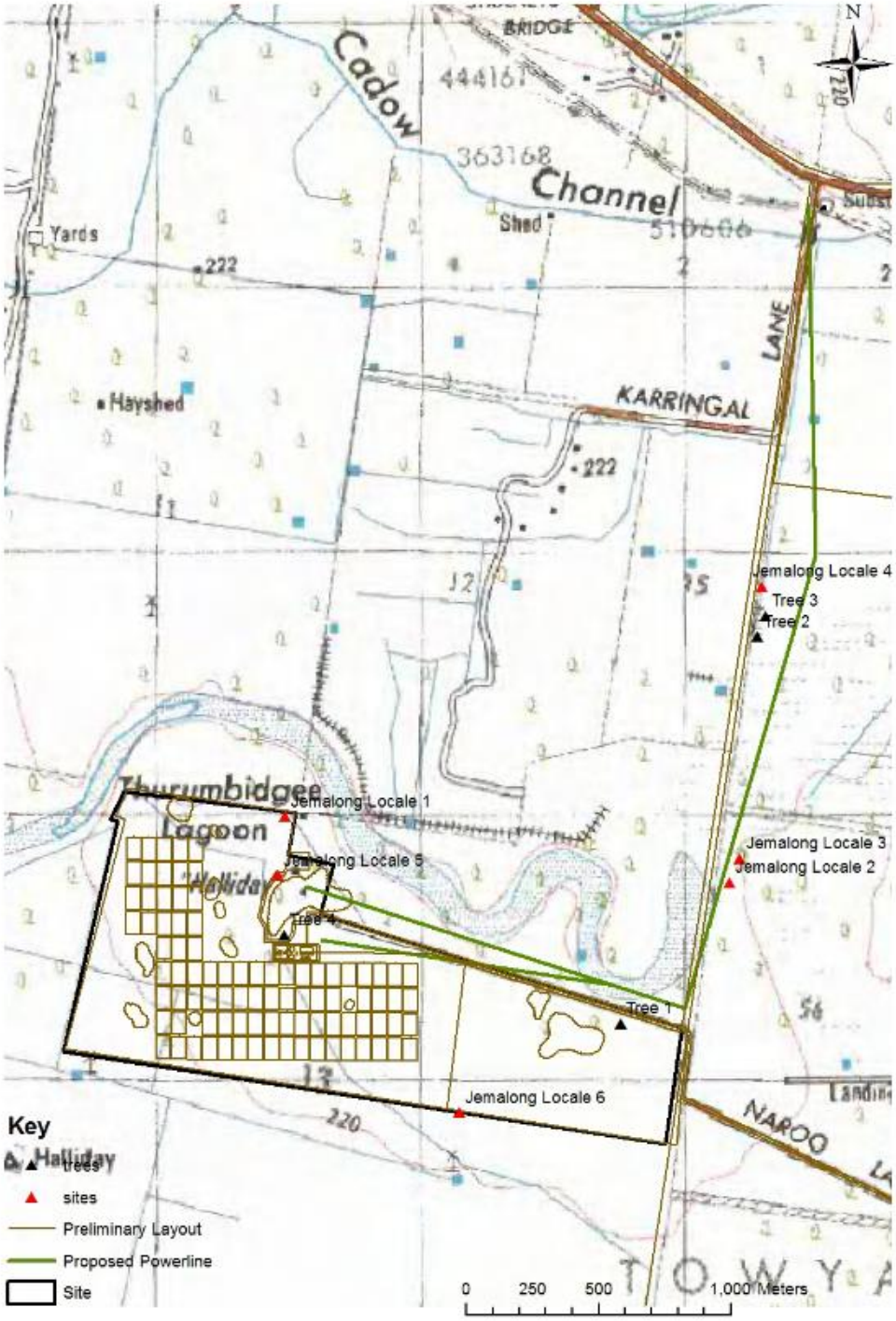

Figure 5-2 Location of Aboriginal objects in respect of proposed preliminary layout

5.3.3 Safeguards and mitigation measures

The ACHA Report proposes the following management and mitigation strategies. Most are relevant to the pre-construction design phase of the project and focus on avoidance of impacts.

Table 5-7 Safeguards and mitigation measures for Aboriginal heritage

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
A Cultural Heritage Management Plan would be prepared to guide the process for management and mitigation of impacts to Aboriginal cultural heritage. This would be undertaken in consultation with a consulting archaeologist, the registered Aboriginal parties and the NSW Office of Environment and Heritage. The specific mitigation measures would include: • Development of a strategy of conservation with regard to any impacts (if any) within 100-200 m of the Thurumbidgee Lagoon. • Salvage excavation works with regard to any impacts within 100 m of Jemalong Locale 2.	Pre-construction		
Personnel involved in the construction and management phases of the project would be trained in awareness and procedures to implement recommendations relating to cultural heritage, as necessary.	X		
Cultural heritage would be included within any environmental audit of impacts proposed to be undertaken during the construction phase of the development.	X		
Additional archaeological assessment would be required in any areas which are proposed for impacts that have not been surveyed during the current assessment.	X		

5.4 HEALTH AND SAFETY

This section addresses the use, storage and transportation of chemicals and hazardous materials associated with the proposed the proposed solar plant. It is also covers potential hazards and risks associated with electric and magnetic fields (EMFs). Aircraft safety is addressed in Section 3.

5.4.1 Background

Chemical and hazardous materials

Vast Solar has, over the course of its prior CSP demonstration projects, developed extensive chemical management, emergency management and risk management knowledge and processes. It has undertaken a range of technical safety studies addressing the risks associated with hazardous materials. Of particular note are the following studies undertaken in support of the 6MWth and 30MW plant designs:

- Hazard Identification Study (HAZID) – aiming to qualitatively assess the risk of identified hazards on the personnel, the surrounding environment, and the proponent's business.
- Hazard and Operability Study (HAZOP) – a detailed safety review of the plant design focussing on potential deviation from design intent or operational procedure.
- Preliminary Hazard Analysis (PHA) – undertaken by Mat Collin and Howard Lister of Scott Lister specifically to support this EIS with a key objective of assessing the suitability of the proposed facility according to the guidance provided in the DPE's Hazardous Industry Planning Advisory Paper No.6 *Hazard Analysis*.

These studies have collectively provided recommendations on how to reduce hazards within the design and operation of the project. The Preliminary Hazard Analysis is at Appendix C and the results of the study are discussed in the following sections.

Table 5-8 outlines chemical and hazardous materials identified to be stored and used for the proposed the proposed solar plant. These are discussed in further detail below.

Table 5-8 Chemical and hazardous materials proposed to be stored / contained onsite

Chemical/hazardous material	Approximate quantities to be onsite*	Use onsite	Storage onsite
Sodium	506, 000 kg	Heat transfer fluid within thermal pipe network between receiver towers and heat exchanger.	Within the pipe network and in tanks within the bunded central power island.
Molten salt	2, 723, 038 kg	Thermal energy storage medium	Contained in large tanks ('cold' ~ 240C and 'hot' ~550C) within the power island
LPG	20 KL	Auxiliary heating and plant start-up	Tanks adjacent to the power island
Thermal oil	3 t	Thermal pre-heat for storage tanks (to avoid solidification of molten salt or sodium in storage tanks	Reservoir within the power island
Fuels and lubricants	Minimal	Running and maintenance of machinery and vehicles.	Within bunded central power island.
Argon	To be confirmed	Inert gas blanketing of process equipment containing liquid sodium	Primarily in process equipment only, with limited stored quantities for miscellaneous operational purposes such as laboratory use, process make-up etc.

*These quantities are estimations pending the completion of the detailed project design.

Sodium and thermal oil

Sodium (Na) is the 5th most abundant element on earth and has the 3rd highest thermal conductivity of any element behind only gold and copper. Sodium has a wide liquid temperature range and excellent thermal conductivity which makes is a superior heat transfer fluid.

Most existing CSP projects internationally currently use oil, as opposed to sodium or molten salt, as their heat transfer fluid. The oil is generally a synthetic fluid such as benzene. This can be unstable and inoperable at high temperatures (in excess of 380 ˚C). Molten salt is used as an alternative in some CSP projects but its limited operating range (240 ˚C - 600 ˚C) present significant challenges in control systems and for maintenance.

Sodium is preferable due to its low melting point, and stability at high temperatures.

Sodium is a hazardous material primarily because of its extreme reactivity when it comes in contact with water, oxygen and certain other substances. Under the Australian Dangerous Goods Code it is classified as Division 4.3 – Substances which in contact with water emit flammable gases. Sodium melts at 97.8ºC boils at 884 ºC and will flow easily in a liquid phase, with a viscosity similar to water.

Sodium is not encountered in the pure metallic state in nature. It is used in applications that require unusual heat transfer and electrical conductivity properties including as a heat transfer medium in the nuclear energy industry.

For JSS1, liquid sodium would be present as a heat transfer medium throughout the heliostat arrays and in heat exchanger equipment and storage buffer tanks on the power island. Limited quantities of sodium is also expected to be stored on site in packaged form.

Sodium poses a risk to humans and the environment that may come in contact with it due to the potential for explosion, plus heat exposure and burns that could cause injury or mortality. Strict handling and emergency response protocols are required. All alternative media candidates for heat transfer has benefits and drawbacks, and in the case of sodium the principal drawback is high reactivity to water. Design and engineering measures form the primary level of risk mitigation, with operational risk mitigation measures then applied for additional precaution.

A small amount of thermal oil would be used for the proposal. It is required to pre-heat storage tanks to avoid solidification of molten salt or sodium within the tanks.

Molten salt

Molten Salt is commonly used for large scale thermal energy storage. The molten salt to be used for the proposal would be made up of type of salt e.g. Sodium Nitrate ($NaNO_3$) and Potassium Nitrate (KNO_3). The molten salt would be used at temperatures between 240 ˚C and 550 ˚C. The liquid is nontoxic and non-flammable.

The high temperature of the molten salt poses a risk to humans and the environment that may come in contact with it. Heat exposure and burns could cause injury or mortality at these temperatures, requiring strict handling and emergency response protocols. The heat can also adversely affect soil biota and vegetation, should it come into contact with them.

There is minimal risk associated with the molten salt spreading in the circumstance of it being spilt or leaking. Upon contact with cooler air or water it immediately solidifies, sealing any further leakage. In contact with air, it can produce a white smoke. The smoke is nontoxic.

LPG

Liquefied petroleum gas (LPG) is a mixture of hydrocarbon gases commonly used as fuel in heating appliances, cooking equipment and vehicles. It will be used on site as an auxiliary heating source. It will be stored in tanks adjacent to the power island. Transportation and handling would be undertaken by qualified suppliers. LPG is highly flammable.

Fuels and lubricants

Fuels and lubricants would be used for a range of uses on site including running and maintenance of vehicles and machinery. They would be stored in the bunded central power island. Fuels and lubricants pose a risk to humans if they come in contact with them such as irritation of skin and eyes. In the environment fuels and lubricants can change soil properties and pollute waterways harming aquatic flora and fauna. Correct storage and handling are required to mitigate these risks.

Electromagnetic fields

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 thunder storms 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.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO undated). 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 plant 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 2011) 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 extremely low frequency electric or magnetic fields. ARPANSA refers to the limits in the National Health and Medical Research Council's (NHMRC) *Interim guidelines on limits of exposure to 50/60 Hertz electric and magnetic fields* (1989) (Table 5-7).

Table 5-9 Summary of the Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields

Exposure characteristics	Electric field strength (volts per metre - V/m)	Magnetic flux density (microteslas - µT)
Occupational		
Whole working day	10,000	500
Short term	30,000	5,000
General public		
Up to 24 hours/day	5,000	100
Few hours/day	10,000	1,000

The proposal includes four main types of infrastructure that could create EMFs:

1. Solar array modules.
2. Underground cables.
3. Overhead 66V transmission line.
4. Transformer station and switchgear area.

Typical and maximum EMF levels for these types infrastructure are discussed below. Strength attenuates with distance from the infrastructure, as seen below.

There is currently no research on electric and magnetic fields at CSP. Research into photovoltaic solar arrays in California[2] by Chang and Jennings (1994), indicated that magnetic fields (the EMF type of greatest public concern) was 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. This would be the case for the proposed solar plant.

The underground cabling is expected to be low voltage. 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.

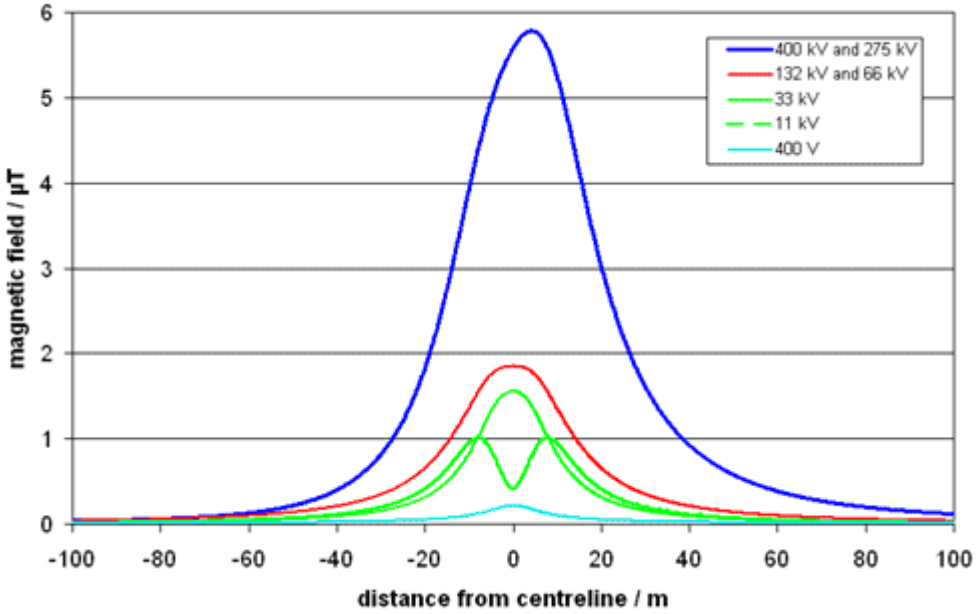

Figure 5-3 Typical magnetic fields from overhead powerlines (EMFS info, 2015)

[2] Converted from mG where 1 mG = 0.1 µT.

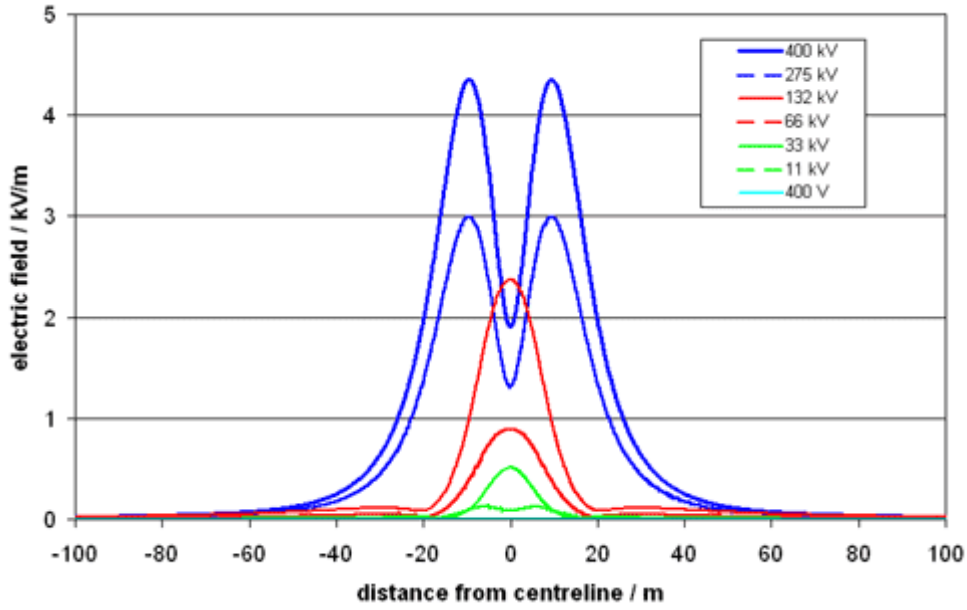

Figure 5-4 Typical electric fields from overhead powerlines (EMFS info, 2015)

ARPANSA (2015) provides the following typical levels of magnetic fields near transmission lines and substations.

Table 5-10 Typical magnetic fields from overhead powerlines

Source	Location of measurement	Range of measurement	
		(mG)	(μT)3
Transmission line	Directly underneath	10 - 200	1 - 20
Transmission line	At edge of easement	2 - 50	0.2 - 5
Substation	At substation fence	1 - 8	0.1 – 0.8

5.4.2 Potential impacts

Construction and decommissioning

A significant quantity of sodium would present at the site and is above the threshold required for designation as a Major Hazards Facility (MHF). Key hazards associated with the loss of containment of sodium include:

- Sodium fire/explosion.
- Hydrogen explosion.

A sodium fire or explosion can have significant consequences, including fatalities. Whilst it is well known that small quantities of sodium can result in small explosions, the consequences of incidents involving large quantities of sodium are less well understood. Sodium fires also generate large volumes of non-toxic, but caustic, smoke. A review of literature indicates that large scale incidents involving sodium are extremely rare but can be expected to be very localised (contained well within the site boundary for this

facility). Sodium is used around the world, particularly in the nuclear industry and risks can be reduced to an acceptable level with appropriate safeguards.

The Preliminary Hazard Analysis included a review of available literature with respect to incidents involving sodium. Several reports on incidents involving sodium fires and explosions were reviewed, including the sodium leak and fire at Vast Solar's 6MW pilot plant in 2015. All of the incidents had fire and explosion consequences contained within a limited area of approximately 20 m from the initial sodium fire or explosion. No incidents were identified of major industrial accidents involving sodium where the consequences went beyond a localised effect (approximately 20m).

During construction and decommissioning sodium and molten salt would require transportation and installation at the proposal site. Fuels and lubricants would be required during construction and decommission for the operation of machinery. Soda-ash would be stored on site for use in the event of a sodium leak to extinguish and contain combustion. LPG would be delivered by road tanker to gas storage tanks in a manner similar to re-stocking of automotive service stations. Key risks from these materials are fires and explosions, as described in more detail in Appendix C, Preliminary Hazard Analysis. Fuels and lubricants would all be contained in sealed vessels, minimising risks of contamination of surrounding areas. Some residual risk may remain of pollutants becoming mobilised during rainfall events, these are unlikely to affect the lagoon due to its location upstream of the power island but could impact local drainage lines. Due to molten salt melting properties, it is unlikely to spread from the spillage location.

Similar impacts are associated with the transportation of sodium, molten salt and fuels and lubricants along the transport route to the site. All materials concerned have existing classifications under the Australian Dangerous Goods Code (Commonwealth of Australia, 2014) and would be transported by licensed contractors in accordance with Dangerous Goods regulations.

There is low potential for EMF impacts during the construction and decommissioning phases of the project. Site staff would be exposed over intermittent periods during works at and around the existing and proposed 66kV transmission lines. The maximum magnetic field of the existing transmission lines are well under the 100 µT and 500 µT limits respectively recommended for public and occupational exposure. Given the voltage workers would be exposed to and the intermittent nature of exposure, the effects are likely to be negligible.

With the exception of the transmission line, the construction site would be fenced to protect the public from construction health and safety risks.

Operation

During operation the use of sodium, molten salt, fuels and lubricants would have similar impacts to those discussed for construction and decommissioning. Sodium and molten salt would be used at high temperatures, the former, within insulated pipes and the thermal receivers, the latter within the storage tanks within the power island. Extensive engineering design precautions and safety systems result in low potential for leaks. Fuels and lubricants would be used for operation and maintenance of vehicles and equipment.

The impact of risk from hazardous materials was analysed in detail in the Hazards Analysis study (refer Appendix C, Preliminary Hazard Analysis). It was concluded that offsite risks are extremely low and the applicable risk criteria are easily satisfied.

During operation, EMF sources would include a 66kV transmission line, switchgear, and the solar array incorporating underground cabling.

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 site fencing around the plant and existing 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 plant 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.

The power island would also be fenced. While there are number of EMF sources within the power island, design procedures relating to equipment selection, layout, electrical connection techniques and compound size would ensure the EMFs produced by the equipment within the station would also be typically indistinguishable from background levels beyond the fence. The power island design would be similar to other designs used throughout Australia that have had EMF measurements taken to ensure levels within the compound are within recommended occupational exposure limits for staff.

The largest potential for public exposure would be associated with the 66kV transmission line alignment, which crosses agricultural land and adjacent to Whisperings Pine Lane. Public exposure would be fleeting and intermittent when accessing those areas.

Staff exposure to EMFs from the proposed transmission line would be intermittent during site access and maintenance activities.

Using the Principle of Prudent Avoidance to design and site this 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.

5.4.3 Safeguards and mitigation measures

Health and safety impacts are proposed to be addressed via the following mitigation measures.

Table 5-11 Safeguards and mitigation measures for health, hazard and risk

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
All design and engineering would be undertaken by qualified, competent persons with the support of specialists as required.	X		
The findings from the PHA, HAZOP and HAZID studies are to be integrated into the remaining detailed engineering, design and procedures.	X	X	X
Procedures specific to the transportation, use and storage of chemicals and hazardous materials to be developed. This would include: • Storage of hazardous chemicals in a bunded area onsite and in accordance with the manufacturers requirements. • Only trained staff to use chemicals, in accordance with the manufacturers requirements.	X	X	X

Safeguards and mitigation measures	C	O	D
• Development of emergency response protocols, including: o in the event of widespread flooding, o to promptly identify and respond to pollution events, including EPA notification where required.			
The power island and transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure to EMFs.	X		
Design of electrical infrastructure would minimise EMFs.	X		
Fencing around the power island would be maintained to limit public access.	X	X	X
The 30MW plant will be subjected to HAZOP and have detailed HAZID undertaken. The following measures are to be implemented: • Emergency Response Plan to recognise possibility of vapour cloud explosion (from LPG) in congested or confined areas. • Procedures for working around low oxygen environments. • Safety Management System to include safe storage and handling procedures for sodium.		X	
Emergency response plans should include specific details of preparations necessary to secure sodium in event of an impending flood.	X	X	X
Procedures for the management of sodium fires will be developed, including: • The site Safety Management System will address pre-incident planning for sodium fires. • Fire & Rescue NSW (Forbes Unit and Hazardous Materials Response Unit) to provide input into site Safety Management System. • Fire & Rescue NSW may consider upgrading their Local and Regional Emergency Management Plans to incorporate JSS1 (which would be Critical Infrastructure).	X	X	X

5.5 HYDROLOGY (INCLUDING FLOODING)

5.5.1 Approach

A Flood Impact Assessment for the proposal was prepared by Southeast Engineering and Environmental. It is appended in full (Appendix C) and summarised below.

The report investigated the following issues in relation to the development, as required by the SEARs:

- An assessment of any proposed modification to surface water management including modelling of redistribution of waters.
- An assessment of the impact on neighbouring properties and the associated watercourse and floodplain including a review of the proposed levees in accordance with the requirements of the Lachlan River Jemalong Gap to Condobolin Floodplain Management Plan 2012 (FMP).
- An assessment of potential flooding impacts in accordance with the principles, processes and guidelines as outlined in the NSW Government Floodplain Development Manual, 2005.

In assessing the potential impacts from the development, the following studies were reviewed:

- Guidelines for Floodplain Development; Lachlan River Jemalong Gap to Condobolin (WRC, 1978).
- Lachlan River, Jemalong Gap to Condobolin, Floodplain Risk Management Study (FRMS, DECC, 2009b).
- Lachlan River, Jemalong Gap to Condobolin, Floodplain Management Plan (OEH. 2012).

No modelling or assessment of events outside of those provided in the Floodplain Risk Management Study (DECC, 2009b) and the FMP was undertaken. It was considered that an assessment of the available modelled events was sufficient to garner an understanding of the flood impacts associated with the development at the site.

5.5.2 Background

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 vast area of the floodplain for prolonged periods (DECCW, 2009). The Jemalong Gap, is a significant hydraulic control with almost all floodwaters passing through this point. Downstream of the Jemalong Gap, large flows in the Lachlan River spill onto the northern and southern floodplains. Generally, the Lachlan River can be expected to convey approximately 15 per cent of flood flows with the remainder split between the north and southern systems.

The proposal site is located in the southern system of the Lachlan River (Figure 5-5) and is immediately downstream of the Jemalong Gap in an area considered to be a particularly sensitive to hydraulic modifications. The FMP categorises the floodplain into four hydraulically independent floodway network zones, each with different potentials for generating adverse hydraulic impacts. The site is located outside but adjacent to the boundary between Flood Network Zone A and Flood Network Zone B. Zone A is considered to be of very high significance (where very small flood level changes could produce significant flood flow redistribution between the southern and northern major flow paths) and Zone B is considered to be of high significance (areas where the flow redistribution and flood level increases have already been created and no further hydraulic impacts should be allowed).

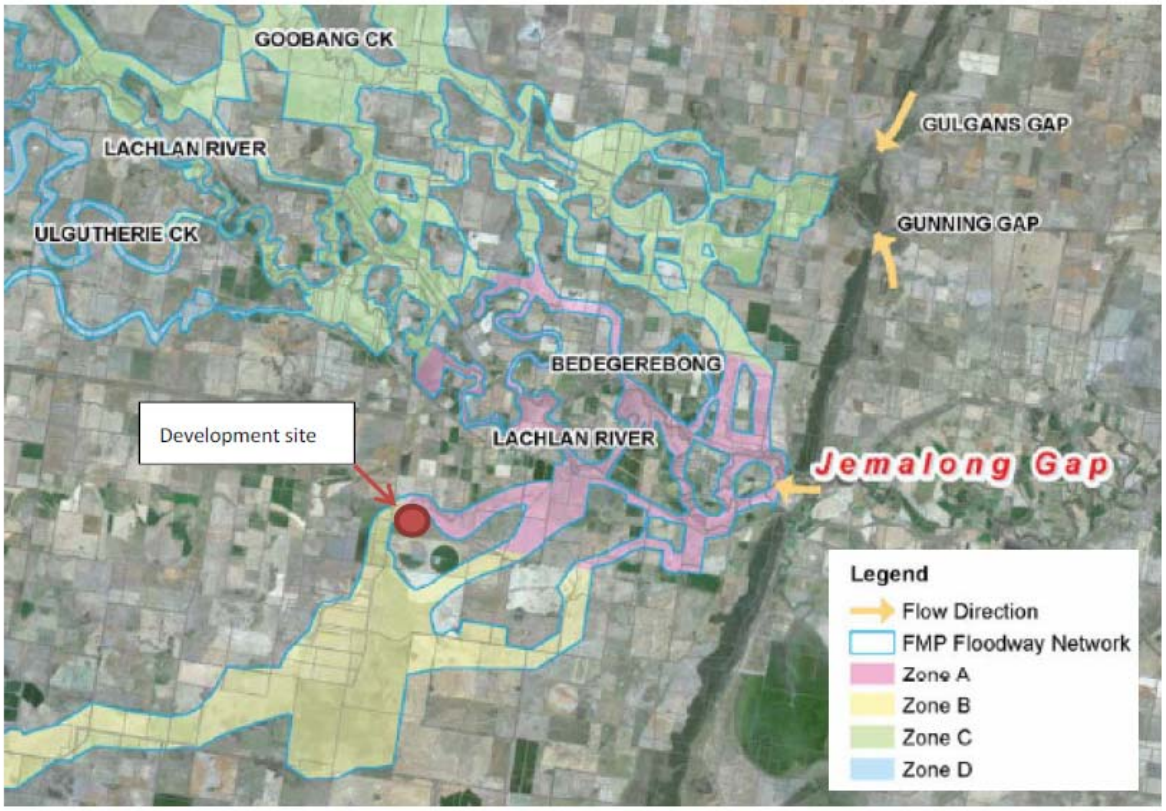

Figure 5-5 Flood network and zones for management

Floodplain management in the area has been influenced by modelling significant flood events which occurred in 1952, 1974 and 1990. The adopted design flood for the FMP is the 1990 historical event and is identified as the 25 year ARI event. An existing levee (which generally follows the 1978 Guideline levee locations) is present in the location shown by the purple line in Figure 5-6. Figure 5-6 also shows the approved levee locations in the 2012 FMP.

Figure 5-6 Development extents and 1978 Guideline Levees (purple) and FMP approved levee (red)

5.5.3 Floodplain planning controls

Works that are managed through the *Water Act 1912* are known as 'controlled works', which are generally earthworks, embankments or levees or other works that are likely to affect the flow of water that are also declared to be a 'controlled work'. Controlled works within the floodplain are either considered complying, or non-complying works under the *Water Act 1912*. The definition of 'complying' generally refers to where NOW is satisfied that the work complies with the floodplain management plan for the area in which the work is situated or proposed to be constructed. The key consideration for the proposal is whether the possible 'impact on overall flood behaviour could be significant and therefore far-reaching.'

As set out above, the floodway network has been divided into four zones based on the hydraulic impact of works within the floodway (non-complying works). The proposal site is located adjacent to zone A and zone B however no works within these areas are proposed.

5.5.4 Potential impacts

Construction

Activities occurring during the construction of the proposal would be confined to the development footprint shown in Figure 5-6. There would also be some additional works to upgrade Naroo Lane and Wilbertroy Lane. Construction works associated with the proposed development would be located within the designated floodplain area but outside the floodway and beyond the existing levee location (refer Figure 5-6). The proposal would therefore not result in modifications within the floodway or modifications to existing levees.

It is noted that while the proposal site is located outside of the floodway network, events greater than 4 per cent Annual Exceedance Probability (AEP) would overflow onto the floodplain. Potential sedimentation impacts may result if this event was to take place during construction period. Whilst unlikely to occur (it is equivalent to a 25 year Average Recurrence Interval event), the potential risk should be acknowledged and managed by the implementation of appropriate erosion and sediment control measures. If a heavy rainfall event was predicted, the site should be stabilised and work ceased until the wet period had passed. This measure is included in Section 6.9: Soils.

Operation

During operation, there would be no impacts to the floodway, levee banks or floodplain unless an event greater than 4 per cent AEP occurs, resulting in overflow onto the floodplain. Under these conditions, the solar plant infrastructure may impact on flood flows by potentially altering flow behaviour as well as flood levels and distribution over the broader landscape. This is mostly as a result of changes in surface roughness that would occur as a result of the development (changes from managed pasture landscape to a large area of steel poles).

The FMP states that:

> "*Development outside of the limits of the FMP floodway network would not generally cause a significant redistribution of design flood flows or a significant increase in flood levels*".

However, it is noted that in some cases impacts could be significant.

To determine whether the proposal would result in significant changes, hydraulic modelling (a HECR RAS model) was used to assess whether the works are considered complying in relation to the current FMP. The HEC RAS model was adapted from the existing MIKE11 model from the 2009 Flood Study. The maximum increase in flood level was estimated to be 3 cm. This is not considered sufficient to create a 'significant change in flood level' to the overall flood extents. Impacts resulting from the bund around the proposed power island, were not modelled but are also considered non-significant due to the small size of the bund area in relation to the heliostat fields.

To appropriately manage flood risk and protect infrastructure against flooding impacts, it is recommended to raise infrastructure above a selected flood level or flood proof infrastructure below the 0.5 per cent AEP flood level. This is estimated to be between 0.9 m and 1.1 m above ground level. The current proposal design is consistent with this recommendation; the heliostats would be 0.5 m above the ground surface during normal operations, but could be orientated to a horizontal position during a flood event which would exceed 0.9 m above ground level.

This risk of sodium coming into contact with water will be mitigated by rigorous design of a closed sodium system and the adoption of design and operating protocols as described in Section 5.4 and consistent with the requirements imposed by the project's classification as a Major Hazard Facility.

5.5.5 Safeguards and mitigation measures

The following management and mitigation strategy is recommended to manage flooding impacts associated with the development.

Table 5-12 Safeguards and mitigation measures for hydrology (including flooding)

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Minimise risk of flooding impacts by either raising infrastructure above a selected flood level or flood proof infrastructure below the 0.5 per cent AEP flood level.	Design / Pre-construction		
The thermal piping network will be protected by appropriate 'armouring' to prevent potential of flood debris impacting infrastructure.	Design / Pre-construction		

5.6 GLARE AND GLINT

5.6.1 Background

Concerns have been raised about the potential glint and glare hazards produced by very large scale CSP projects, based on overseas experience, particularly in the USA. Two potential sources for glint and glare exist for the proposal:

- Reflections from the heliostat (mirror) surface.
- Reflected radiation from the receiver on top of the tower.

Glare and glint impacts of operational infrastructure were assessed in a specialist report prepared by Nick Bartos, BEng (Mech), appended Appendix C. The assessment is summarised in this section.

5.6.2 Approach

Only a small amount of empirical data relating to glint and glare is available for the current heliostat and receiver arrangement. As a result, conservative assumptions have been made based on values for similar systems found in the literature. These assumptions are justified in the full assessment, Appendix C. Key aspects of the methodology and assumptions are provided below.

- Under normal operating conditions, it is expected that the majority of heliostats would point toward the receiver and therefore not produce glint or glare hazard to other observers. However, sunny periods during the middle of the day present the greatest risk of glint and glare due to the high incident solar flux. The assessment considered the case when heliostats are operational and directed at the towers, as well as when they may be in a standby state and directed toward another point.
- Damage to the eye is determined by the intensity of the radiation hitting the retina. Both the flux intensity at the retina and the angle of the source are important due the focusing action of the eye lens. Thresholds for temporary damage to the eye, or flash blindness were modelled with respect to the proposal. Longer heliostat focal lengths pose the greatest eye risk due to the narrow beam angles they produce. The modelling used the largest expected focal length of 125 m as a 'worst-case scenario'.

- It is important to define the viewing location relative to the glare source in order to assess the potential impacts. Three points of interest were evaluated by the assessment. These locations represent two nearby roads, Lachlan Valley Way (3.2 km from the site boundary) and the Newell Highway (16 km from the site boundary), and the closest residence on Willawang Road (3 km from the site boundary). These locations are all situated at ground level.
- To present a worst case scenario, the modelling provides no consideration for obstructions or atmospheric attenuation of the glare.
- Due to the shielding of glare from the ground level heliostats by the surrounding vegetation, the primary concern for glint and glare is due to the receiver on top of the towers rather than the heliostats.

5.6.3 Potential impacts

Operation

Potential impacts of operational infrastructure may result for nearby residents, motor vehicles and aircraft flying over or near to the site. The assessment quantified the risk of impact in three categories at an observation distance of 4 km:

- Low potential for an after image[4]
  - Single heliostat
  - Single receivers
  - Multiple receivers.
- Potential for an after image
  - Multiple heliostats
  - Direct sun.
- Potential for permanent eye damage (retinal burn; irradiation levels above 0.118 W / cm^2)
  - None in this category.

These results are explained below.

Nearby residents, motor vehicles

Single heliostat

A single heliostat may produce glare to a ground level observer if it is offline or during a tracking procedure. The glare may pass through a gap in surrounding vegetation or obstructions in order to reach the observer. The glare has low potential to produce an after-image in the eye. The minimum distance at which the model predicts low potential for glare from a single heliostat is approximately 0.9 km.

Multiple heliostats

An observer may receive glare from a cluster of heliostats. This would primarily occur for a group of heliostats that are in a standby state and all focused to a similar point. A cluster of up to 300 heliostats, or almost half a field, needs to be directly observed at 4 km in order to produce a similar level of hazard as looking at an unshielded sun.

[4] After image refers to an image continuing to appear in one's vision after exposure to the original image has ceased.

Single receiver

The glare produced by a single receiver when the plant is running at full capacity results in a retinal intensity of 0.007W/cm^2. This produces low potential for an after image. No consideration has been given for the viewing angle and therefore this result over estimates the glare risk.

Multiple receivers

The glare from multiple receivers may be observed from a distant location. It is conceivable that approximately 90 receivers are viewed at one time forming a glare source. The retinal irradiance remains the same as a single receiver at 0.007W/cm^2 which produces low potential for an after image.

Flight paths and pilots

The solar array modules could potentially cause glare to pilots in aircraft. Both domestic and international commercial flights cruise at an elevation typically greater than 4 km. The Forbes aerodrome (YFBS) is the closest public airfield at an approximate distance of 26 km, east-north-east of the site. The flight pattern around the aerodrome requires that aircraft approach with a minimum altitude of 0.915 km at distances between 14.8 and 27.8 km from the aerodrome. The runway at the aerodrome runs in an approximately east-west direction with the approach from the west.

It would be possible for pilots approaching the Forbes Aerodrome from the West to observe all approximately 90 fields of heliostats. Since the approach is north of the site, there is no possibility to observe the south facing receiver surfaces. The highest potential for glint and glare occurs if all heliostats in all fields are placed into the standby position. Modelling suggests that at the distances described above, it is possible for only one heliostat from each field to reflect the sun into the eye of an observer at any one time. Therefore, the results presented in this section relate to approximately 90 heliostats forming a combined source of glare. The expected retinal irradiance for an aircraft pilot at 4 km is 7.21W/cm^2 which results in potential for an after image. This is considered a worst-case scenario.

Conclusion

The diffuse glare due from approximately 90 towers provides no significant eye hazards to the nearby points of interest considered. If viewed as a group, multiple heliostats could potentially produce a temporary after-image however the tracking algorithms and physical obstructions make this scenario unlikely to occur for any observers at ground level.

It is possible for a collection of heliostats to produce a hazard resulting in an after-image at a distance of 4 km. The scenarios modelled represent the condition where all heliostats are in the standby position and produce a combined source of glare. During normal operation, especially in times of high solar energy, it is expected that the heliostats would very rarely all be in this state. It is more probable that a few fields of heliostats may be in standby for maintenance. This reduces the risk to that of a single heliostat. In all cases modelled, even with the conservative assumptions applied, the predicted potential for the after-image is no stronger than looking directly at the sun.

5.6.4 Safeguards and mitigation measures

The glare and glint investigation suggests that no mitigation is likely to be required however the following three measures would be included to confirm assumptions and provide additional certainty regarding management of this impact.

Table 5-13 Safeguards and mitigation measures for glare and glint

C: Construction; O: Operation; D: Decommissioning

Mitigation strategies	C	O	D
The results of the glare and glint modelling would be validated once the pilot plant is completed, to confirm several assumptions made by the assessment.	Pre-construction		
A Community Consultation Plan would be developed to manage impacts to community stakeholders, including but not limited to: Protocols to respond to any complaints received.	X	X	X
Should clusters of stand-by state heliostats be identified by complaints as producing unacceptable glare, staggering the location of the standby target would be investigated.		X	

5.7 VISUAL IMPACT

A visual impact assessment was undertaken and prepared by Fresh Landscape Designs. The full assessment is provided in Appendix D. The purpose of the visual impact assessment was to identify the nature and degree of visual change that would be introduced into the landscape by the proposal, assess whether it is an adverse or beneficial change, evaluate its significance and recommend mitigation measures where appropriate.

Glare was assessed in the visual impact assessment but is discussed separately in Section 5.6.

5.7.1 Approach

The visual assessment consists of two components, a baseline study and a visual impact assessment. The baseline study is an inventory of the existing visual character and the ways views of the proposal may be experienced. The visual impact assessment describes the changes in visual character and visual amenity that are expected to result from the development. Specifically, the elements of each component include:

- Baseline study:
  - Definition of study area
  - Desk study including collection and review of existing literature, tourism information, maps and aerial photos, review of the description of the proposed development, identification of approximate visibility of the development based on the topography and identification of potential viewing opportunities for residents, workers, visitors and travellers
  - Field survey to validate the actual extent of visibility, identify key and representative viewpoints and construct a comprehensive photographic record
  - Visual baseline analysis including the classification of landscape character units and values for particular areas.
- Impact assessment:
  - Identification of the views likely to be affected by the proposal
  - Identification of susceptibility of viewers to change at those locations based on general principles and the results of community consultation

- Identification of visual effects introduced by the development for key and representative viewpoints
- Assessment of options for mitigation of adverse visual effects
- Evaluation of the level of visual impact and its significance after mitigation.

Public consultation (the results of feedback forms described in Section 3 of this EIS) and photomontages (prepared to illustrate visual effects for viewpoints most likely to be impacted) were referenced in the preparation of the visual impact assessment. Maps and photomontages used in the visual impact assessment are provided in Appendix C of this EIS.

5.7.2 Results

The study area for the visual impact assessment was limited to within 16 km of the proposal site. The distance limit is based on the extent of the background distance zone (WAPC 2007) in relation to the proposal site.

The study area was divided into six landscape character units (LCUs) (similar in terms of landform, vegetation patterns, water form, land use patterns and aesthetic qualities) and their scenic quality was assessed. These are described below.

Table 5-14 Landscape character units

LCU	Visual amenity and quality
LCU1: Farmland	Considered attractive as a working rural landscape with wide, open spaces covered with pasture or crops and areas of natives. It contains some buildings of heritage interest. Views from individual houses likely to be highly valued by the occupants.
LCU2: Lachlan Valley Way corridor	Moderately attractive travel route through a typical rural working landscape.
LCU3: Lachlan River corridor	Highly valued locally as a relatively natural area used for recreation. It is an area mentioned in tourism literature and is a landmark and backdrop for surrounding areas. It is likely to have significance for traditional owners.
LCU4: Bedgerabong settlement	Likely to be valued locally as familiar rural-style landscape without distinctive scenic features. Contains areas of heritage interests. View from individual houses likely to be highly valued by the occupants.
LCU5: Jemalong Ridge	Valued locally as dramatic landform and relatively natural area. Identified as a key landscape feature for the Forbes area.
LCU6: Wilbertroy State Forest	Valued at state level for ecological values.

Viewing opportunities of the proposal development are outlined in Table 5-13.

Table 5-15 Viewing opportunities of the proposal

Location and types of viewers	Nature of views to proposal
Newell Highway – many travellers on transport route.	Fleeting views looking NNW from short section of highway approximately 16 km from the proposed solar plant and transmission line.
Lachlan Valley Way – moderate number of travellers on transport route	Short duration views looking south (perpendicular to direction of travel), closest points are approximately 3.1 km from the proposed solar plant and 150m from transmission line.
Lachlan River – moderate number of tourists and local people	Long duration views for campers, fishers and other people engaged in social and recreational activities looking south, closest points are approximately 3.3 km from the proposed solar plant and 3.3 km from transmission line.
Bedgerabong – small number of residents in and around houses and visitors travelling through locality, moderate numbers attending events	Views looking south to the proposed solar plant (closest residence 4.9 km) and transmission line (closest residence 2.1 km). Long duration views from private houses and small farms, medium duration views from community facilities, short duration views from North Condobolin Road.
Warroo – small number of residents in and around houses, small number of visitors to heritage sites	Medium to long duration views looking south east from several private houses, small farms and heritage buildings to the proposed solar plant and transmission line (approximately 8.8 km).
Jemalong Weir Picnic Area – moderate number of people engaged in recreation activities	Medium duration views looking west from public recreation area approximately 10.7km from transmission line and 12.2 km from the proposed solar plant.
Jemalong Polo Club – small number of people engaged in sport and recreation	Short to medium duration views from private facility (on involved property) looking west to transmission line (approximately 900 m) and south west to the proposed solar plant(approximately 3.7 km).
Jemalong Ridge – few if any people walking or working	Elevated views of unknown duration looking west to the proposed solar plant and transmission line (approximately 10 km). No public access or residences were identified in this study.
Wilbertroy State Forest – few if any people	Views of short duration looking north. Closest point of the proposed solar plant is approximately 3.5 km.
Local roads – small number of residents and workers on transport routes	Views of short duration. Local roads closest to the proposed solar plant/transmission line are Whispering Pines Lane, Driftway Road, Constables Road, Willawang Road, Murphys Road, Hodges Road, Waree Lane, Dowra Lane and North Condobolin Road.
Rural residences – small number of residents	Medium to long duration views by residents in and around houses. Closest houses are in Whispering Pines Lane.
Paddocks – small number of workers	Short duration views from paddocks and other farm facilities.

5.7.3 Potential impacts

Impacts on important views

From the results of the community consultation, there appears to be little concern in the local community about the visual impacts of the proposal. One concern was expressed regarding the location of the proposed transmission line in close proximity to one of the residences. The design for the transmission line was subsequently changed to a route further away from that residence.

The landscape character of the productive agricultural landscape with some native vegetation was identified as what is valued by the community. The solar plant infrastructure would be unique infrastructure within this landscape.

Areas identified as tourist attractions to the area were the Lachlan River, Jemalong Weir and events in Bedgerabong. The assessment determined that the proposal (solar plant infrastructure and transmission line) is not expected to be visible from these areas.

Cumulative impact

Cumulative visual impacts are assessed by reviewing the visual integrity and form of other built structures within the visual catchment of the proposed solar plant and transmission lines. Structures with similar scale and dominance are identified as having a level of visual impact that together with the proposal would have a cumulative visual effect.

The transmission line has the greatest potential for cumulative impact since there are other transmission lines in the vicinity including one running along a similar route. The proposed transmission line is relatively short in length and follows a route where it is unlikely to be noticed by the public. The cumulative effects are minor and not significant.

The proposed solar plant infrastructure is an unusual structure in the landscape, has novelty value and is relatively discrete thanks to screening by existing vegetation throughout the landscape. Cumulative impacts at this stage do not appear to be relevant.

Significance of visual impacts

Many elements of the proposal would not be seen except by visitors to the site and workers in paddocks near the proposal site. This is due to the flat terrain of the study area and because of the relatively low height of heliostats and receiving towers and the screening vegetation surrounding the proposal site. The main visual effects have been identified from the receiving towers and transmission line.

Twenty-six viewpoints were assessed separately, 22 viewpoints were considered to have low impact significance. The other four viewpoints included two viewpoints identified as significant visual impact and two identified as significant impact due to potential glare impacts from the proposed heliostats. Predicted impacts to all viewpoints are summarised in Table 5-14 and illustrated in Figure 5-7. Mitigation measures have been recommended for the four viewpoints identified to be significantly impacted. Only the two viewpoints identified as a significant visual impact are discussed in this section: V12 House 1 – Whispering Pines and V13 House – Whispering Pines Lane. The photomontages prepared (Figures 5-8 and 5-9; Appendix C) illustrate the existing conditions and expected views of infrastructure from these locations.

Table 5-16 Summary of significance of visual impacts

Viewpoint	Visual impact significance	Comments
V1 Lachlan Valley Way 1	Not Significant	Development barely visible if seen at all due to distance to the proposed development.
V2 Murphys Road	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V3 Warroo Road	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V4 Willawang Road 1	Not Significant	Top few metres of the thermal receivers may be visible above the tops of the trees. Generally not seen by highly susceptible viewers. Potential glare from individual heliostats has potential to occur on occasions refer to Section 5.6 for mitigation measures.
V5 Willawang Road 2	Not Significant	Development unlikely to be seen due to screening effects of vegetation and existing present infrastructure (sheds).
V6 Willawang Road 3	Not Significant	Top few metres of the thermal receivers may be visible above the tops of the trees. Glare may be visible from receivers seen above trees during daylight hours until the galvanised surface dulls (approximately one year). Refer to Section 5.6 for mitigation measures.
V7 Driftway 1	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V8 House - Driftway	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V9 Lachlan Valley Way 2	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V10 Hodges Road	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V11 House – Lachlan Valley Way	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V12 House 1 –Whispering Pines Lane	Significant	The proposed transmission line and top of receiving towers would be visible across the breadth of the view but are relatively small in height. Landowner is unconcerned. Mitigation measures are proposed.

Viewpoint	Visual impact significance	Comments
V13 House 2 –Whispering Pines Lane	Significant	The proposed transmission line will contrast with existing elements and be viewed for extended lengths of time from house and garden. Visual effects of the proposed solar plant would not be significant because of the small proportion of view occupied by development. Mitigation measures are proposed.
V14 North Condobolin Road West	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V15 Substation	Not Significant	Additional transmission line would be similar to existing visual character. Top of receiving towers would be visible above the top of trees but unlikely effect due to distance.
V16 Jemalong Polo Club	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V17 Bedgerabong West	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V18 Noakes Road	Not significant	Development unlikely to be seen due to screening effects of vegetation.
V19 Bedgerabong East	Not significant	Development unlikely to be seen due to screening effects of vegetation.
V20 Waree Lane	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V21 Dowra Lane North	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V22 Dowra Lane South	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V23 Specks Lane	Not Significant	Development unlikely to be seen due to screening effects of vegetation.
V24 North Condobolin Road East	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V25 Jemalong Weir	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.
V26 Newell Highway	Not Significant	Development unlikely to be seen due to distance to the proposed development and screening effects of vegetation.

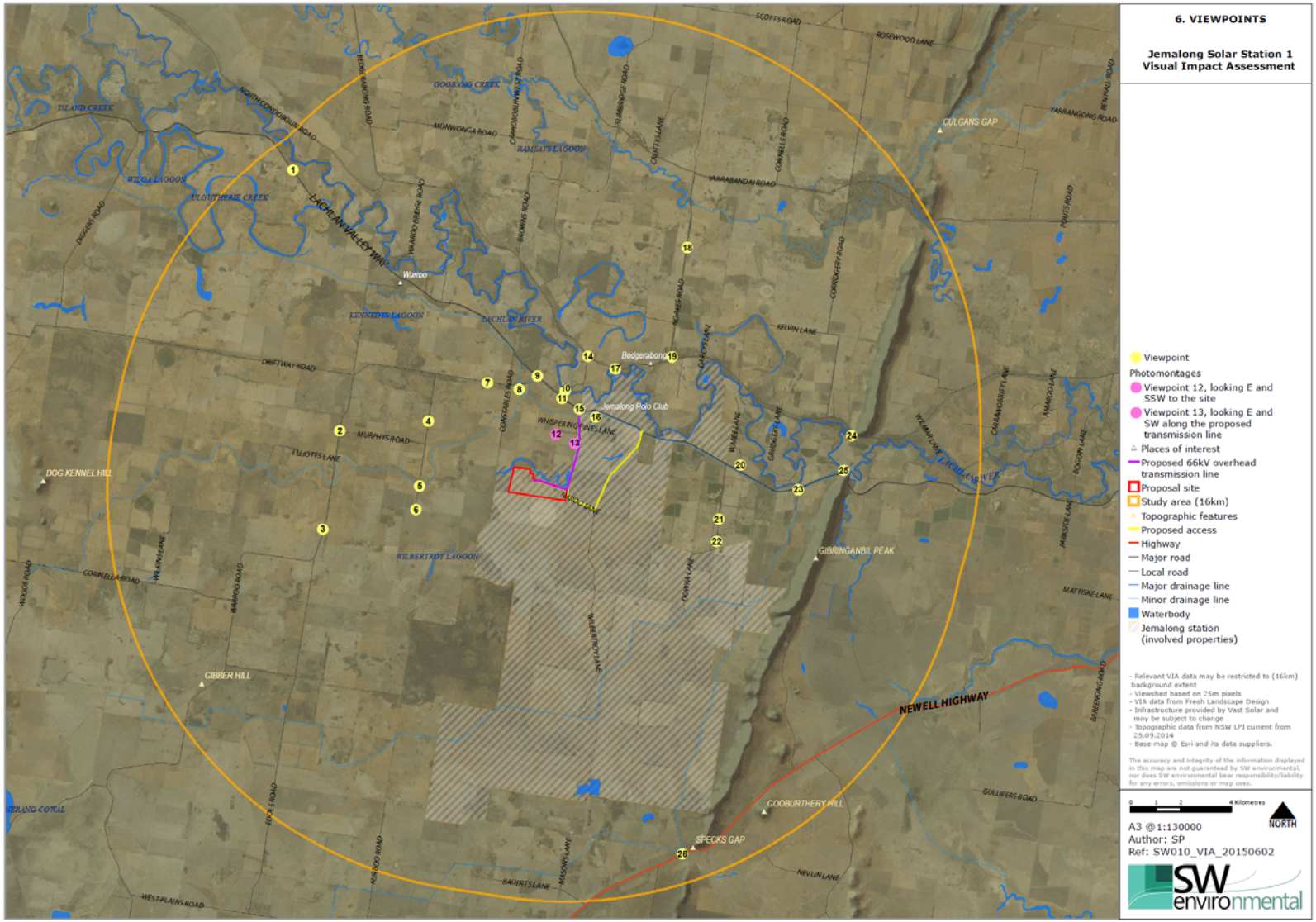

Figure 5-7 Viewpoints and observation points (A3 maps provided in full report, see appendix)

Figure 5-8 Photomontage V12 House 1 – Whispering Pines Lane (A3 maps provided in full report, see appendix)

Figure 5-9 Photomontage V13 House 2 – Whispering Pines Lane (A3 maps provided in full report, see appendix)

5.7.4 Safeguards and mitigation measures

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, the 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 outlined below are implemented.

Table 5-9 Safeguards and mitigation measures for visual impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Stagger the focal direction of heliostats in standby mode (not to target) to minimise potential for glare from a cluster of heliostats, if such glare is identified through complaints.		X	
Consult with neighbouring properties to west, north and east of the proposed solar plant in relation to potential glare from heliostats when not on target and adjust the focal direction of heliostats in standby mode, if such glare is identified through complaints.		X	
Additional screen planting in targeted boundary areas of the proposal site if heliostat glare experienced on neighbouring properties cannot be mitigated by adjusting focal direction of heliostats.		X	
Install shade material on security fence in targeted locations if heliostat glare experienced on neighbouring properties cannot be mitigated by adjusting focal direction of heliostats.		X	
Screen planting south of house area at V12 House 1 – Whispering Pines Lane to screen views to receiving towers.	X		
Locate new transmission line poles to minimise impacts of views from House 2 in Whispering Pines Lane.	X		
Select colours for above ground structures, including the construction site offices, sympathetic to the landscape character of the site.	X		

6. ASSESSMENT OF ADDITIONAL ISSUES

6.1 NOISE IMPACTS

6.1.1 Policy setting

Construction noise

The NSW *Interim Construction Noise Guideline* (DECC, 2009) deals with managing construction noise impacts. According to the guideline, a quantitative assessment of noise impacts is warranted when works are likely to impact an individual or sensitive land use for more than three weeks in total.

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers. For works undertaken during standard working hours, residences are considered noise affected when construction noise is 10 dB above the rating background level (RBL) and 'highly noise affected' when construction noise is above 75dB (A). For works undertaken outside standard working hours residences are considered noise affected when construction noise is 5 dB (A) above the RBL.

Operational noise

The *NSW Industrial Noise Policy* (INP) (EPA, 2000) specifies noise criteria to protect the community from excessive intrusive noise. According to this policy, noise levels within a rural residential area from industrial noise sources should not normally exceed the acceptable levels specified below.

Table 6-1 NSW Industrial Noise Policy amenity goals

Receiver type	Indicative noise amenity area	Time of day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

6.1.2 Background

Existing environment

In terms of existing noise levels, land uses surrounding the proposed work areas are generally limited to sheep and cattle grazing land on improved irrigated pastures and irrigated horticulture. Noise generating equipment would include large harvesters (often operating during harvest late into the night), large grain haulage trucks (double or triple bogey), irrigation systems including pumps as well as tractors, quad bikes and 4WD vehicles. These land uses are frequent but intermittent and would create limited background noise within the area. Noise levels are likely to be concentrated at particular times, determined by farm activities, rather than continuous.

Residential properties are sparsely distributed in the locality (Figure 6-1). Properties in the locality are known to utilise generators and on demand pump pressurised domestic water systems, generating low levels of background noise. The nearest non-involved (in the proposal) residential dwelling is approximately 1.7km from the solar plant boundary (construction activity 1) and 350 m from the transmission line and road works (construction activity 2).

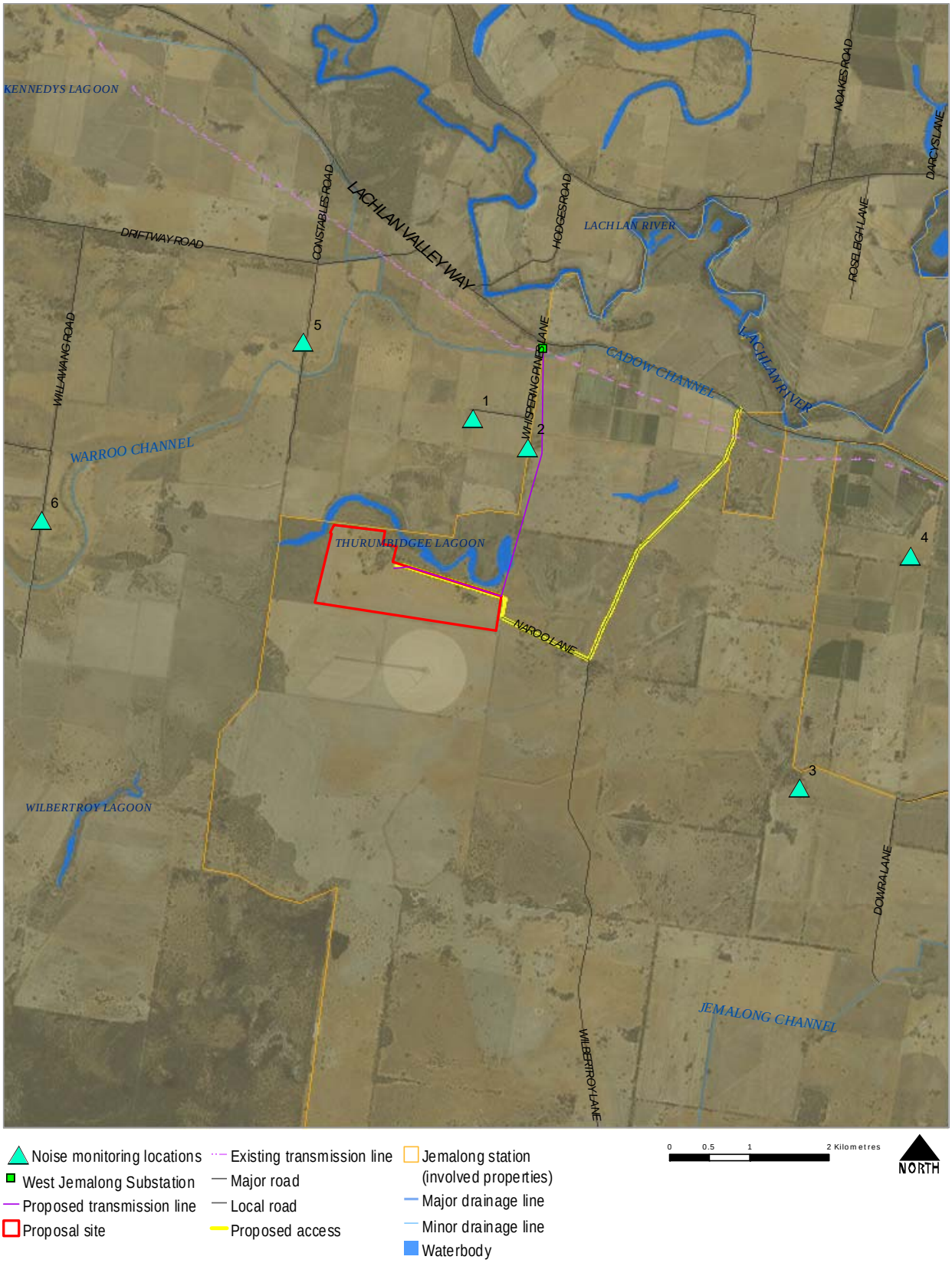

Figure 6-1 Residential receivers and noise monitoring locations adjacent to the proposal site

6.1.3 Noise monitoring

Noise monitoring locations

Background noise monitoring was carried out at six residential locations (Figure 6-1) within the study area on 8 October 2014. All noise measurement instrumentation used in the surveys was designed to comply with the requirements of AS 1259.2-1990 "Acoustics - Sound Level Meters. Part 2: Integrating - Averaging" and carried appropriate and current calibration certificates. The equipment utilised for the noise surveys comprised of a SoundPro SE DL Noise Monitor, fitted with a microphone wind shield.

The noise monitoring results were used to characterise the existing noise environment at the sensitive receivers and to establish the noise management levels for the proposal. The monitoring locations were selected based on discussions with Vast Solar and a detailed inspection of the residential locations potentially affected by the proposal. The aim was to select a representative number of closest non-involved receivers surrounding the proposal site.

Background noise monitoring results

The recorded background noise levels (RBL) at each of the six receivers ranged between 36.8 and 50.9 dBA (L_{A90} (15min)). Based upon the background noise levels at each receiver, the noise management level (NML) for day timeworks were identified as being between 46.8 and 60.9 dBA (Table 6-2). Noise management levels have been calculated using Table 2 of the NSW *Interim Construction Noise Guideline* (DECC, 2009a).

Table 6-2 Results of background noise monitoring and noise management levels

Receiver	Distance (km) from closest proposal boundary Solar Plant and construction (Approximate)	Distance (km) from closest proposed transmission line and road works (Approximate)	RBL/LA90 (15 min)	Daytime NML (dBA) (+10 dBA) (LAeq 15 min)
1	1.70	0.90	50.9	60.9
2	1.90	0.35	45.5	55.5
3	4.30	4.30	41.8	51.8
4	5.20	4.80	36.8	46.8
5	2.45	3.00	45.9	55.9
6	3.60	6.20	45.4	55.4

6.1.4 Construction noise impact assessment

Noise impact predictions on each sensitive receiver were conducted. The predictions has taken into account the typical noise levels of construction equipment likely to be used for the construction phase (Table 6-2).

Two construction activities were assessed. Using the sound power levels in Table 6-3, construction noise levels have been predicted at the nearest receivers for the construction of the solar plant (construction activity 1) and for the construction of the transmission line and road works (construction activity 2).

Table 6-3 Construction equipment sound power levels

Equipment used	Sound power level (dBA) LAeq (Data sourced from the RMS construction noise estimator)
Scenario 1 – Solar plant	
Fixed Crane	113
Front End Loader	113
Grader	110
Vibratory Roller	109
Concrete Truck	109
Delivery Truck	108
Water Cart	107
Concrete Pump	105
Backhoe	111
Power Generator	103
Concrete Vibrator	103
Light vehicles (eg 4WD)	103
Scenario 2 – transmission line and road works	
Front End Loader	113
Grader	110
Vibratory Roller	109
Delivery Truck	108
Water Cart	107
Light vehicles (eg 4WD)	103

The noise predictions at the nearest receivers were calculated based on noise attenuation with distance from source. They do not take into account any obstacles between the source nor weather conditions which can influence the level of noise perceived. Furthermore, noise has been predicted based on all construction plant working concurrently (worst case scenario).

The predicted noise levels from the proposed works at the nearest sensitive receiver, with all construction plant working concurrently for scenario 1, would vary between 38 and 47 dBA. Based on the noise attenuation modelling, the construction activities are unlikely to exceed the NML for standard work hours at all receivers for scenario 1 (Construction of solar plant) (Table 6-4).

Table 6-4 Predicted noise levels at each receiver, scenario 1 (Construction of solar plant)

Receiver	Distance (km) from project boundary (Approximate)	LA90 (15 min)	Predicted Construction Noise Level (dBA) Worst case scenario with all plant working simultaneously	Daytime NML (dBA) (+10 dBA) (LAeq 15 min)
1	1.70	50.9	47 dBA	60.9
2	1.90	45.5	46 dBA	55.5
3	4.30	41.8	39 dBA	51.8
4	5.20	36.8	38 dBA	46.8
5	2.45	45.9	44 dBA	55.9
6	3.60	45.4	41 dBA	55.4

Based on the noise attenuation modelling the construction activities are unlikely to exceed the NML for standard work hours at most receivers for scenario 2 (Construction of transmission line and road). The proposed work would likely exceed the NML for receiver 2 located approximately 0.35 km west of the proposed route (Table 6-5).

Table 6-5 Predicted noise levels at each receiver, scenario 2 (Construction of transmission line and road)

Receiver	Distance (km) from proposed road and transmission line (Approximate)	LA90 (15 min)	Predicted Construction Noise Level (dBA) Worst case scenario with all plant working simultaneously	Daytime NML (dBA) (+10 dBA) (LAeq 15 min)
1	0.90	50.9	51 dBA	60.9
2	0.35	45.5	58 dBA	55.5
3	4.30	41.8	37 dBA	51.8
4	4.80	36.8	36 dBA	46.8
5	3.00	45.9	40 dBA	55.9
6	6.20	45.4	34 dBA	55.4

Works would be undertaken in a rural environment where there is a low level of background noise. Construction activities that are likely to result in noise generation include earthmoving equipment and truck deliveries. The works are likely to generate a small amount of short-term local noise pollution from the operation of machinery and plant, and the unloading of trucks with construction materials. The works would be undertaken during normal working hours and are not likely to cause undue concern to sensitive noise receivers due to distance from construction activities. Only sensitive receiver 2 has been assessed as being potentially impacted during the construction of the transmission line and road works. Furthermore, feasible noise management measures are proposed to further mitigate noise impacts.

6.1.5 Operation noise assessment

Background noise monitoring

Background noise data collected to assess construction noise were also used to assess operational noise. Refer to Section 6.1.3 for background noise monitoring results.

Operational noise impacts

During operation, sources of noise from the solar plant would be from the electrical substation[5], on-site transformers and occasional maintenance activities.

Sources of noise from the transmission line would include aeolian and corona discharge:

- Aeolian noise is the sound produced by wind when it encounters an obstacle, such as building and wires, causing a humming or other constant sound (Encyclopaedia Britannica, 2015).
- Corona is the breakdown of air into charged particles caused by the electrical field at the surface conductors. The weather and voltage of the line causes variation in corona noise, most often occurring during heavy rainfall and high humidity. Corona noise has two major components, a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing' and is generally only a feature during foggy or raining conditions.

SOLAR PLANT

Power island noise

The power island would be located in the middle of the site at the northern boundary, with power generated in the solar plant transformed in the power island to grid voltage via a 66 kV transformer.

Australian Standard AS 60076 Part 10 2009 *"Power Transformers – Determination of Sound Levels"* specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the proposed power island is not yet available, a conservative assumption is provided below based on a 250 MVA plant, with the installation meeting the requirements of AS 60076. AS 60076 indicates that a transformer of this capacity may produce sound power levels up to 100 dBA. The predicted noise level at the closest property 1.7 km north of the proposed power island) is 27 dBA, which is well below ambient background noise levels.

Given that a conservatively large power rating has been assumed, and that all noise sensitive receivers are generally greater than 1.7 km from the solar plant, noise impacts from the power island is are expected to be negligible.

Noise from maintenance works

During operations, two to five staff would be required on site to operate and maintain the solar plant. Road noise from maintenance vehicle access would be infrequent with up to five vehicles accessing the site per day (up to 10 vehicle movements).

[5] The West Jemalong Substation is existing and therefore not part of this noise assessment.

Noise from the maintenance works would mostly be due to infrequent maintenance works conducted inside the prefabricated steel maintenance building located in the southwest corner of the site. As such, noise from any maintenance works would be intermittent and occur during the day period only. Given the large distance from the site to the surrounding receivers, noise from most scheduled maintenance works would be well below the NSW INP criteria.

To provide an indicative assessment example of a worst case maintenance activity, noise from a concrete saw (with a sound power level of 117 dBA) would result in a level of 44 dBA at the nearest residential receptor, which is below the corresponding background noise level.

Transmission line

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. In the context of the 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 nearest sensitive receiver (1.7 km), 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 30m along the ground from the line a L_{eq} noise level of approximately 44 dBA was measured. At a distance of 100 m the corona noise was calculated to be approximately 39 dBA. Assuming a minimum night time RBL value of 30 dBA, the minimum intrusive criteria as determined by the NSW INP would be 35 dBA. SLR therefore conservatively estimates that the minimum criteria level of 35 dBA would be complied with at a distance of 240 m. The proposed transmission route is further than this distance from receiver 2 (350 m) and hence any occasional corona noise would comply with the NSW INP minimum limit at all residential receivers.

6.1.6 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.

No operational ground vibration sources from the proposal have been identified that are likely to generate ground vibration impacts at the nearest residential dwellings (350 m). Potential vibration impacts are therefore not assessed any further.

6.1.7 Safeguards and mitigation measures

Noise impacts are proposed to be addressed via the following mitigation measures.

Table 6-6 Safeguards and mitigation measures for noise impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Works should be undertaken during standard working hours only. • Monday – Friday 7am to 6pm • Saturday 8am to 1pm No work on Sundays or public holidays	X		
All staff onsite should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	X	X	
A letter box drop would be prepared and provided to residences within 2km of the site. The letter would contain details of the proposal including timing and duration of construction and a contact details for a person for any enquiries or complaints. Plant would be operated in an effective manner to minimise noise such as by turning off plant which is not being used.	X	X	
Regular inspection and maintenance of equipment to ensure that plant is in good condition.	X	X	

6.2 CLIMATE AND AIR QUALITY

Air quality can be affected by dust caused by soil disturbance and emissions from vehicles and machinery. These impacts can be a nuisance to nearby receivers (residences, farm workers). At worst they can interfere with plant growth, degrade ecosystems, represent human health risks and contribute to greenhouse gas emissions and anthropogenic climate change.

6.2.1 Background

Local air quality

The proposal site is located within the South Western Slopes Bioregion. The South Western Slopes is dominated by a sub-humid climate with hot summers and no dry season (NSW National Parks and Wildlife Service, 2003). The closest Bureau of Meteorology Automatic Weather Station (AWS) to the site is Forbes Airport, approximately 26 km north east. The average annual minimum temperature is 9.6˚C and the maximum annual average temperature is 24.4 ˚C. The average annual rainfall is 500.7mm, with most rain falling in December, February and June (Weatherzone, 2015; Figure 6-2). Winds speeds are greatest during spring and summer. During these warmer months the strong winds (>40 km per hour) come from the north. In the coolers months the strong winds (>40 km per hour) originate from the south east (BOM, 2015b). The highest periods of air quality are during spring and summer where drier periods of high temperatures are associated with strong winds.

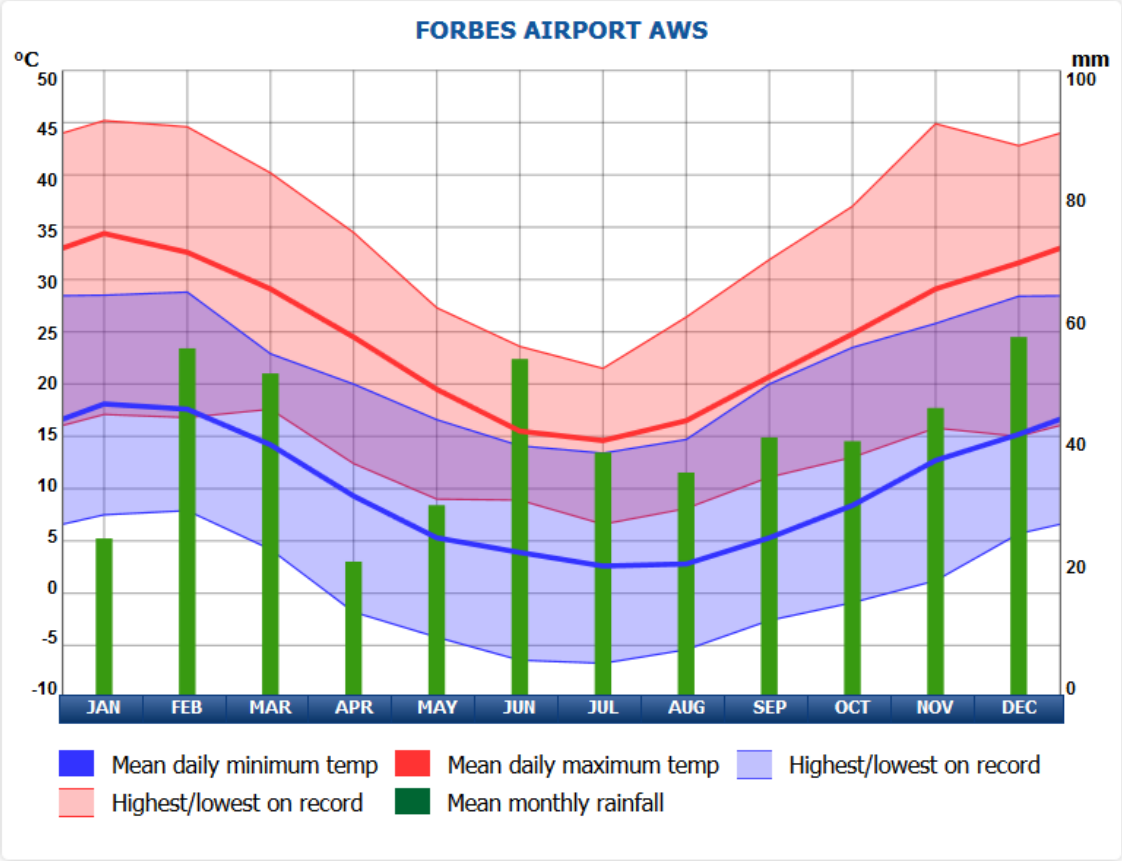

Figure 6-2 Forbes Airport AWS monthly climate statistics (Weatherzone, 2015)

The Forbes Shire Management Plan 2008-2009 State of the Environment Report (Forbes Shire Council, 2009) identifies that the Forbes area enjoys good air quality due to its rural setting in NSW. This is owing to the relatively low population and distance from industrial pollution sources. Local air quality can be affected by traffic fumes, dust during dry periods, agricultural practices and industrial activities. During colder months, there would be a minimal increase in air contaminants due to smoke from the operation of solid fuel heating.

Two major polluters occur in the local region, Forbes Depot and Kaloola Piggery, which are located 34km and 11 km from the proposal site, respectively. Emissions from the Forbes Depot is benzene, Toluene, cyclohexane, Xylenes and Volatile Organic Compounds. The Kaloola Piggery emissions are in regards to livestock include ammonium (DoE, 2015).

Settlement within proximity of the site is considered sparse (refer Section 6.4). The closest non-involved receiver is approximately 1.7 km to the west of the proposal site. Several other residences are located to the west and north west within 5 km of the proposal site. Topography of the proposal area is flat.

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/m2 are also specified.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases in the atmosphere. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall declines in southern Australia

and more extreme weather events including intense rainfall, severe drought and harsher fires (CSIRO, 2015).

It is now generally accepted that the release of certain gases including, most notably carbon dioxide, contribute to global climate change. These gases are collectively referred to as 'greenhouse gases'. Construction and maintenance activities where plant and equipment uses diesel, gasoline and other hydrocarbons, result in greenhouse gas emissions and are likely to contribute to climate change. The construction, operation and decommission of the proposed solar thermal project assessed in this EIS would produce minimal CO_2 emissions. This is compared to conventional coal and gas fired powered stations outlined in Table 6-7.

Table 6-7 Comparison of CO_2 equivalent emissions produced per kilowatt hour

Generation method	Emissions produced (grams CO2 equivalent per kWh)	Source
Solar CSP plant	**8.5-11.3**	**Wright and Hearps (2010)**
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema *et al*. (2006)

The operation of the proposal would help reduce greenhouse gas emissions and move towards cleaner electricity generation. Based on 84,000 MWh, the proposal would offset the equivalent of 99 kilotonnes per annum of CO_2 emissions for Brown Coal, 75 kilotonnes per annum of CO_2 emissions for Black Coal and power the equivalent of 14,000 NSW homes (emission calculation based on 2013 NTNDP emission intensity values averaged across the power stations).

6.2.2 Potential impacts

Construction and decommissioning

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along unsealed access roads during construction and decommissioning of the proposed solar plant. 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 where severe or prolonged.

Earthworks associated with construction would be relatively minor and concentrated in the area of the power island and evaporation ponds. The footprint of the central power island is approximately 0.12 ha. Pile footings are used and no ground preparation is required for heliostats. No extensive cut and fill earthworks are proposed.

The construction phase is expected to last 24 months with a peak period lasting approximately nine months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (bus) transport, (approximately 500 construction personnel during the peak period) and haulage traffic delivering construction components (detailed further in Section 6.5).

Dust and emissions would be expected to attenuate with for a very limited distance from the site. Given that the closest non-involved residential dwelling to the proposed the proposed solar plant is approximately 1.7 km from the proposal site, substantive air quality impacts are not anticipated. Furthermore, the proposed solar plant site is well screened to most receivers, by vegetation which

placing a barrier between the works and receivers, trapping dust and reducing potential for emissions to affect these receivers. The transmission line construction works would be closer to receivers but this stage of works would be much shorter in duration and works would move progressively such that there would not be any sustained close proximity works. These works also involved mainly piling equipment, involving minimal earth-moving.

Greenhouse gas emissions would be generated during construction and decommissioning. These emissions would contribute to climate change at a global level, but are offset many times over by the benefits of carbon reduction delivered from the electricity produced by the proposal over its operational life. Construction related emissions would not impact materially on the local climate.

Mitigation strategies include a formal community consultation and engagement system, and complaints mechanisms, whereby the sources of complaints are promptly identified and addressed, and appropriate application of a suite of dust and emission reduction measures.

The construction of the proposal is not anticipated to have a significant impact on air quality. Identified impacts are highly manageable.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase. Impacts during decommissioning would be less in extend, given the concrete foundations for the power island would be retained in place and traffic requirements would be similar in type but of shorter duration than that required for the construction phase.

Due to the existing activities surrounding the proposal site and the minimal impacts on air quality during construction and decommissions, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 6.11 0.

Operation

The generation of thermal energy during the operation of the proposal would generate negligible air quality impacts and emissions.

There is potential for smoke to be produced, should a leak occur in the heat transfer network. Sodium is to be used for heat transfer within insulated pipes between the receiving towers and central heat exchange. When sodium comes in contact with air, such as a leak within the pipe network, it produces a white smoke. The smoke is not toxic but would reduce air quality for a short period of time. Significant engineering design and fabrication effort is invested to eliminate or minimise risk of such emissions and maintenance of the pipe network would eliminate or reduce the occurrence of these incidents.

Maintenance activities during operation would result in some localised, intermittent vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads and tracks. The impacts on local and regional air quality are expected to be negligible during normal operation; two to five vehicles are expected to be required at the site during normal operation. During major maintenance operations, this number could increase to 20-30 vehicles at any one time for a limited period.

During operation, high temperature sodium would be flowing through a pipeline network between the receiving towers and the central heat exchanger. The pipes are heavily insulated to minimise thermal losses with the pipe network. The capture of thermal energy at the thermal receivers has potential to increase the air temperature at the site, particularly tops of towers, through the receivers. These are also designed to minimise thermal losses, as this adversely impacts the efficiency of the power generation. The resultant cumulative heat losses are not expected to increase the local temperature.

Limited amounts of fuels would be required for maintenance vehicles during operation of the solar plant and for temporary power generation in the event of an unplanned outage of the CSP system. 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 1.3.6).

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 6.11.

6.2.3 Safeguards and mitigation measures

Air quality impacts would be addressed via the following mitigation strategies.

Table 6-8 Safeguards and mitigation measures for climate and air quality impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Protocols to guide vehicle and construction equipment use, to minimise emissions. This would include but not limited to Australian standards and (POEO Act).	X	X	X
Protocols to minimise and treat dust (water carts or similar in response to visual cues).	X		X
Development of a complaints procedure to promptly identify and respond to issues generating complaints.	X	X	X
Development of emergency response protocols, to promptly identify and respond to pollution events, including EPA notification where required.	X	X	X

6.3 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

The nature of a development would determine whether a permanent land use change occurs as a result of the development proceeding or whether the development is reversible and existing or alternative land uses can occur in future. As well as direct uses of the land, such as agriculture, electricity generation or mining, other 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.

6.3.1 Background

Agriculture

The soil and water characteristics of the proposal site are key to the existing land use. The proposal site and surrounding area is currently used for agriculture, primarily irrigated agriculture, grazing and cropping.

Agriculture is a significant land use in the local area, with over 679, 000 ha of land dedicated to agriculture within the Forbes LGA and a gross value of over $50.2 million in 2011 (ABS, 2011; RDA Central West, 2012).

The proposed solar plant is located within Jemalong Station which is 15, 478 ha of agricultural land managed by Twynam Agricultural Group. Water entitlements within the locality are held by Jemalong Irrigation Ltd. This private corporation holds a Water Supply Work Approval and Water Use Approval licence under the *Water Management Act 2000.* The station is also occupied by a polo field, an airstrip, woolsheds and rural residences.

The proposal site is located within the Hallidays lot of Jemalong Station. Hallidays is a laser levelled paddock that has been used for cropping. The proposed 66Kv transmission line connecting the solar plant to the existing West Jemalong Substation would traverse other paddocks within Jemalong Station. It would avoid other private landholdings and Crown Land.

Mining

In Forbes LGA, metallic mineral deposits include gold, iron and lead. The nearest known deposits are gold approximately 31 km west and south west of the proposal site (Department of Trade and Investment, 2015). These gold deposits are also part of the nearest operating mine to the proposal site, Cowal.

There are no current exploration licence applications held for the proposal site. The current mineral titles and exploration licence applications held in the Forbes region are illustrated in Figure 6-3.

Other land uses

The proposal site and all land immediately surrounding it is zoned RU1 Primary Production, with the exception of the Lachlan Valley Way zoned SP2 Infrastructure (Classified Road). The proposal site is not located on land proposed for rural residential development in local planning instruments, nor is it on land managed for forestry or conservation purposes. The nearest land zoned for conservation or forestry is approximately 4 km to the south. Crown Land is located adjacent to the proposal site to the west and south-west. No works are proposed on any land managed by Crown Lands.

The proposal site has a number of characteristics that make it suitable for development of a solar plant, including:

- High potential for solar energy production.
- Consistent solar access, with few to no obstructions shading the site.
- Nearby access to the electrical grid infrastructure.
- Flat site topography and geotechnical conditions that allow for a low impact module mounting structure and layout.
- Relatively distant location from sensitive receivers (approximately 1.7 km), reducing potential for noise and visual amenity impacts during all project phases.
- Low biodiversity values generally, and the ability to retain higher value areas, by careful siting of infrastructure and management prescriptions.

Further, the proposal is largely reversible; at the end of the project all above ground infrastructure would be removed and current agricultural land use activities could resume or other land uses could be considered.

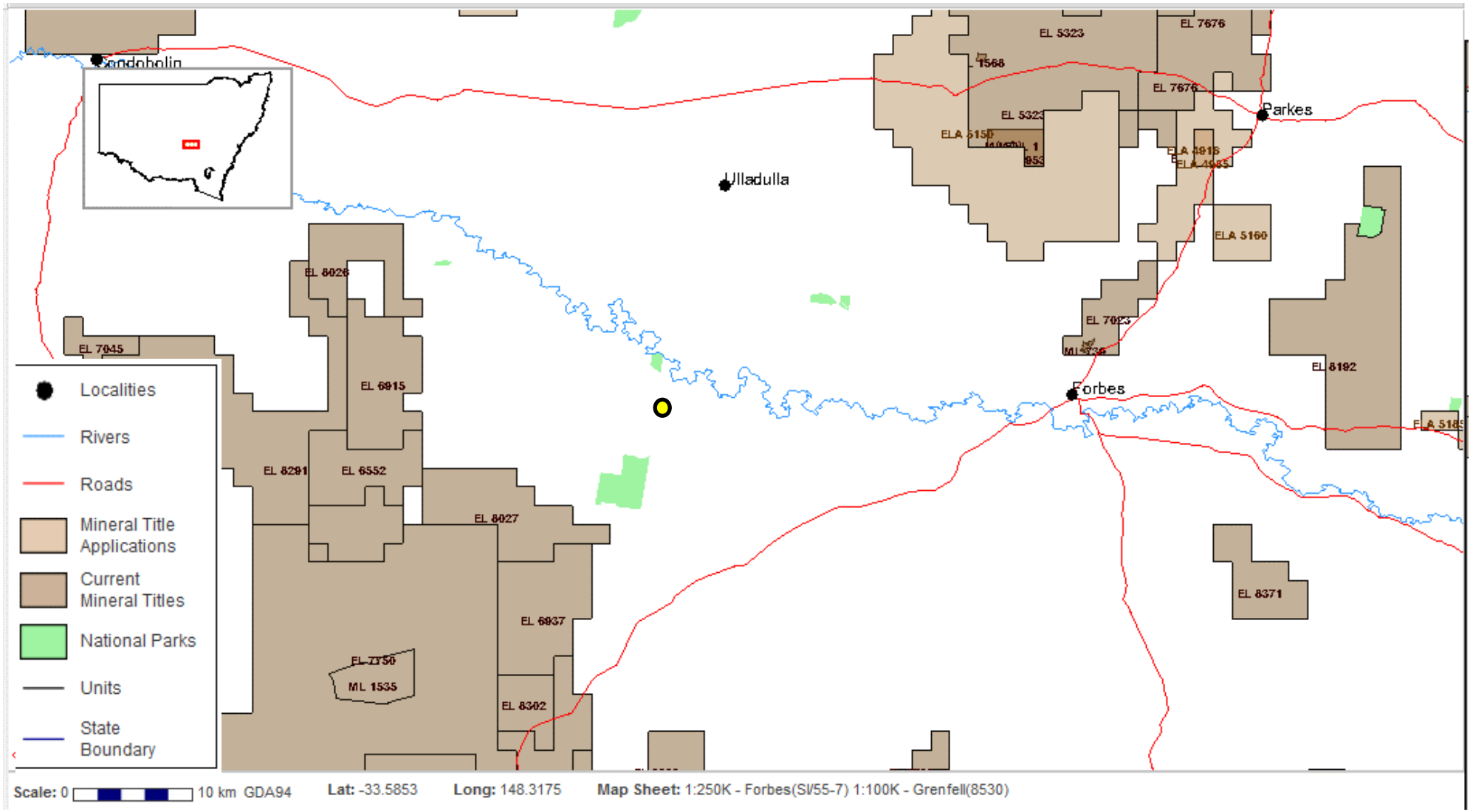

Figure 6-3 Mineral titles and applications within the locality of the proposal site (Department of Trade and Investment, 2015). *The proposal site is indicated by yellow circle*

6.3.2 Potential impacts

Construction

During construction, agricultural activities would cease in areas required for access and construction of the proposal. Fencing would allow grazing within close proximity to the works areas, however collision risks from increased vehicle numbers may affect grazing nearby.

Construction of the transmission line would result in temporary loss of access to land along the transmission line easement during the construction period. Construction impacts would be short term and limited in extent.

No extraction of minerals or extraction licences would be impacted by the construction of the proposal.

No land use conflicts are foreseen during construction. The impacts would be temporary and mitigation strategies can reduce the level of impact on nearby agricultural activities.

Operation

Current uses: Agriculture

During operation, the proposal site would change from agricultural land use to power generation. Managed grazing may be utilised to manage ground cover vegetation but this would not be considered an income generating agricultural activity. Trees and tall shrubs would be suppressed under the transmission line to assist maintenance of infrastructure. However, grazing within the easement would be possible.

The area affected by the operational footprint, including the new transmission line, would be 165 ha. The duration of the project would be 25 years. The loss of this amount of agricultural land in the region for this period is not considered a significant loss either in the locality or for the Twynam Agricultural Group, who, as an involved landowner, would be compensated financially for these losses from the operation of the proposal.

Future land uses

Given the context of the site, surrounded by large agricultural land holdings, no land use conflicts are likely during operation in terms of rural residential development, land managed for forestry or conservation purposes.

During the operation of the proposal, future mineral exploration would be limited within the site boundary. Exploration in areas with above ground infrastructure would be precluded. Traffic and additional underground infrastructure such as cabling would make exploration in other areas very difficult and this would not be preferred.

Decommissioning

As the development of the site requires relatively low levels of impact on the soil surface, the proposal is viewed as largely reversible. With the exception of the central power island concrete slab footprint of 0.12 ha, the impacts would be discrete. Tower and heliostat mountings would require small discrete footings or driven piles respectively. Underground cabling would be removed for its recycling value. Some compaction on access roads would have occurred. The rehabilitated site (discussed in Section 6.2.2) would have similar opportunities for land use as the site currently possesses. At the end of the project all

above ground infrastructure would be removed and current agricultural land use activities or alternative activities including rural residential development, forestry or mining could be undertaken.

6.3.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the following mitigation measures.

Table 6-9 Safeguards and mitigation measures for land use impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Consultation with Jemalong Station Farm Manager regarding any temporary impacts to access or risks to livestock. Additional specific mitigation may be required such as: • Additional fencing to protect livestock from collision risks. • Vehicle speed restrictions on access roads.	X		
Removal of all above ground infrastructure and rehabilitation of areas disturbed during the operation of the plant. This may include specific remediation of evaporation ponds to restore landforms and vegetative cover.			X

6.4 SOCIOECONOMIC AND COMMUNITY

Large or novel developments can produce social and economic impacts on local communities. These can be positive, such as the provision of employment and increased retail trade. They can also produce unintended or adverse impacts, such as creating strains on existing infrastructure (such as public transport or accommodation facilities during construction), including social infrastructure (volunteer services, social ties and networks). This section investigates the socio-economic profile of the region to understand the impact of the proposal on socioeconomics and the community.

6.4.1 Background

Socio-economic profile

The Forbes LGA has a population of 9,170 people (ABS, 2011). This represents a population decrease of around 2 per cent since the 2006 Census (9,361 people). The percentage of people of Indigenous origin (9.6 per cent in 2011) is very high compared to the Australian average (2.5 per cent in 2011). The overseas immigrant population is small; 91 per cent of the population were born in Australia compared to the Australian average of 69.8 per cent (ABS, 2011).

The local economy is based on irrigated and dryland agriculture, including broadacre cropping and sheep and cattle production. Sheep, beef cattle and grain farming involve 14.0 per cent of the population. Other sectors that support the economy include wholesale trade, health care, manufacturing, finance, education and government (RDA Central West, 2012).

The unemployment rate for Forbes LGA is similar to the broader population at 5.3 per cent, compared to the national rate of 5.2 per cent (ABS 2011).

Forbes is a service centre for the area:

- Accommodation options in the township of Forbes include eight motels, four caravan parks, one hotel and six bed and breakfasts (Forbes Shire Council, 2015).
- Educational facilities within the Forbes Shire includes two high schools, five primary schools, five pre-schools, TAFE campus, Conservatorium of Music and Jemalong Regional Education Centre (Forbes Shire Council, 2015; RDA Central West, 2012).
- Forbes Hospital provides facilities for accident/emergency, medical, surgical, maternity, paediatric, aged care, health promotion and district nurses. Which is complimented by the Forbes Community Health Centre (Forbes Shire Council, 2015).
- Recreational and sporting facilities in Forbes include facilities for bowls, golf, tennis, basketball, equestrian activities, go-karting racing, swimming, rugby, AFL, squash, shooting, cricket (indoor/outdoor), netball (indoor/outdoor), gliding, hockey, archery, polocrosse and pony club (Forbes Shire Council, 2015).
- Tourist attractions within the Forbes LGA include: the Lachlan River, Gum Swamp and Bird Hide, Forbes and Districts Historical Museum, Central West Livestock Exchange, and Lake Forbes (Forbes Shire Council, 2015).

Community feedback on the proposal

Community feedback on the proposal has been through feedback forms, discussions at presentations and statements of support from nearby neighbours (refer to community consultation and community consultation plan for the proposed solar plant, Section 3 and Appendix B). Consultation with the community has been ongoing and is proposed to continue for the life to the project.

Consultation with Forbes Shire Council has also been ongoing. Council has been and remains supportive of the proposal and has indicated strong support for the proposal in light of the potential employment, business and tourism benefits as well as helping build Forbes as a regional centre for specialist research, medical and high skill services.

As of November 2014, community consultation feedback forms show a positive community response to the proposal. While only representing a proportion of the community, key issues raised in relation to the proposal include:

- Potential to create a hub for renewable energy in the area.
- Financial benefits anticipated for local suppliers.
- Potential for employment, through construction and operation.
- Creation of an image of sustainability that would be linked to the area.
- Demonstration of the areas suitability for other similar projects.
- Tourism potential.
- Potential environmental benefits for the broader society.
- Compatibility with existing industries in the area, including agriculture and mining.
- Suited to the area's climate.

6.4.2 Potential impacts

Construction

Large scale solar plants can create polarised reactions in communities; some may see it as a large change to existing land use, lifestyles and land character. This feature alone can generate uncertainty, stress or opposition to the development. Others may see it as a positive contribution and sign of progress and may derive some direct benefit.

The local area has few large scale industries and would be a large change to the character of the site. It is not highly visible to the public however and in this way the impact would be contained. It is located 36km from the nearest town and 3.2 km from the nearest sealed road and major transport corridor.

The proposal would provide a new less polluting form of electricity generation. It demonstrates the potential of the area to host other such plants and to be a part of this positive contribution to reducing man made impacts on climate change.

The proposal would represent a local economic and direct economic benefit to some. The construction of the proposal would utilise up to 500 staff at peak construction. Many of these could be drawn from the local area. Additional workers moving to the area temporarily may stimulate local economic activity. Accommodation and retail services would be stimulated. Conversely, the temporary influx may place pressures on local services such as schools and health services. Additional demands for accommodation and additional traffic may present an adverse effect on local tourism, if coinciding with local festivals for example. Additional traffic may be noticeable. Additional hazards accompany construction traffic (refer to Section 6.5). Mitigation strategies to address these impacts centre on consultation with the community, so that benefits can be maximised and conflicts resolved where possible.

Operation and decommissioning

Minimal impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be at low levels. The additional accommodation and traffic impacts of five to twenty operational staff are not likely to be noticeable.

Decommissioning is likely to require less staff onsite than for construction. It would offer similar economic benefits to construction in terms of opportunities for local staff and industries. It may also include local recycling of infrastructure components.

6.4.3 Safeguards and mitigation measures

Potential for adverse socio-economic impacts is proposed to be addressed via the following mitigation measures.

Table 6-10 Safeguards and mitigation measures for socioeconomic and community impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
The Community Consultation Plan would be implemented 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. • Complaints mechanisms to identify and respond to complaints.	X	X	
Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	X		
Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	X	X	X
Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	X	X	X

6.5 TRAFFIC, TRANSPORT AND ROAD SAFETY

For the proposed solar plant, key traffic and transport impacts relate to haulage during construction. Increased vehicle numbers, particularly heavy vehicles, can equate to increased traffic collision risk, cause damage to roads and indirect impacts such as noise and dust to other motorists and nearby receivers.

Roads and Maritime Services identified issues relating to traffic, transport and road safety as important during the development of the SEARs for the proposal (Section 3). Specific issues raised are addressed in this section.

6.5.1 Background

Regional road network

While a detailed haulage plan has not yet been developed, it is expected that the project's components would be delivered by road from Sydney, via either:

- Sydney, Bathurst, Cowra, Forbes:

  Great Western Highway, Mitchell Highway, Mid Western Highway, Lachlan Valley Way.

- Sydney, Bathurst, Orange, Parkes, Forbes:

  Great Western Highway, Mitchell Highway, The Escort Way, Orange Road, Newell Highway, Lachlan Valley Way.

These major roads are administered by Roads and Maritime Services. In terms of capacity:

- The Newell Highway (National Highway 39) is an important road link connecting NSW with Queensland's and Victoria's borders. In the proposal area the Newell Highway is the main road transport route connecting Forbes with Parkes in the north and West Wyalong in the South. Annual Average Daily Traffic (AADT) levels at the Forbes Shire boundary on the Newell Highway, were 4597 in 2005 (Roads and Maritime, 2014).
- The Lachlan Valley Way connects Forbes to the east through Cowra and west through Condobolin. The road is expected to carry medium volumes of traffic which are likely to increase during periods of grain harvest. AADT levels are not currently available. The Lachlan Valley Way is a bus route for Forbes. There are no other bus routes or public transportation along the route.
- The Escort Way Annual Average Daily Traffic (AADT) is 1605 (in 2010) which is relatively low. Traffic around the locality would mostly be a result of industry and rural activities.

Local road network

The proposal site is located approximately 3.2 km south of the Lachlan Valley Way. From this point, the site would be accessed via Wilbertroy Lane and then Naroo Lane. Where it intersects Wilbertroy Lane, the Lachlan Valley Way is a two lane sealed road with a posted speed limit of 100 km per hour. Both Wilbertroy and Naroo Lanes are unsealed Council administered public roads. They contain sharp corners and are not 'all weather' roads; during high periods of rainfall they are impassable. Wilbertroy Lane, Naroo Lane and Lachlan Valley Way are infrequently affected by flooding.

The Lachlan Valley Way is a school bus route for Forbes and surrounding areas such as Jemalong. There are no other bus routes or public transportation along this section of local road networks

Proposal requirements

Access requirements can be separated into the following categories:

- Cars –the largest proportion of vehicles and would be used by project management staff and site workers to access the site. Up to 30 cars on average are anticipated during construction. Five – Fifteen cars are expected during normal operation.
- Utilities – would be required to transport equipment and materials around the site and for local pick up of materials. Approximately five utilities would be used on a daily basis at the site during construction.
- Trucks – would also 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 utilities.
- Standard articulated trucks – would be used to transport 12 m containers from point of origin. A few large components, including the steam turbine and electricity generator, would require large trucks and may require special convoy arrangements. These trucks would be similar in scale to large grain-haulage trucks (multi-bogey) used in grain haulage operations. Heavier trucks would deliver components such as the switch station components and transmission line poles. The number or these vehicles is expected to be low.
- Trucks used for the transportation of sodium would be subject to the regulatory requirements for transport of Dangerous Goods, to be undertaken by licenced hauliers.

Vehicles would travel around the site via constructed access tracks to the following locations:

- Solar array module clusters.
- Central power island.
- Construction equipment laydown area.
- Around the perimeter of the solar plant.
- Along the transmission line corridor.

Wilbertroy Lane, Naroo Lane and internal access tracks would remain unsealed but may be re-sheeted with gravel to maintain their condition during the construction phase.

Approximately 30 employees would be required during the first month with up to 500 employees during the peak construction period (approximately nine months). Following installation of the solar array modules, the employee numbers would reduce toward the end of the 18 month construction programme. Temporary car parking during construction would accommodate approximately 30 vehicles. There would also an area to park buses. It is proposed employees would be transported by bus from Parkes and Forbes area.

During operation, there would be five to twenty maintenance personal employed. Parking would be available within the site.

6.5.2 Potential impacts

Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction and decommissioning 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 (where traffic is on unsealed roads) 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 vehicles.
- Potential incidents involving Dangerous Goods vehicles, in particular the transport of sodium during construction/commissioning.

Haulage program

The haulage network is of sufficient capacity to accommodate the haulage of components required for the construction of the solar plant and transmission line.

The additional traffic would be a small component of the existing loads. No substantive increased collision risks, damage to road infrastructure, noise or dust impacts, disruption to existing services or reduced level of level of service is expected to accompany construction. This outcome would be ensured by the preparation of a detailed haulage plan, to manage the haulage process.

A large proportion of project components, including lattice towers, heliostat mountings and fencing, are expected to be assembled onsite within Jemalong Station.

Given the high level of usage of local road networks by large grain haulage vehicles during grain harvesting operations, it is not anticipated that upgrades would be required to the Wilbertroy Lane and Lachlan Valley Way intersection commonly used by these vehicles. Consultation would be undertaken with Roads and Maritime and Forbes Council to ensure adequate and safe entry and exit of the unsealed Wilbertroy Lane.

Onsite and local traffic

Increased vehicle numbers

Local vehicle movements could be reduced by organising carpooling and bus services, including shuttle buses from Parkes and Forbes to transport the majority of up to 500 construction personnel required onsite, during peak periods. Assuming an 80 per cent uptake rate and 50 person capacity, up to eight bus trips would be required per day during the construction program. During non-peak periods approximately half as many shuttle buses are expected to be required.

In addition, it is estimated that 30-60 trips would be required per day by standard or 4WD vehicles, during the construction program. During non-peak periods approximately half as many would be expected.

Traffic impacts would largely be confined to standard hours of construction. Exceptions would occur as staff arrive and leave the site, before and after shifts; some of this traffic may occur outside the standard

construction hours. Additionally, the delivery of large components may take place outside normal working hours.

Delivery times of components can be scheduled with the haulage contractors so that "platooning" of large vehicles on the highways does not occur. This outcome would be ensured by the preparation of a detailed TMP to manage traffic and access in the local area throughout the construction phase.

Increased collision risks

The increased collision risk would be mainly limited to the construction period and relates primarily to traffic entering and exiting Wilbertroy Lane from Lachlan Valley Way. This relates to both oncoming traffic and traffic following turning vehicles. Necessity of any change to the main access road intersection with the Lachlan Valley Way would be determined in consultation with Roads and Maritime Services. Slowing vehicles may present a risk to through traffic, however it likely these risks can be mitigated by increased signage in the advances to the intersection, to warn motorists of potential vehicle movements and the construction time frames.

Access to the proposal site follows the course of a school bus route (Jemalong – Forbes). The proposal may increase risk to students boarding and exiting the bus on the Lachlan Valley Way, and crossing the road along transport routes with higher traffic volumes. Consultation with bus companies (which are intended to be used for worker transport to and from the proposal site) would be undertaken. The nearest school bus stop is over 1 km in either direction from the intersection, however a further potential risk mitigations could be required move any existing stops further away from the intersection.

Damage to road infrastructure

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along the Lachlan Valley Way the impact is expected to be negligible, due to the existing capacity of the road network, but the impact of turning traffic at the intersection to Wilbertroy Lane would require monitoring to ensure it remains within the expected peak hourly volumes.

Wilbertroy Road and Naroo Lane would remain unsealed but may be re-sheeted with gravel to maintain their condition during the construction phase. Damage to Wilbertroy Lane and Naroo Lane would be increased during wet conditions. These roadways would need to be monitored and restored at end of the construction period.

While closure due to flooding may occur at times, Vast Solar would manage construction impacts on Wilbertroy Road and Naroo Lane trafficability such that other road users are not inconvenienced or put at greater danger of collision during construction. This may require periodic road improvements and lane closures to preserve traffic flow.

Associated noise and dust

Construction of the proposal may result in increased noise and dust, particularly on unsealed roads, though all such roads are within the Jemalong Station property. Impact from dust generated from the proposed activity, including that associated with increased traffic, is considered in Section 6.5. During construction, water would be used to minimise dust generation on the unsealed lanes and internal site tracks.

The DECCW (2011) *NSW Road Noise Policy* (NSW RNP) been used to evaluate impacts from road traffic noise. This policy outlines a range of measures required to minimise road traffic noise and its impacts, including noise generated by developments that generate additional traffic on existing roads.

The criteria for various road categories and land uses are presented in Section 2.3 of the NSW RNP. Those criteria are presented in Table 6-11.

Table 6-11 Applicable NSW Road Noise Policy (DECCW 2011) noise criteria

Type of project/land use	Assessment criteria – dB(A)	
	Day (7am – 10pm)	Night (7am – 10pm)
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	LAeq, (15 hour) 60 (external)	LAeq, (9 hour) 50 (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq, (1 hour) 55 (external)	LAeq, (1 hour) 50 (external)

The nearest non-involved residence is 1.7 km from the traffic access route to the proposal site. The area is flat but vegetation screening is present. The residence is also currently affected by the Lachlan Valley Way traffic noise, exceedance of these levels is considered unlikely. In the event a noise complaint is received during construction, mitigation including monitoring may be undertaken.

Disruption to existing services

The increase in traffic volumes and slow turning vehicles may have a minimal effect on bus movements, including the school bus (Jemalong to Forbes on school days), but would have no impact on scheduled services. Consultation with bus providers, to ensure there is no disruption to the bus schedule or to the location of stops will mitigate potential risk. There are no Countrylink bus services along this section of Lachlan Valley Way.

Local traffic in Forbes and Parkes would be minimally affected by increased vehicles from staff seeking accommodation and services, and conducting commercial activities related to the solar plant. This would extend outside construction hours but would be insignificant in the context of traffic movements in these major regional centres.

Dangerous Goods Transportation

Road transport of Dangerous Goods is inherently hazardous but the risks are well understood and well controlled by compliance with stringent regulations. Of particular interest is the transport of sodium used as the heat transfer medium for the plant, but other more common Dangerous Goods such as LPG are also to be transported to site.

The key risk control will be compliance with the well-defined regulations for transport of Dangerous Goods. Vast Solar will carefully select qualified hauliers and will ensure, so far as is practicable, that all parties throughout the supply chain comply with these requirements.

Operation

Vehicles would use the designated road network to access the site and travel within the site during the operational phase (25 year period). Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar plant. Operational staff would be confined to designated parking areas and access roads/tracks within the proposal site.

During heavy rainfall periods and flooding access to the site would be restricted for personnel. Wilbertroy Lane and Naroo Lane would be impassable. This may be an issue during emergencies at the site. The implementation of an emergency protocol would ensure the safety of people and the environment.

During operation, between five and twenty maintenance personnel would access the proposal site to operate and maintain the solar plant. The anticipated volume of staff (<20) would result in a very minimal increase in traffic flow on the Lachlan Valley Highway. It is considered highly unlikely that operational traffic would obstruct public or private access. Risks to road safety from operational traffic would be very minimal.

Decommissioning

Decommissioning impacts are likely to follow a similar pattern as construction as components are dismantled and removed, over a lesser time period.

6.5.3 Safeguards and mitigation measures

Traffic and haulage impacts would be managed in consultation with the roads authorities covering issues such as, but not limited to, reinstatement of pre-existing road conditions, shuttle bus transport, intersection upgrade, scheduling of deliveries and traffic controls (speed limits, signage etc.), Dangerous Goods transportation requirements, as detailed below.

Table 6-12 Safeguards and mitigation measures for traffic, transport and safety impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
A Traffic Management Plan would be developed with input from the road authorities, including but not limited to: • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • Carpooling/shuttle bus arrangements to minimise vehicle numbers. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts: bus schedules – i.e. school and local events (festivals, trade shows) and industry operations (such as mining). • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Avoiding use of Naroo Lane and Wilbertroy Lane during floods or after heavy periods of rain. • Consideration of any specific requirements of Dangerous Goods regulations	X		X
A Haulage Plan would be developed with input from the roads authority, including but not limited to: • Assessment of road routes to minimise impacts on	X		

Safeguards and mitigation measures	C	O	D
transport infrastructure. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic including buses). • Community consultation regarding impacts to school bus routes. • Traffic controls (signage and speed restrictions etc.). • Use of qualified hauliers for transport of Dangerous Goods. • Notify NSW Fire & Rescue of the transport routes and timing for transportation of sodium.			
The proponent would consult with Roads and Maritime Services in regard to use of the Wilbertroy Lane / Lachlan Valley Way intersection and requirement for upgrades, if any.	X		X
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.	X	X	X

6.6 RESOURCE USE AND WASTE GENERATION

6.6.1 Background

Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar plant include:

- Structural metal components for lattice towers, heliostat mountings and supports, fencing, site buildings, transmission line poles 5,700 t.
- Metal cladding and piping. 850 t
- Metal and glass for heliostats (copper layer, reflective silver layer, and a top protective layer of thick glass) 380 t.
- Metal and plastic for cabling 270 t.
- Metal and plastic for computing components (heliostat tracking controls) 60 t.
- Masonry products, including concrete for slabs and footings, thermal tanks 6,000 t.
- Fuels and lubricants associated with operation of machinery and motor vehicles minimal.
- Sodium for heat transfer 506,000 kg.
- Molten salt for thermal energy storage 2,723,038 kg.
- LPG for auxiliary heat 20 KL.
- Thermal oil for auxiliary heat 3 t.
- Soda ash for use in sodium leak containment 20 t.
- Gravel and road base, for local road maintenance, access tracks and car parking areas 5,200 t.
- Water, for cooling, steam generation, heliostat cleaning and dust suppression (maximum consumption <20ML/pa).

- Soil, excavated from evaporation ponds and used to construct earth bund.

During operation and decommissioning resources used would be associated with maintenance activities and use of machinery and vehicles.

Waste generation

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 134 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

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

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

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

Construction

Solid waste is one of the major pollutants caused by construction. A number of different construction activities would produce solid wastes, such as:

- Packaging materials.
- Excess building materials.
- Scrap metal.
- Excess soil.
- Plastic, polystyrene and masonry products.
- Vegetation clearing.
- 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 and decommissioning phases would be classified as building and demolition waste within the class general solid waste (non putrescibles). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescibles) in accordance with the POEO Act.

A soil balance is expected to be met, with soil excavated from evaporation ponds and used to construct earth bund. Top soil would be retained and used in site rehabilitation.

Operation

During operation the solid waste streams would be associated with maintenance activities and presence of employees. Some materials such as demineralised water, fuels and lubricants, LPG and thermal salt may require replacement over the operational life of the project.

Additionally, the wet surface air cooler uses water sourced from steam generator blowdown and raw water for cooling. As water is converted into steam, it leaves behind the dissolved solids (carbonates and

sulphates) and suspended solids (minerals) in the water. Increased concentration of these impurities form deposits that cause corrosion and reduce heat transfer rates. A blowdown is done to reduce the concentration of impurities. Blowdown involves removing a small percentage of the water and replacing it with cleaner water. Blowdown can occur continuously through operation and or manually depending on the build-up of impurities. The removed water from the wet surface air cooler is transported to the evaporation ponds for evaporation. The sediment and water quality in the evaporation ponds would be monitored for remediation or disposal.

Decommissioning

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

- Heliostats and steel mountings of the solar array modules.
- Metals from towers, kiosks, posts, cabling, fencing.
- Equipment such as the steam turbine and generator, steam generator, heat exchanger, tanks, condenser, valves, vessels, pumps, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.
- Chemicals would be removed from site and recycled. This would include a large amount of salt and would require consideration of facilities able to accept the waste.

Items that cannot be recycled or reused, such as excess of above, would be disposed of in accordance with applicable regulations and to appropriate facilities. The site would be reinstated during decommissioning, with concrete foundations for the 'power island' being the only infrastructure to be retained.

6.6.2 Potential impacts

Construction and decommissioning

Resource use

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 in light of 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 6.10

Waste

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction and decommissioning phases would be classified as building and demolition waste within the class *general solid waste (non putrescibles)*. Ancillary facilities in the site compound would also produce sanitary wastes classified as *general solid waste (putrescibles)* in accordance with the POEO Act.

During decommissioning, all infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities, except for the 'power island' concrete foundations that would remain in place.

Operation

Electricity production using CSP emits no pollution, produces no greenhouse gases, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the solar plant. Operational waste streams would be very low as a result of low maintenance requirements of the solar plant.

Some materials such as demineralised water, fuels and lubricants, LPG and thermal salt, and some electrical components (e.g., transformers) may need replacement over the proposed life of the solar plant, requiring further use of metal and plastic based products. Repair or replacement of infrastructure components, if required, would result in some waste during plant operations; however, such activities would occur very infrequently and there would be a high potential for recycling or reuse of such waste.

6.6.3 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 following mitigation measures.

Table 6-13 Safeguards and mitigation measures for resource use and waste generation

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	X	X	X
Septic system to be installed and operated in accordance with local Council requirements.	X	X	
Monitoring of the evaporation ponds for remediation or disposal of wastes offsite.		X	

6.7 FIRE AND BUSH FIRE ISSUES AND IMPACTS

Bush fire presents a threat to human life and assets and can deliver adverse ecological impacts. Bush fire risk can be considered in terms of environmental factors that increase the risk of fire:

- Fuel quantity and type.
- Topography.
- Weather patterns.

As well as specific activities (such as hot works) or infrastructure that exacerbate combustion or ignition risks (such as transmission lines and other electrical components).

6.7.1 Background

The proposal site is flat, located in a low lying area of the Lachlan Catchment and has been levelled for agricultural activities. The site has been cleared and cropped with little to no overstorey or shrub story present, except for isolated remnants and tree clusters. Thurumbidgee Lagoon is located 400m north of the proposal site which contains more overstorey and groundcover. The northern and western boundaries of the site are treed.

The proposed transmission line route runs east between the proposal site and Thurumbidgee for 1.5 km before travelling north for 3 km to meet the West Jemalong Substation. It has been sited in cleared areas with little to none overstorey or shrubs. There are patches of vegetation where overstorey and groundcover are present adjacent to the proposed transmission line route. The vegetation is adjacent to Thurumbidgee Lagoon which connects to trees running along the fenceline of the paddocks the transmission line occupies. The trees along the fence line run for approximately 1.3 km from Thurumbidgee Lagoon with a width of 50 m. A larger patch of vegetation (220 m by 200 m is approximately 1.8 km north of the proposal site. Between this patch and the West Jemalong Substation are no patches with overstorey.

The local bush fire season generally occurs between October and March. The local area experiences hot dry summers, generally with very low humidity during this time. Hot north-westerly winds are common with high daytime temperatures, which increases bush fire risk. Dry lightning storms are frequent during the bush fire season. Historically, the Mid Lachlan Valley Bush Fire Management Committee (MLVBMC) area has experienced 150 bush fires on average per year, including approximately one major fire per year. The MLVBMC (2008) identifies the main ignition sources as lightning, storm activity, ignition from farming machinery during harvest times, vehicle accidents along major roads, powerlines and the storage of hay.

The MLVBRMP, prepared in accordance with the *Rural Fires Act 1997*, sets out a five year strategic management plan to reduce bush fire risk on private and public land within several areas of Mid Lachlan Valley including the Forbes LGA. The proposal area does not lie within any of the bush fire management zones identified in this plan.

The proposal includes two infrastructure components, transmission lines and switchyard components, with a risk of exacerbating or causing fire. Molten salt has potential to generate smoke when it comes in contact with air, however no fire is generated. Sodium has potential to generate smoke and to burn when it comes in contact with air. Molten salt, sodium and other hazardous chemical are discussed in above Section 5.4.1 and at Appendix C, PHA.

The nearest Rural Fire Service station is located in Forbes, at 26 Union Street.

6.7.2 Potential impacts

Construction and decommissioning

Activities associated with construction that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol powered tools.
- 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 sparse vegetation cover over the proposed site and other factors discussed above, it is considered unlikely that project would pose a significant bush fire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

The bush fire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bush fire mitigation measures outlined in Section 6.7.3.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction and operation activities (below), any bush fire risk associated with decommissioning of the project would be highly manageable.

Operation

As well as the activities listed above, which also apply to operation, repairs and maintenance activities during project operation could increase bush fire risk.

All electrical components would be designed to minimise potential for ignition.

Asset protection zones would also be maintained around buildings at the site.

It is anticipated that Essential Energy would maintain the transmission line infrastructure to minimise bush fire ignition risks, once constructed.

Bush fire risks during operation of the solar plant and connection infrastructure is considered highly manageable.

6.7.3 Safeguards and mitigation measures

Fire risks would be addressed via the following mitigation measures.

Table 6-14 Safeguards and mitigation measures for fire and bush fire

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Develop a Bush Fire Management Plan with input from the RFS to include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of *Planning for Bush Fire Protection 2006* - o Identifying asset protection zones o Providing adequate egress/access to the site (s4.1.3) o Emergency evacuation measures (s4.2.7). • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar plant.	X	X	X

6.8 HISTORIC HERITAGE

6.8.1 Approach

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the proposal site (solar plant site and surrounding landscape). Several heritage databases were searched between 30 September and 1 October 2014 as part of this assessment. These 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 proposal site. The area searched was the Forbes 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 proposal site.
- The heritage schedule of the Forbes LEP for locally listed heritage items that are within or adjacent to the proposal site.

Many councils across NSW have not listed their local heritage schedule on the NSW SHI. In this instance the Forbes LEP was the main source for local heritage items as these are yet to be included in the SHI. Most of the identified heritage items were listed as a result of the 2006 Forbes Community Heritage Study recommendations.

6.8.2 Results

The results of the heritage searches listed above indicate that no known historic items or places occur on the site. A summary of the results of the heritage searches are illustrated in Table 6-15. Details of listed items are provided below.

Table 6-15 Summary of heritage listings in the Forbes LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	1
NSW State Heritage Register	5
NSW State Agency Heritage Register (section 170)	17
Forbes Local Environment Plan (LEP) 2013	161

Commonwealth Heritage list

One item is listed on the Commonwealth Heritage List. This is the:

- Forbes Post Office (Australia Post).

The Commonwealth and National Heritage Lists are established and maintained under the EPBC Act 1999.

State Heritage Register

A search of the NSW State Heritage Register within the Forbes LGA indicated five listings. These included (owner in parentheses):

- Forbes Post Office (Australia Post).
- Forbes Railway Station Group (Australian Rail Track Corporation).
- The Ben Hall Sites – Ben Hall's Death Site (private).
- The Ben Hall Sites – Grave of Ben Hall (Forbes Shire Council).
- The Ben Hall Sites (Collectively) (various).

These items are listed under the *NSW Heritage Act 1977*. None of these items are located within the Jemalong area.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register within the Forbes Shire LGA indicated 17 listings. These included (owner in brackets):

- Mulyandry Creek Bridge (Roads and Maritime Services).
- Paytens Bridge Over Lachlan River at Colletts Crossing (Roads and Maritime Services).
- Iron Bridge Over Lachlan River at Forbes (Roads and Maritime Services).
- Forbes Courthouse (Attorney General's Department).
- Forbes District Ambulance Station (NSW Department of Health).
- Main building and Mortuary, Berkley Street, Forbes (NSW Department of Health).
- Forbes Official Residence 1, 6 Victoria Lane, Forbes (NSW Police).
- Forbes Police Station, 8 Victoria Lane, Forbes (NSW Police).

- Forbes Railway Station (Australian Rail Track Corporation).
- Bumbuggan Creek Weir (State Water Corporation).
- Cottons Weir (Forbes) (State Water Corporation).
- Island Creek Weir (State Water Corporation).
- Jemalong Regulator and Offtake (State Water Corporation).
- Jemalong Weir (State Water Corporation).
- Jemalong Weir Control House (State Water Corporation).
- Forbes Fire Station (NSW Fire Brigades).
- Warroo Bridge Over The Lachlan River (Roads and Maritime Services).

The above items are listed by State Agencies under s.170 of the *Heritage Act 1977*. Three of the above items are located within the Jemalong area. They are:

- Jemalong Regulator and Offtake.
- Jemalong Weir.
- Jemalong Weir Control House.

Local Heritage Schedule

A search of the Forbes LEP resulted in a total of 161 local heritage items being recorded within the Forbes LGA. The majority of these items (including one conservation area) are concentrated in the main town of Forbes with the remainder located in the smaller towns, villages and rural areas of the LGA. A narrower analysis of all local heritage items identified four items that are within the Jemalong area. These are:

- Jemalong Range Fossils, 7123 Newell Highway.
- Riversleigh Homestead, 1476 South Condobolin Road (now Lachlan Valley Way).
- Jemalong Homestead, 2728 South Condobolin Road (now Lachlan Valley Way).
- Yawarra Rabbit Trap, 402 Specks lane.

The Jemalong Homestead complex is located on the northern side of the Lachlan Valley Way with access down a gravel road. The proposed solar station would be located at least 4 km from the homestead. Heavy vehicle transport during construction would be located approximately 800 m from the homestead when turning off the Lachlan Valley Way.

Unlisted Heritage Items

Although no listed items were identified within the site, it is acknowledged that there may be unlisted items of historic significance on the subject site. No additional potential heritage items were identified within the proposal site during the site inspection for historic heritage.

6.8.3 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. A high percentage of these items are found in Forbes and other towns and villages, although some are scattered throughout the rural parts of the Forbes LGA. A total of seven items were identified as being either within the general Jemalong area. However, none of those items are found within the study area for the solar station proposed site, or adjacent.

The transport of heavy vehicles on roads passing near identified heritage items may increase levels of dust and vibration. Given the site's distance from the identified heritage items (approximately 800 m to Jemalong Homestead being the closest), the capacity of haulage routes to handle large loads and the

temporary nature of works, dust and vibration generated from heavy trucks is not expected to be an issue.

The proposal is not considered likely to have a significant impact in accordance with the NSW *Heritage Act 1977*, the EP&A Act, or the EPBC Act, in terms of heritage. No impacts are considered likely during the construction or decommissioning phases. No heritage approvals are required.

Potential for impacts to heritage items during operational activities would be substantially less than for construction and decommissioning activities. No impacts are considered likely during the operational phase. No heritage approvals are required.

6.8.4 Safeguards and mitigation measures

A protocol for unexpected finds would be developed for the construction phase, as detailed below.

Table 6-16 Safeguards and mitigation measures for historic heritage

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
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.	X	X	X

6.9 SOIL

Topsoils are critical for agriculture and cannot be easily replaced within a human time scale. Adverse soil impacts can also have ecological impacts, affecting habitat condition, water quality and riparian ecosystems. Risks to soils are influenced by landscape position, slope, soil type, hydrology and land use.

NOW and the EPA identified issues relating to soil and water management as important during development of the SEARs for the proposal (refer Section 3.1.1). Specific issues raised by these agencies are addressed in this section.

6.9.1 Background

Soils and landforms

The topography of the proposal site and surrounding area is flat within a low lying area of the Lachlan River Catchment. It lies in Lachlan Fold Belt geological region (Scheibner, 1996). The Lachlan Fold Belt is located across NSW and Victoria and is characterised by deformed, Palaeozoic deep and shallow marine sedimentary rocks, cherts and mafic volcanic rocks (Gray, 1997). Forbes 1:250, 000 Geological Sheet (Raymond *et al,* 2000) identifies as most of the as alluvium including active depositional plains and terraces containing present day drainage. Small areas of the south west and south east sections of the proposal site is occupied by inactive alluvial plains.

Soil at the proposal site is mapped as three soil landscapes including Corinella, Scrubby plains and Warroo Channel (King, 1998). These landscapes specific locations in reference to the proposal area are described below in Table 6-17.

Table 6-17 Proposal area soil landscapes (King, 1998)

Soil landscape	Location
Corinella (alluvial)	Proposal site, transmission line and access track.
Scrubby plains (stagnant alluvial)	Northern sections of the proposal site.
Warroo Channel (alluvial)	Northern end of the transmission line connection with existing substation.

ESPADE (OEH, 2014) identified a number of soil profiles within the proposal area including within the proposal site, Thurumbidgee Lagoon and adjacent to Naroo Lane. None of these profiles showed evidence of salinity or acid sulfate soils (ASS). The soils were mapped as erodible (NSW Government, 2014). The proposal site had evidence of moderate wind erosion however it was noted to be stable and there was evidence of minor erosion around Thurumbidgee Lagoon and Naroo Lane. All soils were noted to be hard setting and cracking could occur during dry periods. Further the NSW Natural Resources Atlas searches did not show any occurrences of ASS or dryland salinity. It is expected that the soils in the proposal area are susceptible to erosion due to previous vegetation clearing and agricultural activities. Rural land capability mapping indicates that the site is not subject to severe limitations, and is generally suitable for cultivation (NSW Government, 2014).

A search of the OEH contaminated land public record (NSW Government, 2015a) was undertaken for contaminated sites within the Forbes LGA on 5 June 2015. There was one record returned, Forbes Gas works. This contaminated site is located within the Forbes township, therefore not located near Jemalong Solar Station. The online *List of NSW contaminated sites notified to EPA* (NSW Government, 2015b) was also searched on 5 June 2015. There is no sites listed in the Jemalong area, however there were seven sites found in the Forbes area, these are all located within the Forbes township.

There is a risk of contamination associated with agricultural activities (e.g., use and disposal of pesticides). During a site inspection a farm waste site was located within the proposal area. The site contained mostly scrap metal and plastic, no chemical containers were located however, such material cannot be discounted as being buried onsite.

6.9.2 Potential impacts

Construction and decommissioning

Soil impacts

Construction activities at the proposal site, such as excavation, have some potential to cause soil erosion, which the site is susceptible to and subsequent sedimentation. This would occur when excavating footings for the power island, constructing bunds (small levees adjacent to the power island), excavating trenches for electrical cables and when compacting areas for roads and car parking. Given the relatively flat landforms, large scale bulk earth works would not be required.

Upgrading (resheeting, as required) access roads and tracks would disturb soils however reshaping and widening is not proposed. Soil compaction would occur as hardstands and tracks are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. Trenches excavated for electrical cables would remove vegetation cover and disturb soils, potentially decreasing their stability and increasing susceptibility to erosion. During excavations mixing of different soil horizons can retard plant growth due to inadequate top soil layer.

Post driving of steel posts supporting the heliostats as well as installation of power poles and fencing uses light equipment and is unlikely to result in material compaction or disturbance of soils. However, the areas of disturbance would be small and sparsely distributed, and the majority of groundcover would be retained.

The use of fuels and other chemicals on site pose a risk of soil contamination in the event of a spill. Chemicals used onsite would include sodium, molten salt, soda ash, fuels, lubricants and (minimally) herbicides. During preparations for commissioning, sodium and molten salt would be required to be transported and installed on site. 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.

The presence of a farm rubbish site and agricultural activities such as the use of pesticides within the proposal area presents a risk of contamination.

Operation

Soil impacts

Minimal operational impacts to soils would occur. Maintenance activities and vehicles would be largely confined to the formalised access tracks. There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides, molten salt, sodium), requiring the development of strict emergency protocols.

The potential for wind erosion (dust generation) during regular plant operation would be low given the ability to stabilise soils exposed during after construction. Areas that were temporarily used during construction (e.g. laydown and construction parking areas) would be rehabilitated.

Concentrated runoff from the heliostat could lead to increased soil erosion below the solar array modules during significant rain events. Retaining vegetation cover would assist in reducing potential for erosion from rainfall run-off.

6.9.3 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 6-18 Safeguards and mitigation measures for soil impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
A soil and water management plan would be prepared, implemented and monitored during the project, in accordance with Landcom (2004), to minimise soil and water impacts. These plans would include provisions to: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Controls must be regularly inspected, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Minimise the area of disturbance from excavation and compaction • Ensure any discharge of water from the site is managed to ensure ANZECC (2000) water quality criteria are met, • Manage traffic generated soil erosion. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised and work ceased until the wet period had passed.	X		X
Spill Response Plan would be developed as part of the overall Risk Management Plan to prevent contaminants affecting adjacent pasture and dams. It would: • 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).	X	X	X
A water cart (or other means) would be utilised to manage dust on all access roads and exposed dusty surfaces in response to visual cues and complaints.	X	X	X
Stockpiled topsoil and other materials that exhibit significant dust lift off would be wet down or covered to manage dust.	X		X
Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored back to original condition or re-vegetated with appropriate species (native in native dominated areas).	X		

Safeguards and mitigation measures	C	O	D
A contamination management plan would be developed to address: • Clean up of the existing farm rubbish site within the proposal site. • Procedure for discovering buried contamination within the proposal site (eg pesticide containers). Disposal would be at a facility able to accept the waste.	X		

6.10 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER)

6.10.1 Background

This section addresses water use and water quality impacts, including surface and groundwater. Flooding and hydrology impacts are addressed separately in Section 5.5.

Water use requirements

The proposal site is located in an area subject to the following water sharing plans:

- Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Source
- Water Sharing Plan for the Lachlan Regulated River Water Source.

Any requirement for additional groundwater or surface water entitlement would be obtained through purchase and trade in accordance with these plans. Water entitlements within the locality are held by Jemalong Irrigation Ltd. This private corporation holds a Water Supply Work Approval and Water Use Approval licence under the *Water Management Act 2000.*

Jemalong Station has an existing 20 ML allocation of water under the water extraction licence held by Twynam Agricultural Group. This would be used for water supply and/or storage for use in dust suppression during project construction. No additional allocation is required.

During operation, an installed 220 kilolitre (kL) rainwater tank and run off captured in the evaporation ponds would be used. The water use would be mainly for the cleaning of heliostats. Demineralised water will be produced onsite for use in the steam generator. The demineralised water is used in a closed loop and would only require minimal top ups during operation. The water use during operation is expected to be minimal, less than 20 ML per year.

Water resources and quality

The proposal is located in the Central West Local Land Services (formerly Lachlan Catchment Management Authority). The site is within the floodplain of the Lachlan River, which is located approximately 3.7 km to the north of the proposal. Thurumbidgee Lagoon is the closest waterway to the site, located approximately 400 m to the north of the proposal site. Other irrigation channels and canals are located in the area, supplying water to agricultural properties.

Thurumbidgee Lagoon is approximately 3 km long spanning east to west. The lagoon size varies substantially with rainfall. It is shallow lagoon and intermittently filled after moderate to heavy or prolonged rainfall. There are no drainage lines or other waterways that enter the lagoon, therefore

Strahler System is no applicable. During the site inspection, the western end of the lagoon retained ponds only and even these would be considered to dry up during drier periods. The eastern end was more shallow in character and dry (Figure 6-4 and Figure 6-5).

Thurumbidgee Lagoon has a history of being used for agriculture with the removal of vegetation and grazing within the lagoon. The water quality within the lagoon is expected to vary with amount of water, being poor as it becomes shallower and receives runoff from agricultural activities (expected to contain fertilizers and pesticides).

Figure 6-4 Western end of Thurumbidgee Lagoon (NGH Environmental, 2014)

Figure 6-5 Eastern end of Thurumbidgee Lagoon (NGH Environmental, 2014)

Groundwater

There are a number of bores within the local area (refer to Figure 6-6). No new bores are currently proposed as part of the solar plant proposal.

The closest bore that offers groundwater levels is Lachlan River Bore at Cottons Weir East Pipe 2 (Gwma011), 32 km east of the proposal site. The Groundwater level as of 2 July 2015 is 6.418 m below ground. Given the very flat terrain and the close proximity of Thurumbidgee Lagoon, groundwater is expected to be similarly shallow at the proposal site (DPI, 2015).

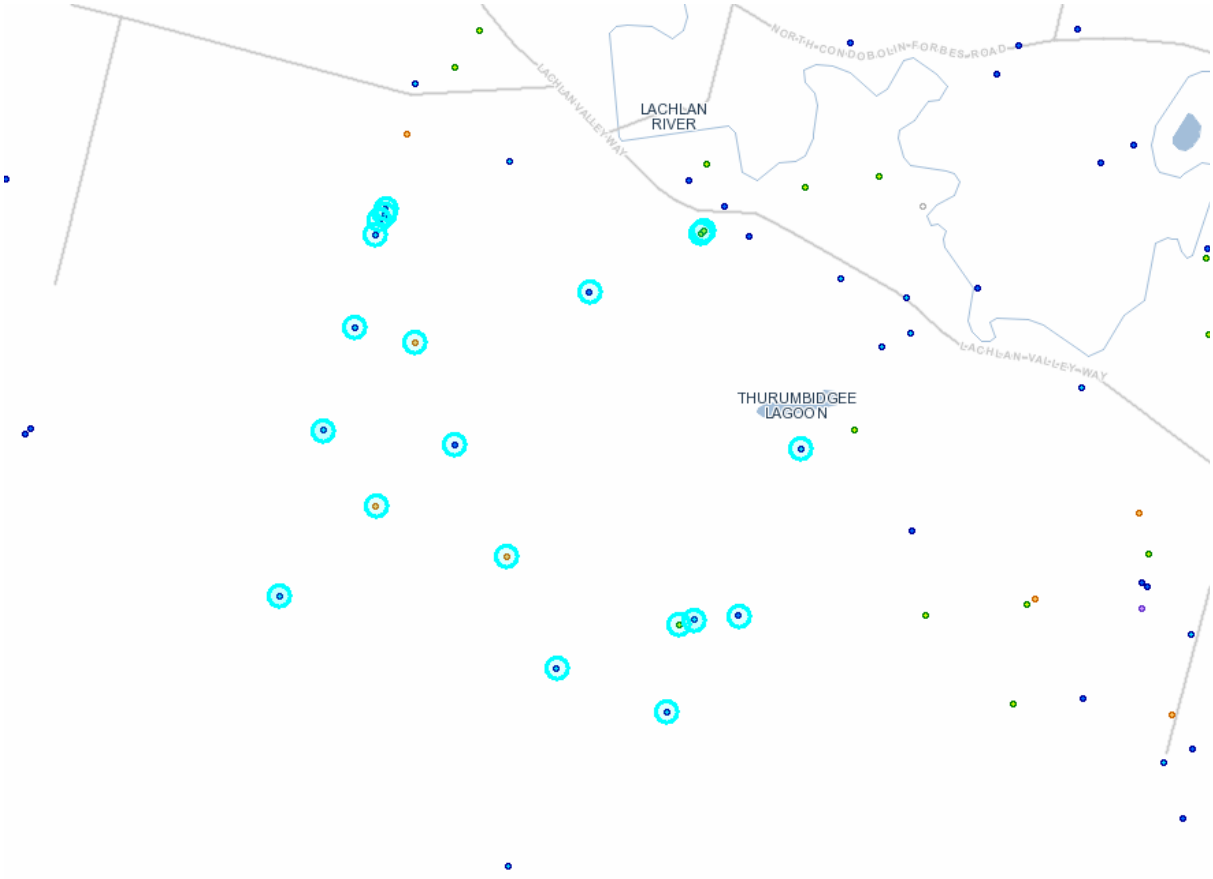

Figure 6-6 Groundwater bores in the area (BOM, 2015a)

6.10.2 Potential impacts

Construction and decommissioning

Water use

Water usage during construction would be minimal, mainly for dust suppression on unsealed roads. This water requirement is likely to vary depending on weather conditions. It is not proposed that concrete batching would be undertaken onsite.

This water is proposed to be sourced from a 20 ML allocation which is part of the existing 33, 000 ML per annum Twynam Agricultural Group allocation. Twynam Agricultural Group are involved in the proposal.

Under normal conditions, there would be no stresses on the supply. During drought conditions water use may increase slightly, particularly with increased requirement for dust management. However there is unlikely to be material impact on the aquifer which is the source of the Twynam Agricultural Group supply. Given the construction period of 24 months and minimal water use required for construction, this is considered low risk. Chemical dust suppression can be used as an alternative to water trucks if required, but is not preferred by the proponent. In the event on-site water supply is insufficient during construction, water access can be secured through commercial arrangements with local water supply authorities.

Impacts on water use during decommissioning would be similar to those during constructed. They are considered low risk and manageable.

Pollution control measures provided in Section 7.2 and the proposal would generally comply with the requirements of Jemalong Station's EPL 5102.

Water quality

Construction activities at the site have minimal potential to degrade the water quality of Thurumbidgee Lagoon as the power island and evaporation ponds, which are sites of the main earthworks are downstream of the Lagoon. The disturbance of soils in the western part of the solar array area has some potential for sediment runoff to enter the lagoon. This has potential to occur from the following activities:

- Pile foundations of receiving towers and trenches for electrical cables
- Minor upgrades to unsealed access roads
- Post driving for steel posts of heliostats, installation of power poles and fencing.

However, the areas of disturbance would be small and sparsely distributed, and the surrounding groundcover would be retained, helping maintain sediments onsite. These risks are considered minimal and manageable with standard sediment and erosion control safeguards.

The use of fuels and other chemicals on site pose a risk of surface or groundwater contamination in the event of a spill. Chemicals used onsite would include molten salt, sodium, soda-ash, fuels, lubricants (the majority by volume of which will be contained within the power island) and limited herbicides. During construction sodium and molten salt would be required to be transported and installed on site. Spills of these contaminants can reduce water quality. 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. Bunding and appropriate containment and spill management procedures are planned as part of the proposal and would address this risk.

Groundwater

Considering the relatively shallow depth of local groundwater, local groundwater resources could be impacted by excavation at depth. Minimal excavation is proposed for slab footings and evaporation ponds. Excavation, including tower and heliostat foundations, would be less than 3 m with the exception of footings for the turbine and electricity generator, which may be in the order of 10 m, and thermal storage tanks, which may be in the in the order of 5 m. It is considered unlikely that ground water would be intercepted. Similarity, contamination of groundwater would be highly unlikely given that chemicals and fuels would be appropriately stored, and spills procedures would be implemented (spill management is discussed in Section 6.9.3).

Clearing of trees can impact on groundwater; saline groundwater can move up through the soil profile if there is a reduction in water uptake and transpiration by trees in the landscape, exacerbating salinity impacts. The clearing proposed during construction is very minor in this context. Most trees can be retained by the proposal. No operational impacts would affect groundwater at the site.

As the Proposal would not be altering the existing groundwater supplies within the solar plant site, it is considered that no impacts to Groundwater Dependent Ecosystems (GDE) would result from the Proposal. Additionally, it is noted that there are no High Priority GDEs as listed on Schedule 4 of the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Source 2012* regulation in proximity to the proposal site.

Impacts on groundwater during commissioning would be similar to those during construction. They are considered low risk.

Operation

Water use

Water use volumes during operation would be minimal. Requirements include:

- Staff amenities for up to five people at the control and maintenance building
- Cleaning of heliostats.
- Topping up of the water required for the steam generation and cooling system

It is expected the total water requirement during operation, would be less than 20 ML per annum. The water would be supplied from a 220 kL rainwater tank and run off capture in the evaporation ponds. Water would also be sourced from the water under existing water licences held by Twynam Agricultural Group. This would be sufficient to the meet the projects water requirements during operation.

Water quality

Minimal operational impacts to water quality would occur. There would remain a risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides, molten salt, sodium), requiring the development of strict storage and handling and emergency protocols, refer to Sections 5.4.2 and 6.9.3.

Groundwater

No operational impacts would affect groundwater at the site.

Operational risks to water resources are considered highly manageable.

6.10.3 Safeguards and mitigation measures

Impacts would be managed through mitigation measures developed and implemented for soil and hazards, as detailed in Section 5.4.3 and Section 6.9.3. Only additional measures are cited below.

Table 6-19 Safeguards and mitigation measures for water impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
The Proponent will consult with EPA to determine whether any changes are required to Jemalong Station's EPL 5102.	X		
Concrete washout shall be carried out offsite or in concrete washout areas described in the Soil and Water Management Plan and identified on the ESCP.	X		X
Procedures for testing, treatment and discharge of construction waste water must be as described in the Soil and Water Management Plan.	X		X
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.	X	X	X
The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	X	X	X
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	X	X	X
All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	X		X
A Groundwater Management Plan would be developed to manage impacts on groundwater. This would be informed by onsite geotechnical survey and include: • Pollution controls • Management of dewatering.	Preconstruction		

6.11 CUMULATIVE IMPACTS

6.11.1 Background

Cumulative impacts, for the purpose of this assessment, relate to the combined potential effects of different impact types of the proposal (i.e., construction noise combined with dust or visual impact) as well as the potential interaction with other proposals in the local area (e.g., the combined effects of the proposal coinciding with other utility works). Cumulative impacts can occur concurrently or sequentially.

6.11.2 Potential impacts

Construction and decommissioning

The key cumulative impacts of construction are considered to relate to biodiversity impacts, traffic impacts, and adverse amenity impacts (dust, noise, visual).

The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 per cent of the native vegetation in NSW has been cleared or highly modified since European settlement (NSW Scientific Committee 2001e), and the removal of the minimal amount of vegetation for this solar station is contributing to this process. However, the large majority of native woodland in the proposal site has been preserved due to a design aimed at minimizing clearing of native vegetation in the study area. This is most apparent with the preservation of all Western Grey Box Woodland within the proposal site.

The loss of large habitat trees or hollow-bearing trees is a long-term cost of projects such as these, because these features of the environment can take well over 100 years to form (Mackowski, 1984; Wormington & Lamb 1999). Loss of hollow bearing trees would offset by development and implementation of an Offset Management Plan.

The additional clearing impacts proposed would be minor and not likely to add substantially to cumulative impacts of native vegetation removal.

Construction traffic impacts include:

- Minimal increases in collision risks (other vehicles, stock and wildlife).
- Some incremental damage to road infrastructure.
- Associated noise and dust (where traffic is on unsealed roads) may adversely affect nearby receivers.
- Potential minor disruption to existing school bus services and farm vehicle movements.

A TMP would be prepared to take into account other road users including buses and tourist or trade events that may generate additional traffic impacts. It is noted that DPE's major projects register (DPE 2015) identifies that approval has been granted for development and operation of a Nickel Cobalt Mine and processing facility (Syerston Nickel Colbalt project) located approximately 110 km north of the proposed solar plant. The mine is not proposing to use any of the roads required for the proposal.

Amenity impacts would be managed through a consultation processes, including complaints mechanisms, whereby the sources of complaints are promptly identified and addressed. Although the construction process would be relatively long (18 months) these amenity impacts would be temporary and unlikely to be present equally at any one location. The construction activities and their location onsite would be changing throughout the construction process. Considering the distance to sensitive receivers and their

low numbers, the cumulative effect of these impacts is considered highly manageable. Cumulative construction impacts are considered to be best managed by managing well each component (dust, noise etc.) individually. Cumulative decommissioning impacts would be minor. Cumulative impacts would be managed at the time of decommissioning. Infrastructure developed during construction (e.g., access tracks) would be utilised during decommissioning.

Operation

During operation, potential cumulative impacts would relate to biodiversity and agricultural production.

An assessment of operational impacts on fauna, including bird populations has identified that operational hazards are unlikely to result in a significant impact on the bird populations. Overall, there are benefits gained by installing a 30 MW solar power plant. For instance, the proposal would counteract human-induced climate change, which Foden *et al*. (2013) and Garnett & Franklin (2014) conclude to be one of the most significant global threats to birds today.

Agricultural production from the proposal site would be affected during the operation of the solar plant. Following decommissioning, the existing forms of agricultural production (grazing and cropping) could resume. Existing land used for grazing and cropping could continue under the proposed transmission line during operation. Sheep grazing could potentially continue within the solar plant area, but would occur at reduced levels of production. A temporary reduction in agricultural production at the proposal site is not expected to have a major impact on the overall agricultural production from Jemalong Station or the Forbes areas.

6.11.3 Safeguards and mitigation measures

Cumulative impacts are best addressed through careful management of individual components, as set out in the sections above. No additional measures are considered to be required.

7. ENVIRONMENTAL MANAGEMENT

7.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposed solar plant would be managed by implementing a project-specific suite of mitigation measures detailed in Sections 5 and 6 and summarised in Section 7.2 of this EIS.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan (PEMP), consisting of a CEMP, an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). 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.

7.2 CONTRAINTS MAP

An environmental constraints map has been prepared for the proposal site. This map illustrates location of proposed infrastructure and site access. It overlays environmental aspects, including constraints with the proposed infrastructure. Environmental aspects include;

1. Site access
2. Nearest residents (sensitive receivers)
3. Drainage lines and water bodies
4. Aboriginal heritage sites
5. Vegetation communities

The Environmental Constraints Map is included as Appendix D.

7.3 MITIGATION MEASURES

Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Construction (C), Operation, (O), Decommissioning (D)

Ref	Safeguards and mitigation measures	C	O	D
	Biodiversity			
1	Clearing impacts would be minimised by: • A CEMP would be prepared including an erosion sediment control plan, vegetation management measures, a revegetation and weed management program, fauna management measures, and Work Methods Statements for all works within 10 m of the waterways occurring adjacent to the proposal site. All site workers should be inducted and made aware of the conservation issues and associated CEMP for the site. • Prior to the commencement of work, the clearing limit needs to be clearly demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar. • Pre-clearing surveys would be carried out by an ecologist and would include targeted surveys for nesting Superb Parrots, Grey-crowned Babblers, Brown Treecreepers and general tree hollow inspections where possible. They would include targeted searches for arboreal fauna and inspections of vegetation for other fauna occupancy. Habitat trees would be clearly marked with flagging tape. If active nests are found during clearing works, or hollows are being used by nesting birds or arboreal mammals, an ecologist or local wildlife carer should be contacted to remove the eggs, chicks or juvenile mammals to be hand-raised. • Trees would be removed in such a way as not to cause damage to surrounding vegetation. Root systems of trees and shrubs to be removed should be retained in-ground to ensure surrounding ground layer vegetation is undisturbed and to prevent soil erosion. • Where possible, trees to be removed would be mulched on-site and re-used to stabilise disturbed areas. • Where trees are to be retained, an adequate protection zone (TPZ) would be provided around each tree for the duration of construction. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. • If work cannot avoid encroaching into the TPZ, it would not impinge on the structural root zones (SRZ) of trees to be retained. Details for calculating the SRZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. • An unexpected threatened species finds procedure would be developed before clearing is begun.	X		

Ref	Safeguards and mitigation measures	C	O	D
2	Hollow bearing tree impacts would be minimised by: • Staged habitat removal for the removal of hollow-bearing trees would be undertaken where non-habitat vegetation would be cleared initially following a pre-clearing inspection by a qualified ecologist. Habitat trees would be disturbed by 'knocking' at this time and cleared at least 24 hours after. • Clearing of hollow-bearing trees would not take place between September and February, where possible. If clearing during this period cannot be avoided, an ecologist would be present on site to check all hollows for animals. If a hollow is being used by a threatened species (e.g. Superb Parrot), an exclusion barrier of appropriate distance (e.g. 30 m from the base of the tree) would be installed to prevent disturbance. If a hollow is being used by a species not listed under the TSC Act or EPBC Act, any animals present will be caught and either released into appropriate alternative habitat or taken to a wildlife carer.			
3	Residual impacts would be offset: • An Offset Management Plan would be developed and implemented to offset the loss of native vegetation, including hollow-bearing trees. This may include direct offsets or other strategies to improve biodiversity outcomes commensurate with the impacts of the project on native vegetation.		X	
4	To minimise impacts native vegetation outside the impact zone, stockpile and compound sites would be located using the following criteria: • Within the proposal site. • At least 40 m away from the nearest waterway. • In areas of low ecological conservation significance (i.e. previously disturbed land). • On relatively level ground. • Outside the 1 in 10 year Average Recurrence Interval (ARI) floodplain.			
5	A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites. This would include: • Declared noxious weeds would be managed according to the requirements stipulated by the *Noxious Weeds Act 1993* during and post construction • Develop protocol for weed hygiene in relation to plant, machinery and importation and management of fill • All pesticides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation. • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated and reported.	X	X	X

Ref	Safeguards and mitigation measures	C	O	D
6	Disturbance to habitat features would be minimised by: • Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.			
7	To minimise injuries to microbats and birds: • Use of barbed wire would be avoided.	X	X	
8	Implement feral animal management program, including species such as rabbits, rodents and starlings to reduce risk of attracting raptors.		X	
9	To manage risks to birds during operation, develop and implement an Adaptive Bird Hazard Management Plan to monitor and manage bird hazards during operation. The plan would include triggers to implement management actions, in response to unacceptable levels of impact or predictions of unacceptable impacts. It would include a set of feasible management actions that could be promptly implemented. A range of potential management actions are provided in Section 5.1 of Part 2 of the Biodiversity assessment and include: • Application of deterrents to dissuade use by birds of the site or sections of towers where monitoring identifies an unacceptable risk to target species • Restrictions on lambing near the site which could attract raptors • Tilting heliostats downwards at an angle from the vertical at night (between 20 and 40 degrees downward) to avoid their appearance as 'water bodies' • Use of reflective power line marking balls on transmission lines • Actions would be monitored and adapted to ensure their effectiveness. The program would operate until such time as risks are demonstrated to be low.		X	
	Aboriginal Heritage			
10	A Cultural Heritage Management Plan would be prepared to guide the process for management and mitigation of impacts to Aboriginal cultural heritage. This would be undertaken in consultation with a consulting archaeologist, the registered Aboriginal parties and the NSW Office of Environment and Heritage. The specific mitigation measures would include: • Development of a strategy of conservation with regard to any impacts (if any) within 100-200 m of the Thurumbidgee Lagoon. • Salvage excavation works with regard to any impacts within 100 m of Jemalong Locale 2.	Pre-construction		

Ref	Safeguards and mitigation measures	C	O	D
6	Disturbance to habitat features would be minimised by: • Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.			
7	To minimise injuries to microbats and birds: • Use of barbed wire would be avoided.	X	X	
8	Implement feral animal management program, including species such as rabbits, rodents and starlings to reduce risk of attracting raptors.		X	
9	To manage risks to birds during operation, develop and implement an Adaptive Bird Hazard Management Plan to monitor and manage bird hazards during operation. The plan would include triggers to implement management actions, in response to unacceptable levels of impact or predictions of unacceptable impacts. It would include a set of feasible management actions that could be promptly implemented. A range of potential management actions are provided in Section 5.1 of Part 2 of the Biodiversity assessment and include: • Application of deterrents to dissuade use by birds of the site or sections of towers where monitoring identifies an unacceptable risk to target species • Restrictions on lambing near the site which could attract raptors • Tilting heliostats downwards at an angle from the vertical at night (between 20 and 40 degrees downward) to avoid their appearance as 'water bodies' • Use of reflective power line marking balls on transmission lines • Actions would be monitored and adapted to ensure their effectiveness. The program would operate until such time as risks are demonstrated to be low.		X	
	Aboriginal Heritage			
11	Personnel involved in the construction and management phases of the project would be trained in awareness and procedures to implement recommendations relating to cultural heritage, as necessary.	X		
12	Cultural heritage would be included within any environmental audit of impacts proposed to be undertaken during the construction phase of the development.	X		
13	Additional archaeological assessment would be required in any areas which are proposed for impacts that have not been surveyed during the current assessment.	X		

Ref	Safeguards and mitigation measures	C	O	D
	Health and Safety			
14	All design and engineering would be undertaken by qualified, competent persons with the support of specialists as required.	X		
15	The findings from the PHA, HAZOP and HAZID studies are to be integrated into the remaining detailed engineering, design and procedures.	X	X	X
16	Procedures specific to the transportation, use and storage of chemicals and hazardous materials to be developed. This would include: • Storage of hazardous chemicals in a bunded area onsite and in accordance with the manufacturers requirements. • Only trained staff to use chemicals, in accordance with the manufacturers requirements. • Development of emergency response protocols, including: o in the event of widespread flooding, o to promptly identify and respond to pollution events, including EPA notification where required.	X	X	X
17	The power island and transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure to EMFs.	X		
18	Design of electrical infrastructure would minimise EMFs.	X		
19	Fencing around the power island would be maintained to limit public access.	X	X	X
20	The 30MW plant will be subjected to HAZOP and have detailed HAZID undertaken. The following measures are to be implemented: • Emergency Response Plan to recognise possibility of vapour cloud explosion (from LPG) in congested or confined areas. • Procedures for working around low oxygen environments. • Safety Management System to include safe storage and handling procedures for sodium.		X	
21	Emergency response plans should include specific details of preparations necessary to secure sodium in event of an impending flood.	X	X	X
22	Procedures for the management of sodium fires will be developed, including: • The site Safety Management System will address pre-incident planning for sodium fires. • Fire & Rescue NSW (Forbes Unit and Hazardous Materials Response Unit) to provide input into site Safety Management System. • Fire & Rescue NSW may consider upgrading their Local and Regional Emergency Management Plans to incorporate JSS1 (which would be Critical Infrastructure).	X	X	X

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
23	Minimise risk of flooding impacts by either raising infrastructure above a selected flood level or flood proof infrastructure below the 0.5 per cent AEP flood level.	Design / Pre-construction		
24	The thermal piping network will be protected by appropriate 'armouring' to prevent potential of flood debris impacting infrastructure.	Design / Pre-construction		
	Glare, glint and visual			
25	The results of the glare and glint modelling would be validated once the pilot plant is completed, to confirm several assumptions made by the assessment.	Pre-construction		
26	A Community Consultation Plan would be developed to manage impacts to community stakeholders, including but not limited to: Protocols to respond to any complaints received.	X	X	X
27	Should clusters of stand-by state heliostats be identified by complaints as producing unacceptable glare, staggering the location of the standby target would be investigated.		X	
28	Stagger the focal direction of heliostats in standby mode (not to target) to minimise potential for glare from a cluster of heliostats, if such glare is identified through complaints.		X	
29	Consult with neighbouring properties to west, north and east of the proposed solar plant in relation to potential glare from heliostats when not on target and adjust the focal direction of heliostats in standby mode, if such glare is identified through complaints.		X	
30	Additional screen planting in targeted boundary areas of the proposal site if heliostat glare experienced on neighbouring properties cannot be mitigated by adjusting focal direction of heliostats.		X	
31	Install shade material on security fence in targeted locations if heliostat glare experienced on neighbouring properties cannot be mitigated by adjusting focal direction of heliostats.		X	

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
32	Screen planting south of house area at V12 House 1 – Whispering Pines Lane to screen views to receiving towers.	X		
33	Locate new transmission line poles to minimise impacts of views from House 2 in Whispering Pines Lane.	X		
34	Select colours for above ground structures, including the construction site offices, sympathetic to the landscape character of the site.	X		
	Noise			
35	Works should be undertaken during standard working hours only. • Monday – Friday 7am to 6pm • Saturday 8am to 1pm No work on Sundays or public holidays	X		
36	All staff onsite should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	X	X	
37	A letter box drop would be prepared and provided to residences within 2km of the site. The letter would contain details of the proposal including timing and duration of construction and a contact details for a person for any enquiries or complaints. Plant would be operated in an effective manner to minimise noise such as by turning off plant which is not being used.	X	X	
38	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	X	X	
	Air Quality			
39	Protocols to guide vehicle and construction equipment use, to minimise emissions. This would include but not limited to Australian standards and (POEO Act).	X	X	X
40	Protocols to minimise and treat dust (water carts or similar in response to visual cues).	X		X
41	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	X	X	X
42	Development of emergency response protocols, to promptly identify and respond to pollution events, including EPA notification where required.	X	X	X
	Land use			
43	Consultation with Jemalong Station Farm Manager regarding any temporary impacts to access or risks to livestock. Additional specific mitigation may be required such as:	X		

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
	• Additional fencing to protect livestock from collision risks. • Vehicle speed restrictions on access roads.			
44	Removal of all above ground infrastructure and rehabilitation of areas disturbed during the operation of the plant. This may include specific remediation of evaporation ponds to restore landforms and vegetative cover.			X
	Socioeconomic and community			
45	The Community Consultation Plan would be implemented 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. • Complaints mechanisms to identify and respond to complaints.	X	X	
46	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	X		
47	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	X	X	X
48	Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	X	X	X
	Traffic, Transport and Road Safety			
49	A Traffic Management Plan would be developed with input from the road authorities, including but not limited to: • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • Carpooling/shuttle bus arrangements to minimise vehicle numbers. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts: bus schedules – i.e. school and local events (festivals, trade shows) and industry operations (such as mining). • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate	X		X

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
	procedures. • Avoiding use of Naroo Lane and Wilbertroy Lane during floods or after heavy periods of rain. • Consideration of any specific requirements of Dangerous Goods regulations			
50	A Haulage Plan would be developed with input from the roads authority, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic including buses). • Community consultation regarding impacts to school bus routes. • Traffic controls (signage and speed restrictions etc.). • Use of qualified hauliers for transport of Dangerous Goods. • Notify NSW Fire & Rescue of the transport routes and timing for transportation of sodium.	X		
51	The proponent would consult with Roads and Maritime Services in regard to use of the Wilbertroy Lane / Lachlan Valley Way intersection and requirement for upgrades, if any.	X		X
52	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.	X	X	X
	Resource use and waste			
53	A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	X	X	X
54	Septic system to be installed and operated in accordance with local Council requirements.	X	X	

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
55	Monitoring of the evaporation ponds for remediation or disposal of wastes offsite.		X	
	Fire and Bushfire			
56	Develop a Bush Fire Management Plan with input from the RFS to include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of *Planning for Bush Fire Protection 2006* - o Identifying asset protection zones o Providing adequate egress/access to the site (s4.1.3) o Emergency evacuation measures (s4.2.7). • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar plant.	X	X	X
	Historic Heritage			
57	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.	X	X	X
	Soil			
58	A soil and water management plan would be prepared, implemented and monitored during the project, in accordance with Landcom (2004), to minimise soil and water impacts. These plans would include provisions to: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Controls must be regularly inspected, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Minimise the area of disturbance from excavation and compaction • Ensure any discharge of water from the site is managed to ensure ANZECC (2000) water quality criteria are met,	X		X

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
	• Manage traffic generated soil erosion. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised and work ceased until the wet period had passed.			
59	Spill Response Plan would be developed as part of the overall Risk Management Plan to prevent contaminants affecting adjacent pasture and dams. It would: • 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).	X	X	X
60	A water cart (or other means) would be utilised to manage dust on all access roads and exposed dusty surfaces in response to visual cues and complaints.	X	X	X
61	Stockpiled topsoil and other materials that exhibit significant dust lift off would be wet down or covered to manage dust.	X		X
62	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored back to original condition or re-vegetated with appropriate species (native in native dominated areas).	X		
63	A contamination management plan would be developed to address: • Clean up of the existing farm rubbish site within the proposal site. • Procedure for discovering buried contamination within the proposal site (eg pesticide containers). Disposal would be at a facility able to accept the waste.	X		
	Water use and quality			
64	The Proponent will consult with EPA to determine whether any changes are required to Jemalong Station's EPL 5102.	X		
65	Concrete washout shall be carried out offsite or in concrete washout areas described in the Soil and Water Management Plan and identified on the ESCP.	X		X
66	Procedures for testing, treatment and discharge of construction waste water must be as described in the Soil and Water Management Plan.	X		X
67	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.	X	X	X
68	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	X	X	X

Ref	Safeguards and mitigation measures	C	O	D
	Hydrology including flooding			
69	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	X	X	X
70	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	X		X
71	A Groundwater Management Plan would be developed to manage impacts on groundwater. This would be informed by onsite geotechnical survey and include: • Pollution controls • Management of dewatering.	Preconst ruction		

8. CONCLUSION

This EIS identifies and assesses the environmental issues associated with the construction, operation and decommissioning of the proposed Jemalong Solar Station JSS1 30 MW Concentrating Solar Thermal Power Plant, in accordance with Part 4 of the NSW EP&A Act and the Schedule 2 of the EP&A Regulation.

The proposal would comply with relevant Commonwealth, State and local planning requirements. It would:

- Be sympathetic to landscape and potential environmental impacts.
- Contribute to greenhouse gas emission reduction and the move towards cleaner electricity generation.
- Assist to meet Commonwealth and NSW Governments reach Australia's RET and other energy and carbon mitigation goals.
- Demonstrate the value of large-scale, dispatchable renewable electricity generation (renewable energy with large-scale energy storage) and supply into the Australian electricity grid.
- Provide social and economic benefits during construction and operation of the solar plant.
- Provide a high value added land use to the host property, where the proposal would be operated.

Impact avoidance and minimisation measures have been incorporated into the design of the proposal. Accompanying this proposal is a set of project-specific mitigation measures. Key avoidance measures include siting the proposal on a site which optimises the use of natural screening and provides substantial buffers to surrounding residences and transport corridors, location of the proposed north-south transmission line east of a tree line to minimise visual and biodiversity impacts as well as retaining as many trees onsite as possible, to preserve habitat resources – a feature enabled by Vast Solar's modular CSP design. Key mitigation measures include screening of views and the requirement for maintenance and enhancement of community engagement and communications management plans including a complaints mechanism, whereby the sources of complaints can be promptly identified and addressed. These measures are considered practical and achievable by the proponent.

The detailed Hazard Analysis study conducted for the proposed facility has concluded that offsite safety risks are extremely low, easily satisfying the applicable land use safety planning criteria.

In light of the benefits of the proposal, its low level of expected environmental impacts and their reversibility, the proposal is considered to be ecologically sustainable and justified.

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