Renew Estate Pty Ltd

Bomen 120 MW Solar Farm
Environmental Impact Statement

April 2018

Certification

I certify that I have prepared the contents of this environmental impact statement in response to the Secretary's environmental assessment requirements dated 21 November 2017 and the relevant provisions of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. To the best of my knowledge the information contained in the environmental impact statement is not false or misleading.

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Signature: 

Date: 10/04/2018

Executive summary

The proposal

The proposal involves constructing, operating and eventually decommissioning a 120 megawatt (MWdc) (100 MWac) solar farm at Bomen, about seven kilometres north-east of the Wagga Wagga central business district (CBD) on the eastern side of Byrnes Road (referred to as the 'proposal'). The proposal would consist of the following components:

- about 400,000 photovoltaic solar modules
- about 4,500 trackers comprising single-axis tracking framing systems mounted on steel piles
- up to 44 containerised power conversion stations containing electrical switchgear, inverters and medium voltage transformers
- new on-site electrical switchyard and substation
- connection into the National Electricity Market (NEM) via about 3.5 kilometres of 132 kV transmission line between the proposed on-site substation and the existing TransGrid Wagga North Substation. The transmission line may be overhead or underground, or a combination of both, subject to detailed design
- battery storage system
- control building including office, supervisory control and data acquisition (SCADA) systems, operation and maintenance facilities, spare parts and staff amenities serviced by septic systems and rainwater tanks
- car park
- internal DC and AC cabling for electrical reticulation
- minor upgrade of the unsealed section of Trahairs Road, east of Byrnes Road, for site access (to be maintained as a single lane unsealed road)
- internal all-weather access tracks
- internal fire trail and bushfire asset protection zones
- security fencing around the solar farm
- vegetation screening – plantings along the site boundaries where required
- meteorological stations
- subdivision of the following lots to allow the purchase of the required land for the proposal site, as shown in the plans of proposed subdivision (see Appendix B):
  - Lot 11 DP 1130519
  - Lot 2 DP 590756
  - Lot 174 DP 751405
  - Lot 108 DP 751405.

Subject to planning and environmental approvals, the construction period is expected to be nine to 12 months from site establishment to commissioning, commencing in the third quarter of 2018.

The operational lifetime of the solar farm is about 30 years.

Decommissioning at the end of the operational life of the solar farm would involve removing all above ground infrastructure and rehabilitating the site to allow it to be used for other purposes.

The proposal is estimated to have a capital investment value of about $164 million.

Proposal need

At present, Australia has one of the world's highest greenhouse gas emissions per unit of electricity generated, with the majority of its power generated by aging coal-fired power plants. This position highlights the importance of ensuring an adequate supply of energy as our nation's fleet of coal-fired power stations approach the end of their operating lives, as well as providing an achievable pathway for decarbonising our economy to achieve our international climate commitments.

In November 2015, Australia committed to reducing its greenhouse gas emissions to 26 to 28 per cent below 2005 levels by 2030. The proposal would develop a renewable energy generation facility that would contribute towards reducing greenhouse gas emissions.

The NSW Renewable Energy Action Plan and Large-scale Renewable Energy Target incentives support the international commitment to reduce greenhouse gas emissions.

The Bomen Business Park has been identified an area of strategic industry growth and employment by Wagga Wagga City Council, and is intended to provide a transformative role for the region through the development of the proposed Riverina Intermodal Freight and Logistics Hub. The project provides the opportunity to significantly reduce power prices for current and future industries in the precinct, providing a potential catalyst for growth. Power prices are now regularly identified as a major concern to industry groups, and a growing threat to NSW industry and employment.

Key environmental issues

Aboriginal heritage

A total of eight Aboriginal heritage items are located within the extent of the solar development area. These items would be impacted by the project. The proposal has the potential to impact up to three additional items depending on the final transmission line alignment. Impacts on Aboriginal heritage would be managed by implementing an Aboriginal Cultural Heritage Management Plan. The proposal has also avoided impacts to a known scarred tree located within the proposal site.

Biodiversity

The majority of the proposal site has been extensively used for cropping and grazing and is largely devoid of native vegetation. Two NSW plant community types are present in the proposal site, which are consistent with White Box Yellow Box Blakely's Red Gum Woodland, listed as an endangered ecological community under the BC Act. Paddock trees and plantings are present within the proposal site. The proposal would impact on native vegetation, however impacts have been and will continue to be minimised through ongoing design development. The removal of paddock trees and planted trees would result in a minor reduction in biodiversity values in the study area. The proposal is unlikely to result in any significant impacts on any listed flora, fauna or ecological communities.

Landscape and visual impacts

The proposal would be visible from locations in the surrounding area. A change in elevation from east to west results in large parts of the proposal site being visible from properties to the east. Tree plantings and remnant vegetation in the proposal site provide some screening from the surrounding sensitive receivers. Planting is proposed along parts of the northern, eastern and southern boundaries of the proposal site to provide additional screening. To the extent there are overhead sections, the visual impact of the proposed new transmission line (for both corridor options) will be minimised where possible. The new transmission line will run to the North Wagga substation in the same general direction as an existing transmission line adjacent to the proposal site which will help ensure consistency with the existing character of the area.

Hazard and risk

The proposal involves a number of potential hazards that carry risks associated with asset damage, environmental damage and personal injury. The proposal could cause bushfire during construction/decommissioning or operation. Lithium-ion batteries can pose unique safety hazards since they contain a flammable electrolyte. These risks would be managed by implementing the identified safeguards and mitigation measures.

Noise and vibration

During construction, the proposal is likely to result in some exceedances of noise management levels at nearby residences. These impacts would be minimised by implementing the identified mitigation measures. No sleep disturbance impacts are anticipated on the nearby residents during night-time construction works. No adverse vibration impacts to sensitive receivers are anticipated. Operational noise levels are predicted to comply with the noise criteria at the nearest sensitive receivers during all assessment time periods.

Land use and land capability

The proposed solar farm development areas are on land zoned IN1 General Industrial. These areas are currently being used for agricultural purposes including cropping, awaiting industrial development. During the operational stage of the project, it is intended that some agricultural value in the form of sheep grazing will be retained. This practice is used at solar farms to control vegetation below the photovoltaic modules.

Easement acquisition for the transmission line would occur through negotiation with the relevant landowners and would not result in any unreasonable land use impacts.

The proposal is considered unlikely to cause any substantial conflicts with other land uses.

Traffic, transport and access

It is anticipated that Byrnes Road and Trahairs Road can accommodate the construction vehicle activity associated with the proposal for the following reasons:

- Byrnes Road is currently operating well within its functional mid-block capacity, with bi-directional traffic flows of up to 472 vehicles per hour and a capacity of approximately 1,410 vehicles per hour.
- at its intersection with Trahairs Road, Byrnes Road provides a rural auxillary left turn lane (AUL) and right turn lane (AUR) to allow through vehicles to pass vehicles turning into Trahairs Road
- a minor upgrade of Trahairs Road would be carried out as described above to make it suitable for use by heavy vehicles during construction.

The low number of vehicle movements generated by the proposal during operation would be unlikely to have an adverse impact on the local road system and would be within the typical daily fluctuations in traffic.

Hydrology, groundwater and water quality

The existing runoff characteristics of the proposal site will be maintained throughout the operation of the proposal. This will be achieved through maintaining groundcover beneath the solar arrays and through implementing design measures as necessary to mitigate any significant runoff impacts, such as the establishment of dams, vegetation, retention basins, infiltration trenches or swales. Water quality impacts during operation are considered to be minimal as the site would be stabilised following construction.

Electric and magnetic fields

The proposed solar farm and transmission line would generate electric and magnetic fields. Due to their distance from the nearest sensitive receivers, all components of the proposal are likely to comply with limits for both public and occupational exposure. Potential risks in relation to electric and magnetic fields would be managed through the detailed design process.

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 chapter 6 and summarised in section 7.2 of this EIS.

All commitments and environmental safeguards would be managed by implementing a project environmental management plan, consisting of a construction environmental management plan, an operational environmental management plan and a decommissioning environmental management plan. These plans would be prepared sequentially and submitted to the Department of Planning and Environment, prior to each stage of works commencing.

Conclusion

This EIS has assessed the potential impacts of the proposal and concludes that it is unlikely to result in any significant environmental impacts provided the recommended safeguards and mitigation measures are implemented. The proposal site has been modified by previous land uses, which have cleared most remnant vegetation from the site. The proposal would minimise the need to clear native vegetation. The proposal would contribute to NSW and Commonwealth government commitments to increase the proportion of electricity that is generated by renewable energy technologies.

This report is subject to, and must be read in conjunction with, the limitations set out in section 11.1 and the assumptions and qualifications contained throughout the report.

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1. Introduction

1.1 Purpose and scope of this document

Renew Estate proposes to develop a 120 megawatt (MWdc) (100 MWac) solar farm at Bomen, about seven kilometres north-east of the Wagga Wagga central business district (CBD) on the eastern side of Byrnes Road (referred to as the 'proposal').

The proposal requires development consent from the Minister for Planning under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This Environmental Impact Statement (EIS) has been prepared to support the development application and identifies and assesses the environmental issues associated with the proposal. The EIS addresses the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and Section 79C of the EP&A Act. It also addresses the Secretary's Environmental Assessment Requirements (SEARs) which were provided on 21 November 2017 by the Department of Planning and Environment (refer to Appendix A for a copy and detail of where each SEAR is addressed in this document).

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

1.2 Location and context

1.2.1 Location of the proposal site

The proposal site is located at Bomen about seven kilometres north-east of the Wagga Wagga CBD on the eastern side of Byrnes Road. Bomen is a suburb of Wagga Wagga, comprising industrial, rural and residential areas. The location of the site is shown in Figure 1.1.

The proposal site (shown in Figure 1.2) is about 276 hectares in size of which the disturbance area is about 274 hectares. Renew Estate has a call option with the landowner to purchase the following land on which the proposed solar farm is to be located:

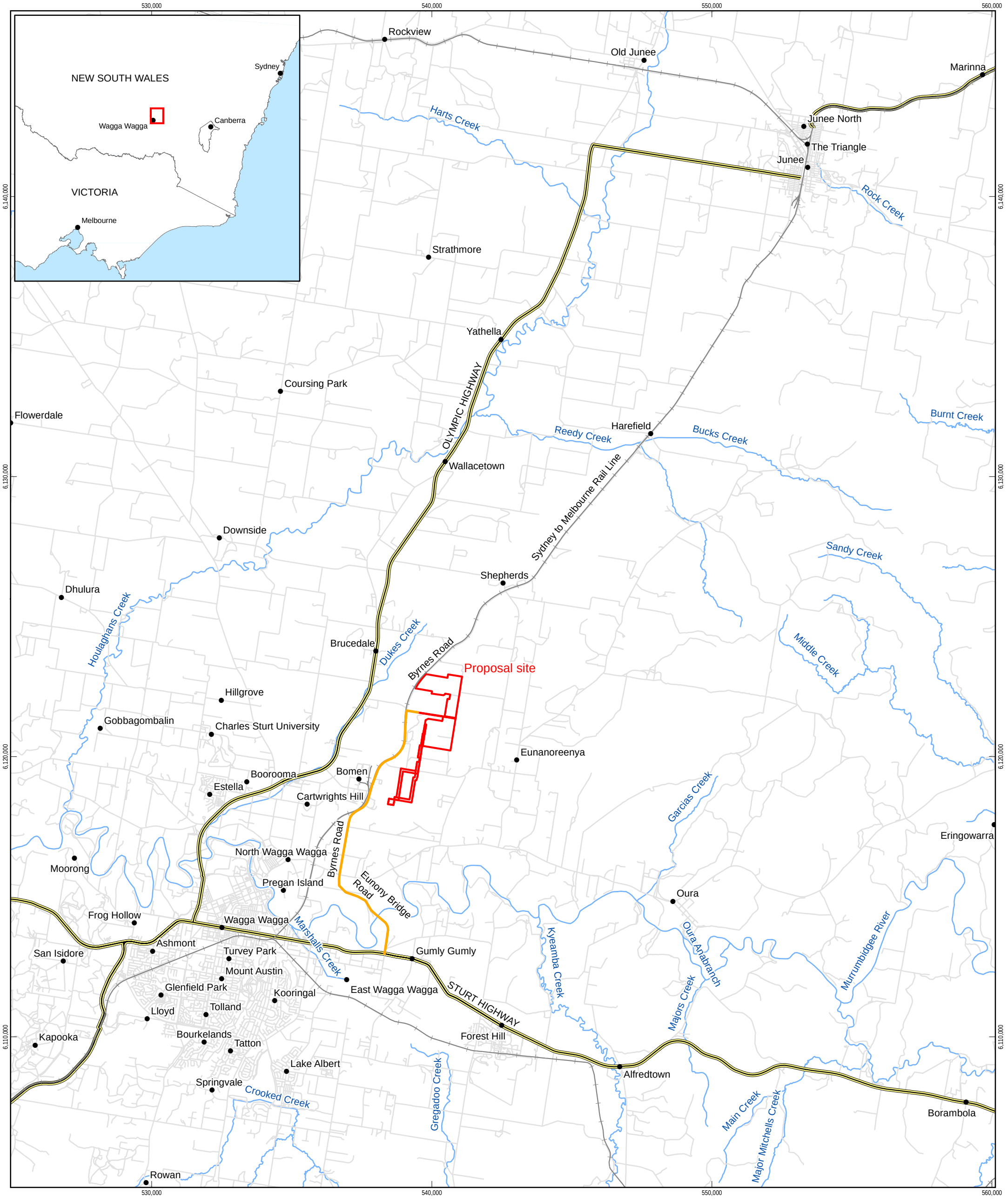
- Lot 11 DP1130519 (part)
- Lot 2 DP590756 (part)
- Lot 174 DP751405 (part)
- Lot 108 DP751405 (part)
- Lot 110 DP751405
- Lot 109 DP751405.

Subdivision of the first four lots listed above is proposed as part of this application, to allow for the purchase of the required land for the proposal site (see sections 3.2.15 and 5.2.2).

An easement would be acquired across the following lots for the transmission line:

- Lot 3 DP594679 (part)
- Lot 22 DP1085826 (part)
- Lot 1 DP1115229 (TransGrid Wagga North substation).

The proposal site is within the Wagga Wagga Local Government Area (LGA). Access to the site is currently via the eastern section of Trahairs Road, off Byrnes Road.



LEGEND

- Locality
- Rail line
- Highway
- Road
- Primary access route from Sturt Highway
- Stream
- Proposal site

Paper Size A3

0 1 2 4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 09 Feb 2018

Site location

Figure 1.1

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Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Localities, streams and roads - 2012. Created by:rtrobinson

538,000 539,000 540,000 541,000

6,123,000 6,122,000 6,121,000 6,120,000 6,119,000

Olympic Highway
Sydney to Melbo
Dukes Creek
Trahairs Road
Byrnes Road
Dampier Street
Dunns Road
East Bomen Road
Windmill Road

R04 R05 R12 R13 R14 R15 R16 R17 R94 R08 R09 R10 R11

Note: The disturbance within the existing 30m transmission easement is proposed to be limited to the contruction of internal roads and cabling and will be agreed with the easment owner

Lot 11 DP1130519
Northern solar farm development area
Lot 2 DP590756
Riverina Oils & BioEnergy
Former Riverina Wool Combing effluent ponds
Lot 12 DP1130519
Lot 108 DP751405
Central work area
Control building
Minor unsealed road upgrade
Hardstand compound area
Battery storage
Substation
Lot 110 DP751405
Lot 1 DP771340
Lot 174 DP751405
Former Riverina Wool Combing facility
Lot 109 DP751405
Southern solar farm development area
Enirgi power storage recycling
Lot 3 DP594679
Enirgi administration building
Transmission line corridor
Lot 2 DP594679
Option 1
Option 2
Lot 22 DP1085826
Lot 15 DP1108978
Lot 2 DP1228221
Lot 1 DP1115229
Proposed connection to TransGrid Wagga North Substation

Note: The disturbance within the existing 20m gas pipeline easement is proposed to be limited to the contruction of internal roads and cabling and will be agreed with the easment owner

LEGEND

- Proposal site
- Residence
- Industrial
- Existing transmission line
- Disturbance area
- Indicative subtransmission line under construction
- Existing subtransmission line
- Existing gas pipeline
- Highway
- Road
- Drainage line/stream
- Rail line
- Indicative pipeline easement
- Indicative subtransmission line easement
- Lot boundary
- Dam
- Wagga Wagga Biodiversity Certification Area
- Control building
- Battery storage
- Hardstand compound area
- Substation
- Central work area
- Vegetation to be protected
  - Covenant
  - Development Control Plan

Paper Size A3
0 200 400 800
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 10 Apr 2018

The proposal

Figure 1.2

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig1-2.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Hydrolines, rail lines, lot boundaries and roads - 2012 and aerial photograph - 2017; TransGrid: Transmission lines - 2017; Essential Energy: Subtransmission lines - 2017; APA Group: Gas pipeline - 2017; Wagga Wagga City Council: Vegetation protection areas - 2017. Created by:afoddy

1.2.2 The proposal site

The proposal site (see Figure 1.2) comprises about 276 hectares of land used for agriculture. Within the proposal site, the potential disturbance area is 274 hectares. Land surrounding the site is used for industrial, agricultural and residential purposes. Services and infrastructure in and around the proposal site include roads, a rail line, electricity transmission lines and a gas pipeline. Easements on the proposal site include (see Figure 1.2):

- an existing Essential Energy 66 kilovolt (kV) subtransmission line and a new 132 kV subtransmission line, which is currently being built to replace the 66 kV subtransmission line. The subtransmission lines traverse the northern solar farm development area and connect to the TransGrid Wagga North Substation
- two parallel buried 450 mm high pressure gas pipelines traversing the southern and northern solar farm development areas
- an AAPT fibre optic telecommunications cable that runs parallel to the existing gas pipelines
- a 132 kV transmission line in the vicinity of the TransGrid Wagga North Substation
- various transmission lines and water services that traverse the proposed transmission line corridor options.

An Enirgi administration building is located on the western side of the proposed transmission line alignment in Lot 3 DP 594679 (see Figure 1.2). This facility is typically used by up to eight Enirgi employees.

Other industrial facilities surrounding the proposal site include (see Figure 1.2):

- Riverina Oils and Bio Energy (ROBE) industrial facility (oilseed crushing and refining) at the Byrnes Road/Trahairs Road intersection, west of the proposed northern solar farm development area
- former Riverina Wool Combing facility and effluent ponds north and south of Trahairs Road, west of the proposal site
- Enirgi power storage recycling facility west of the proposed transmission line in Lot 3 DP 594679.

Native vegetation has been cleared from the majority of the site for agriculture. Vegetation is limited to isolated patches of planted and remnant trees, and remnant paddock trees. Some of these have been identified for conservation under the *Wagga Wagga Development Control Plan 2010* (see Figure 1.2). These areas would be protected, as required to comply with the Wagga Wagga Biodiversity Certification. Plantings and remnant vegetation are also located along a number of the site boundaries and internal paddock boundaries. Large plantings are present in the vicinity of Trahairs Road and the decommissioned Riverina Wool Combing effluent ponds, outside the proposal site.

Figure 1.3 shows a representative view of the agricultural cropping land in the proposal site. The site also contains scattered trees and plantings of native trees along paddock boundaries. Figure 1.4 shows views looking north across the proposed southern solar farm development area towards the nearby ROBE industrial facility. This photo also shows plantings near Trahairs Road and the decommissioned Riverina Wool Combing effluent ponds.

Three ephemeral drainage lines run from west to east through the central and southern portions of the proposal site. Six farm dams are located in the proposal site, with four dams on, or near these drainage lines (see Figure 1.2). One of the dams captures runoff from the Enirgi administration building site. The site does not contain any permanent watercourses. A

photograph of a dam located in the south-eastern corner of the proposed southern solar farm development area is shown in Figure 1.5.

Figure 1.3: View in northern solar farm development area looking south

The proposal site does not contain any residences. The nearest residences are homesteads associated with rural properties, including (see Figure 1.2):

- a residence about 465 metres south of the proposed southern development area and 785 metres east of the transmission line option 2 alignment
- a residence about 640 metres south of the proposed southern development area and 1.1 kilometres east of the transmission line option 2 alignment
- two residences about 980 metres east of the southern end of the transmission line option 2 alignment
- a residence about 490 metres south of the southern end of the transmission line option 2 alignment.

Figure 1.4: View in southern solar farm development area looking north towards ROBE facility

Figure 1.5: Farm dam located in the south-eastern corner of the proposed southern solar farm development area

1.3 Overview of the proposal

The proposal involves developing a 120 MWdc solar farm at Bomen, about seven kilometres north-east of the Wagga Wagga CBD. The four main development areas are shown in Figure 1.7 and include:

- northern solar farm development area
- southern solar farm development area
- minor upgrade of the unsealed section of Trahairs Road
- transmission line corridor, including alignment options 1 and 2.

An indicative layout of the project is provided in Figure 1.6. This layout is indicative only and will be further developed based on the final equipment selections and detailed design. Subject to final detailed design, the primary components of the proposal include:

- about 400,000 photovoltaic solar modules
- about 4,500 trackers comprising single-axis tracking framing systems mounted on steel piles
- up to 44 containerised power conversion stations containing electrical switchgear, inverters and medium voltage transformers
- new on-site electrical switchyard and substation
- connection into the National Electricity Market (NEM) via about 3.5 kilometres of 132 kV transmission line between the proposed on-site substation and the existing TransGrid Wagga North Substation. The transmission line may be overhead or underground, or a combination of both, subject to detailed design. For the purpose of assessment in this EIS, it is assumed the entire transmission line would be overhead, as this would have greater environmental impacts than underground construction
- battery storage system
- control building including office, supervisory control and data acquisition (SCADA) systems, operation and maintenance facilities, spare parts and staff amenities serviced by septic systems and rainwater tanks
- car park
- internal DC and AC cabling for electrical reticulation
- minor upgrade of the unsealed section of Trahairs Road, east of Byrnes Road, for site access (to be maintained as a single lane unsealed road)
- internal all-weather access tracks
- internal fire trail and bushfire asset protection zones
- security fencing around the solar farm
- vegetation screening – plantings along the site boundaries where required
- meteorological stations
- subdivision of the following lots to allow the purchase of the required land for the proposal site as shown in the plans of proposed subdivision (see sections 3.2.15 and 5.2.2 and Appendix B):
  - Lot 11 DP 1130519
  - Lot 2 DP 590756

– Lot 174 DP 751405

– Lot 108 DP 751405.

The single-axis tracking structures would orient the solar modules to follow the sun from east to west each day. The structures would be mounted on piles driven into the ground.

Groundcover vegetation would be managed by sheep grazing where possible, in conjunction with the measures detailed in bushfire management and environmental management plans.

The on-site substation would be in the north-western corner of the southern solar farm development area, shown in Figure 1.2. The connection to the electricity network would be through the existing TransGrid Wagga North Substation via a proposed 132kV transmission line about 3.5 kilometres long. Final design would comply with TransGrid and the Australian Energy Market Operator (AEMO) specifications.

Subject to planning and environmental approvals, the construction period is expected to be nine to 12 months from site establishment to commissioning, commencing in the third quarter of 2018.

The operational lifetime of the solar farm is about 30 years.

Decommissioning at the end of the operational life of the solar farm would involve removing all above ground infrastructure and rehabilitating the site to allow it to be used for other purposes.

The proposal is estimated to have a capital investment value of about $164 million.

Renew estate.

Renew Estate
Bomen 120 MWp solar farm EIS

4 April 2018

Indicative Layout

Figure 1.6

NOT FOR CONSTRUCTION

538,000 539,000 540,000 541,000

6,123,000 6,122,000 6,121,000 6,120,000 6,119,000 6,118,000

Olympic Highway
Dukes Creek
Sydney to Melbourne Rail Line
Sutherlands Road
Northern solar farm development area
Trahairs Road
Trahairs Road
Minor unsealed road upgrade
Byrnes Road
Southern solar farm development area
Transmission line corridor
East Bomen Road
Option 1
Option 2
Webb Street
Lewington Street
Bomen Road
Jersey Street
Dunns Road
Windmill Road

LEGEND

- Highway
- Road
- Drainage line/stream
- Dam
- Northern development area
- Southern development area
- Trahairs Road corridor
- Transmission line corridor

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Main development areas of proposal

Job Number	23-16243
Revision	0
Date	06 Apr 2018

Figure 1.7

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig1-6 Main development areas.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Hydrolines, rail lines and roads - 2012 and aerial photograph - 2017. Created by:jrbacani

1.4 The proponent

Renew Estate is developing medium to large scale renewable energy projects while maintaining a position on strong community values. Renew Estate is passionate about meeting the goals of all stakeholders and delivering appropriate and considerate uses of land, technology and investment. Renew Estate's goal is to embed sustainable energy into rural and urban lifestyles while enhancing energy security and affordability. Renew Estate develops utility scale solar farms that are flexibly designed to work with the natural and built environments.

Wirsol Energy (subsidiary of WIRCON Group) is Renew Estate's largest shareholder. The WIRCON Group is a globally operating group of companies that specialise in the development, construction and operation of photovoltaic systems (ground and rooftop mounted) and wind farms.

WIRCON can demonstrate significant know-how through its engineering of more than 850 MWp of installed power that is of the highest quality. WIRCON consistently uses state-of-the-art technology.

Beast Solutions is also a shareholder of Renew Estate. The Beast Solutions team brings high-end consultancy experience to a small personable consultancy practice. The team provides advisory, due diligence and design management support for property and renewable generation developments, low carbon precincts, smart grids and microgrids. Beast Solutions has played a key role in some of the most advanced and recognisable projects in the field.

1.5 Structure of this environmental impact statement

This EIS has the following structure:

- chapter 1 – Introduction – provides a broad overview of the proposal and where it is located
- chapter 2 – Strategic justification – provides an overview of the need for the proposal, the objectives of the proposal and the options and alternatives considered during the proposal's development
- chapter 3 – Proposal description – provides a detailed description of the proposal during the construction, operation and decommissioning phases
- chapter 4 – Stakeholder consultation – outlines the consultation activities undertaken, issues raised and how these have been addressed
- chapter 5 – Planning context – outlines the statutory requirements and explains the steps in the assessment and approval process
- chapter 6 – Environmental assessment – identifies the key environmental issues, assesses the impacts and proposes environmental management measures
- chapter 7 – Environmental management – outlines the environmental management processes for the proposal and also provides a consolidated list of mitigation measures proposed in Chapter 6
- chapter 8 – Conclusion
- chapter 9 – References
- chapter 10 – Glossary and abbreviations
- chapter 11 – Information about this report.

2. Strategic justification

2.1 Proposal need

2.1.1 Supporting regional development, employment and industry

Supporting local industry

Significant increases in the cost of energy over recent years have been paralleled by significant reductions in the cost of renewable energy technologies, providing industry with the opportunity to secure energy cost savings while improving its carbon footprint (Finkel *et al* 2017).

Power prices are now regularly identified as a major concern to industry groups, and a growing threat to NSW industry and employment; for example, the recent Energy Shock report, Australian Industry Group (AIG 2017).

Wagga Wagga City Council (Council) has identified the Bomen Business Park as an area of strategic industry growth in a number of strategy and planning documents, including the Bomen Strategic Master Plan (WWCC 2009), Draft Activation Strategy 2040 (WWCC 2017a), and the Riverina Intermodal Freight and Logistics Hub Program Background Document (WWCC 2017b). These documents highlight Council's vision for creating a thriving industrial precinct which will leverage benefits from its location, accessibility and infrastructure. It will have opportunity to be supplied with economically and environmentally sustainable infrastructure for transport, energy, communications and resources. In particular, Council's current Draft Activation Strategy includes planning for a solar farm in the precinct.

The proposal would support Council's vision of establishing an industrial area to support local industry by providing an abundant and low-cost energy supply. Figure 2.1 illustrates Renew Estate's preliminary analysis of the current and future energy demands for the precinct and the current supply constraints. The figure shows that the current industrial load in the Bomen Business Park is about 25 MVA, with up to 60 MVA available through the local Essential Energy substation. The expected growth of the Bomen Business Park will require a supply of about 160 MVA (based on the current energy density). The proposal would establish a supply of approximately 100 MVA to the precinct, enabling provision for the precinct's growing demands and mitigating future supply risks.

Renew Estate has engaged with neighbouring industrial entities in the Bomen Business Park, who have expressed their concerns regarding the impact of energy prices on their operations, and their interest in securing a more affordable energy supply from the proposal. The proposal has the ability, and intent, to supply power to the Bomen industrial users at a significantly lower cost than is currently achievable.

There are a number of mechanisms by which the industrial businesses based in the Bomen Business Park, and those further afield, could directly benefit from the low-cost energy source created by the proposal. The simplest method is via a direct cable (private wire) connection to their premises, with the solar feed-in sized to meet the industrial load. The construction of direct cable connections is not sought as part of this application, and would be subject to either a separate planning approval or subsequent modification of the SSD consent. For industrial users further afield, the energy can be provided through a power-purchase agreement mechanism. Under this mechanism, users will contract power from the solar farm and use an energy retailer to perform the function of 'transmitting' the energy from the solar farm to the local load (using the existing electrical network). This would be subject to retailer and network charges. Under a power-purchase agreement, large and small energy users from across the region could benefit from a low-cost energy contract with the solar farm.

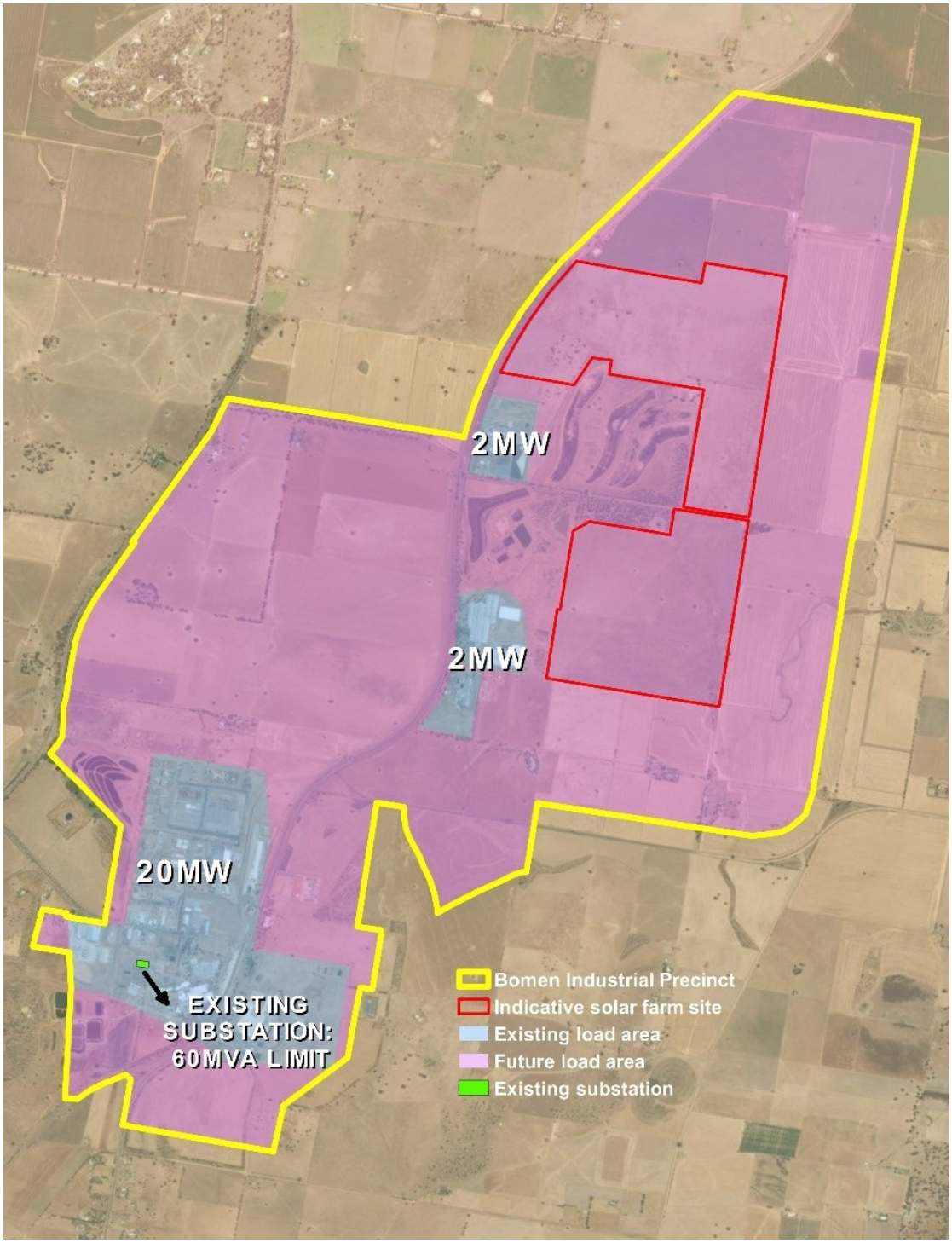

Figure 2.1: Current and future energy loads

In addition to the opportunity to secure a low-cost energy source, all energy users in the region may benefit from reduced 'loss factors' from sourcing energy across the distant electricity network. 'Loss factors' are charged by energy retailers to reflect the additional energy that must be purchased at the source to account for the transmission losses along the way. Locating a solar farm in the heart of the Bomen Business Park could substantially reduce loss factors associated with supplying electricity to this precinct.

By establishing a source of low-cost power in the heart of the Bomen Business Park, the proposal would reduce the energy cost burden faced by local business and improve the competitive advantage of local industry. Other industrial users in the region would also have the potential to benefit from the proposal through purchasing agreements and reduced loss factors.

Contribution to regional development and employment

The proposal would contribute to regional development and employment, and ongoing economic benefits to the local region. The Wagga Business Survey (WWCC 2010) identified a broadly skilled and strong industrial sector, which would be well-placed to benefit from the proposal through its delivery and operation. Local supporting industries such as freight and logistics, hospitality and business services sectors are also expected to benefit.

While Council's three-year economic development strategy is currently being drafted, other NSW regional councils have identified a strategic intent to attract investment and create new employment opportunities to manage a transition to a more skilled workforce (eg the Yass Valley Council Economic Development Strategy (YVC 2014)). Renewable energy infrastructure projects attract significant regional investment and have the potential to create lasting employment and skills in regional areas.

2.1.2 Reducing air pollution

According to the World Health Organization (WHO), air pollution remains one of the world's greatest threats to human life, with approximately 6.5 million deaths occurring each year due to air pollution – greater than the number from HIV/AIDS, tuberculosis and road injuries combined. Air pollution also results in major costs to the economy and damage to the environment (IEA 2016). Recent studies have shown an increase in global deaths from fine particulate air pollution, of which coal is a major source, from approximately 3.5 million in 1990 to 4.2 million in 2015 (DEA 2017).

In Australia, it has been estimated that more than 3,000 Australians die premature deaths each year from air pollution. A 2013 Commonwealth Senate Committee inquiry concluded that despite improvements in Australian air quality over the last two decades, air quality is still a significant problem in many parts of Australia. Some communities are much more affected than others, depending on how close they are to pollution sources (EJA 2014).

The proposal would assist in reducing the levels of air pollution in Australian communities. The provision of pollution-free, renewable energy into the National Electricity Market will displace other sources of harmful, pollution intensive emissions, such as coal-fired generation.

2.1.3 Alignment with energy and climate change policy objectives

National electricity supply

In Australia, approximately 87 per cent of our electricity generation comes from fossil fuel-based generation, making our nation ranked as one of the highest levels of fossil fuel generation (AEC 2016). This position highlights the importance of ensuring an adequate supply of energy as our nation's fleet of coal-fired power stations approach the end of their operating lives, as well as providing an achievable pathway for decarbonising our economy to achieve our international climate commitments.

The Australian Department of Resources, Energy and Tourism defines energy security as "the adequate, reliable and competitive supply of energy to support the functioning of the economy and social development" (DRET 2011). A National Energy Security Assessment carried out in 2011 (DRET 2011) found that Australia's energy security was 'moderate'. In addition, significant amounts of new capacity will be needed over the medium to long term to compensate for the retirement of emissions intensive coal plants and to help achieve emissions reduction targets.

The vulnerability of our nation's reliance on aging coal-fired power generation has been highlighted in recent months, with the failure of four coal units in a single week of December 2017. Reports of failures at the Eraring power station (a 700MW unit) in NSW, Milmerran power

station (a 420MW unit) in QLD, Mt Piper power station (a 700MW unit) in NSW and Loy Yang A Power Station (560MW unit) in VIC, were identified over week-long high temperatures and demands (Renew Economy 2017). Without the introduction of new supply, these aging assets will likely pose a continuing, and increasing, risk of energy security for our nation.

Significant increases in energy prices in recent years have impacted both households and industry. Renewable energy projects are seen as a key mechanism for putting downward pressure on these wholesale energy prices (AEMC 2016).

International commitment to reduce greenhouse gas emissions

Scientists around the world widely acknowledge that human activity is resulting in the release of large amounts of greenhouse gases that trap the sun's heat in our atmosphere and upset the balance of our climate. This acknowledgement was demonstrated in the historic global agreement to tackle climate change in November 2015 at the COP21 conference in Paris. At the conference, Australia committed to reducing its greenhouse gas emissions to 26 to 28 per cent below 2005 levels by 2030.

The Kyoto Protocol is an international agreement that was created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The then Australian Prime Minister signed Australia's instrument of ratification of the Kyoto Protocol in 2007, which committed Australia to reducing its collective greenhouse gas emissions.

Commonwealth renewable energy targets

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

This target was revised and from January 2011 an expanded target was to provide 45,000 GWh of additional renewable energy by 2020. The MRET was split into two components:

- Small-scale Renewable Energy Scheme
- Large-scale Renewable Energy Target (LRET).

This was to ensure that adequate incentives were provided for large scale grid connected renewable energy. The LRET aims to create a financial incentive to establish and increase the capacity of renewable energy power stations, such as wind and solar farms, or hydro-electric power stations by creating large-scale generation certificates.

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

In 2016, the findings of the Progress and status of the Renewable Energy Target report (CEC 2016), undertaken by the Clean Energy Council, found that approximately half of the RET had been met to date, requiring approximately 6 gigawatts (GW) of capacity of new renewables projects by 2020.

To meet the LRET of generating 33,000 GWh of renewable electricity annually by 2020, around 3,000 MW needed to be committed in 2017 and an additional 1,000 MW in 2018 (CER 2017). The proposal would commence generating 120 MW annually in early 2019, contributing to the 2020 LRET.

Federal support for renewable energy

At present, Australia has one of the world's highest greenhouse gas emissions per unit of electricity generated, with the majority of its power generated by aging coal-fired power plants (AEC 2016). The REAP and LRET incentives are supported at the federal level by grant programs from the Australian Renewable Energy Agency (ARENA), and financing programs from the Clean Energy Finance Corporation.

NSW Climate Change Policy Framework

In September 2013, the NSW Government released the NSW Renewable Energy Action Plan (REAP) to guide NSW's renewable energy development and to support the former national target of 45,000 GWh of additional renewable energy by 2020. The NSW Government's vision is for a secure, reliable, affordable and clean energy future for the state. The Plan positions the state to increase energy from renewable sources with least cost to the energy customer and with maximum benefits to NSW. The strategy is to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in NSW.

The NSW Climate Change Policy Framework (OEH 2016) aims to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current emerging international and national policy settings and actions to address climate change.

The framework is implemented through the following documents:

- 'Climate Change Fund Draft Strategic Plan'
- 'A Draft Plan to Save NSW Energy and Money'.

The NSW Government's ambition is to achieve net-zero emissions by 2050, as outlined in the policy framework and the supporting documents. The proposal, along with other renewable energy sources, would assist in meeting this objective by 2050. The ongoing development of further renewable energy projects, including solar farms, is considered to be one of the key ways in which the net-zero emissions target can be met.

2.1.4 Other plans and strategies

Riverina Murray Regional Plan

The Bomen locality is referenced in the Riverina Murray Regional Plan (DP&E 2017) as the home of the Bomen Business Park, which has been identified as a future significant contributor to regional jobs and economic growth. The Plan supports the development of the Bomen Business Park as a priority for the Wagga Wagga area, as well as the need to protect industrial areas from the encroachment of growing cities, and potentially incompatible surrounding land uses.

Wagga Wagga City Council Draft Activation Strategy

The Bomen locality is referenced in Council's Draft Activation Strategy (WWCC 2017a), which identifies the Bomen Business Park as being a key source of economic growth and jobs for the city, through its development and investment. The Strategy also aims to position Wagga Wagga as a "smart city" and home to innovation and new technology as a draw for talent and investment. This will help create higher quality and sustainable jobs, deliver higher business competitiveness and profitability, and act as a signal that the city is a modern and agile economy and a great place to do business. The Strategy specifically identifies a solar farm as one of the key features of the Bomen Business Park.

Bomen Strategic Master Plan

The Bomen locality is referenced in the Bomen Strategic Master Plan (WWCC 2009) and the Riverina Intermodal Freight and Logistics Hub Program Background Document (WWCC 2017b), which identifies the vision of the precinct to be a high-quality and nationally renowned place for transport and logistics-based enterprises and nurture a more sustainable city and Riverina Region. The Master Plan also outlines a vision of Bomen's future as one of the most resource and energy efficient places of business nationally and supplied with infrastructure for transport, energy, communications and resource and materials.

Summary

The proposal demonstrates alignment with all three of the strategic planning documents above by supporting the development of an innovative, well-resourced and flourishing industry hub in Bomen. The proposal would provide a low-cost energy source for local industry and alleviate future energy supply constraints likely to emerge as the precinct develops.

The proposal would be compatible with surrounding land use in the precinct, which will draw investment, development, jobs, new technologies and opportunities for local business. The proposal therefore supports and implements the strategies outlined in Council's strategic plans. It would provide essential infrastructure to support the growth and longevity of the Bomen Business Park.

2.2 Proposal objectives

The objectives of the Bomen Solar Farm proposal are to:

- select and develop a site which is suitable for industrial scale solar electricity generation
- assist the NSW and Commonwealth governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals
- develop a proposal which is acceptable to the local community
- provide local and regional employment opportunities and other social benefits during construction and operation
- provide a clean and renewable energy source to assist in reducing greenhouse gas emissions
- construct a proposal with minimal adverse environmental impacts
- provide electricity generation close to an urban centre with a demand for electricity
- support the development of the Bomen industrial precinct through the supply of low cost and renewable energy.

2.3 Alternatives and options considered

During the development of the proposal, a number of alternatives were considered in relation to the location of the site, size and layout of the proposal and the technology used.

2.3.1 The 'do nothing' option

The 'do nothing' option would involve not constructing the solar farm, which would mean that an opportunity would not be pursued to generate renewable energy and in turn fail to:

- pursue an opportunity to reduce greenhouse gas emissions and move towards cleaner electricity generation
- assist in reaching the LRET

- provide additional electricity generation and supply into the Australian grid
- provide social and economic benefits by creating direct and indirect employment opportunities during construction, operation and decommissioning of the solar farm
- support the development of the Bomen industrial precinct through the supply of low cost and renewable energy.

The 'do nothing' option would avoid the environmental impacts associated with the proposal which would include vegetation impacts, construction noise, traffic and dust, visual impacts and a reduction in agricultural production at the site. Given the benefits of the proposal, the 'do nothing' option is not considered to be a preferred option.

2.3.2 Alternative technologies

Photovoltaic technologies

The proposal would use solar photovoltaic (PV) electricity generating technology. This technology was selected over other electricity generating technologies due to the following benefits:

- the technology is commercially proven, robust and has a low technical risk
- the technology has a low environmental impact in comparison to other power generation technologies
- the region has among the best solar resources in the world
- the technology has a rapid development potential in comparison to other power generation technologies
- solar PV systems provide ease of decommissioning at the end of project life, and ability to reinstate land to current agricultural purposes.

A number of PV module and mounting technologies have been considered for the proposal. PV module technologies include the use of crystalline silicon and amorphous silicon thin film panels. Both technologies have similar visual characteristics and a robust track record of deployment across the globe. The final module type will be selected during detailed design.

Panel mounting technologies

Panel mounting technologies considered include fixed-tilt, north-facing panel mounting systems and single-axis tracking systems. Single axis tracking systems are typically aligned north-south and track east to west throughout the day, following the movement of the sun. Both mounting systems operate at a height above ground level of less than three metres. A single-axis tracking system has been selected for the proposal. While this option is generally considered to be more costly, it has the benefit of improving the yield per panel, therefore allowing a smaller development footprint for the proposal. Reducing the development footprint provides for increased flexibility in site design to avoid environmental constraints and reduce impacts.

The proposed tracking structures would be mounted on piles, which would be screwed or pile driven depending on final geotechnical analysis. This eliminates the need for concrete and

foundations which significantly reduces the impact of construction, keeping ground disturbance to a minimum and allowing the design to follow the existing lie of the land.

Battery storage systems

A lithium-ion battery storage technology (specifically the Tesla Powerpack or similar) has been identified as the preferred battery storage option for the following reasons:

- the technology is commercially proven and robust, and provides fast response abilities
- the technology has been shown to meet individual fatality and injury risk criteria specified in NSW Department of Planning (DoP) publication HIPAP No. 4 'Risk Criteria for Land Use Safety Planning' (DoP 2011a) (see section 6.5)
- the technology has rapid development potential in comparison to other storage technologies
- ease of decommissioning at the end of project life, and ability to reinstate storage footprint area to current agricultural purposes.

There are a number of suitable technologies in the market that provide a range of advantages, and these would continue to be evaluated during the planning phase of the proposal.

2.3.3 Alternative site locations

During the site selection process, alternative locations in the local area were considered. Minimising environmental and social impacts and maximising efficiency were major considerations in the evaluation of alternative sites.

The proposal site was identified as the preferred location, based on the following features:

- proximity to the Bomen Business Park, where future demand for electricity will increase with the growth of industry in the precinct
- low transmission and distribution losses for generation at this connection point in the network due to high, and growing, energy demands in the region
- availability of abundant solar resource and ideal climatic conditions for a commercial-scale solar farm
- proximity to existing electricity transmission infrastructure with sufficient connection capacity
- availability of appropriate land of a suitable scale for a viable commercial-scale solar farm, with suitable topography (sufficiently flat or north-facing)
- minimal environmental constraints due to the site having been disturbed by previous agricultural land use that has cleared vegetation from the majority of the site
- few directly adjacent property owners or properties with residences that would have views of the site
- located in IN1, RU1 and RE1 zones under the *Wagga Wagga Local Environment Plan 2010* (Wagga Wagga LEP), in which zones the proposal is permissible with development consent under the provisions of *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) (as outlined in section 5.2.1)
- serviced by a suitable transport route
- absence of flood risk.

2.3.4 Size and layout of the solar farm

The final sizing and layout of the proposal were developed with reference to advice from the transmission network operator, TransGrid, and the findings of the EIS and specialist studies. The study outputs were incorporated into a constraints map which informed the final layout (Figure 6.1). The environmental factors considered in the final layout are listed in section 6.1.

The final layout of the proposal is a product of efforts by the developer and the EIS specialists to avoid potentially significant environmental impacts. This process has sought to arrive at a final layout that is environmentally and socially acceptable while maintaining the proposal's overall economic viability. All residual environmental issues beyond scope of the proposal design process have been addressed through the proposed application of safeguards and mitigation measures.

2.3.5 Transmission line alignment

Within Lot 22 DP 1085826, two transmission line alignment options are being considered (shown in Figure 1.2). The preferred option will be selected based on consideration of environmental constraints, the preference of the landowner (Council) and matters relating to detailed design.

2.4 Potential land use conflicts

The proposed northern and southern solar farm development areas are on land zoned IN1 General Industrial. The proposed solar farm is considered to be consistent with the current zoning of the land.

Renew Estate has a call option with the landowner to purchase the land required for the proposal site. Subdivision of four lots is proposed as part of this application, to allow the purchase of the required land for the proposal site (refer Section 1.2.1, 3.2.15 and 5.2.2).

Landscaping measures will be implemented to minimise the visual impacts of the proposal as described in section 6.4.4.

Neighbouring landholders have been consulted as described in chapter 4. At the current stage of planning, no major concerns have been raised by neighbouring landholders in relation to the proposal.

The proposal is considered unlikely to cause any substantial conflicts with other land uses (see section 6.7.2).

2.5 Proposal justification and benefits – summary

The proposal is considered to be justified as it meets the proposal objectives outlined in section 2.2, while minimising impacts to the environment and local community.

The proposal, in conjunction with other similar renewable energy projects, would assist in reducing Australia's greenhouse gas emissions, while also providing electricity to help meet future demand. This reduction in emissions would contribute to Australia's target to reduce emissions in line with its international commitment to reduce global greenhouse gas emissions.

The proposal would also stimulate the economy in the Wagga Wagga region by generating employment primarily during the construction phase, but also during the operation and decommissioning phases.

Although the proposal would reduce the area of land that is available for agricultural purposes, as outlined in section 6.4.1, the proposed solar farm development area is zoned IN1 General Industrial to allow for Council's strategy to promote industrial development in the area. If the

proposal were not to proceed, it is likely that the proposal site would be developed for some other industrial purpose in future.

The proposal is consistent with the principles of ecologically sustainable development (see section 5.1.4).

Overall, the proposal is considered unlikely to substantially impact on the environment (see chapter 6), as the proposal site has been disturbed and cleared through previous agricultural activities, and would be unlikely to cause any substantial land use conflicts.

3. Proposal description

3.1 Overview of the proposal

The proposal includes constructing, operating and eventually decommissioning a 120 MWdc solar farm at Bomen, about seven kilometres north-east of the Wagga Wagga CBD.

The four main development areas are shown in Figure 1.6 and include:

- northern solar farm development area
- southern solar farm development area
- minor upgrade of the unsealed section of Trahairs Road
- transmission line corridor, including alignment options 1 and 2.

An indicate layout of the project is provided in Figure 1.6. This layout is indicative only and will be further developed based on final equipment selections and detailed design. Subject to detailed design, the primary components of the proposal include:

- about 400,000 photovoltaic solar modules
- about 4,500 trackers comprising single-axis tracking framing systems mounted on steel piles
- up to 44 containerised power conversion stations containing electrical switchgear, inverters and medium voltage transformers
- new on-site electrical switchyard and substation
- connection into the National Electricity Market (NEM) via about 3.5 kilometres of 132 kV transmission line between the proposed on-site substation and the existing TransGrid Wagga North Substation. The transmission line may be overhead or underground, or a combination of both, subject to detailed design. For the purpose of assessment in this EIS, it is assumed the entire transmission line would be overhead, as this would have greater environmental impacts than underground construction
- battery storage system
- control building including office, supervisory control and data acquisition (SCADA) systems, operation and maintenance facilities, spare parts and staff amenities serviced by septic systems and rainwater tanks
- car park
- internal DC and AC cabling for electrical reticulation
- minor upgrade of the unsealed section of Trahairs Road, east of Byrnes Road, for site access (to be maintained as a single lane unsealed road)
- internal all-weather access tracks
- internal fire trail and bushfire asset protection zones
- security fencing around the solar farm
- vegetation screening – plantings along the site boundaries where required
- meteorological stations

- subdivision of the following lots to allow the purchase of the required land for the proposal site, as shown in the plans of proposed subdivision (see Appendix B):
  - Lot 11 DP 1130519
  - Lot 2 DP 590756
  - Lot 174 DP 751405
  - Lot 108 DP 751405.

The single-axis tracking structures would orient the solar modules to follow the sun from east to west each day. The structures would be mounted on piles driven into the ground.

Groundcover vegetation would be managed by sheep grazing where possible, in conjunction with the measures detailed in bushfire management and environmental management plans.

The on-site substation would be in the north-western corner of the southern solar farm development area, shown in Figure 1.2. The connection to the electricity network would be through the existing TransGrid Wagga North Substation via a proposed 132kV transmission line about 3.5 kilometres long. Final design would comply with TransGrid and the Australian Energy Market Operator (AEMO) specifications. Civil engineering and earthworks would likely be required to meet transmission design guidelines.

Subject to planning and environmental approvals, the construction period is expected to be nine to 12 months from site establishment to commissioning, commencing in the third quarter of 2018.

The operational lifetime of the solar farm is about 30 years.

Decommissioning at the end of the life of the solar farm would remove all above ground infrastructure and rehabilitating the site to allow it to be used for other purposes.

The proposal is estimated to have a capital investment value of about $164 million.

3.2 Key features of the proposal

3.2.1 Photovoltaic modules

The primary components of the solar farm are the approximately 400,000 photovoltaic modules. The modules convert incident photons into electric current and are the power generating plant of the facility.

The final selection of modules would likely be standard 72 cell polycrystalline silicon modules, such as the Canadian Solar CS6U-330P modules shown in Figure 3.1.

The modules would extend to four metres above ground or less, depending on the tracking system used (refer following section).

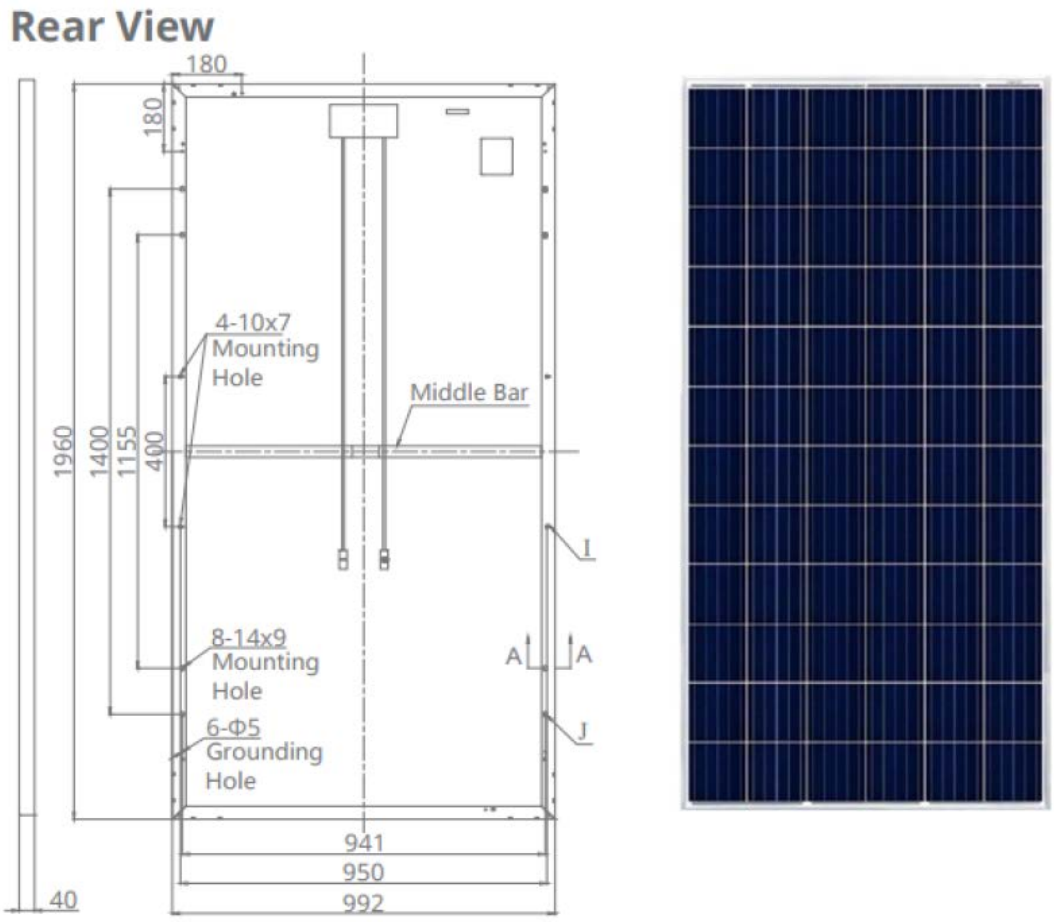

Figure 3.1: Indicative module dimensions and appearance (Canadian Solar PV Module Product Data Sheet)

3.2.2 Tracking system

Overview

The modules would be mounted on single-axis tracking systems (about 4,500 trackers) that follow the sun from east to west throughout the day. Steel piles would be driven into the ground with torque tubes attached, similar to the site shown in Figure 3.2. The modules and tracking systems would be mounted similarly to those shown in Figure 3.3.

Figure 3.2: Pile driven steel posts with torque tubes at the Wirsol owned Hamilton Solar Farm

Figure 3.3: Modules and tracking systems mounted on piles at the Wirsol owned Hamilton solar farm

Two separate tracker solutions (Nextracker and SunPower) are described below as indicative of the technology that would be selected during detailed design.

Nextracker - NX-Horizon

The Nextracker Horizon system primarily consists of a torque tube mounted on galvanised stainless-steel piles. Modules are mounted in portrait orientation with up to 90 modules per tracking arm. A 90 module long tracker table is approximately 94 metres long.

Figure 3.4 shows an indicative configuration with 80 modules mounted per tracker. The motor is in the centre of the tracker, with its own solar panel power supply and uninterrupted power supply. The tracking system does not require external power supply and each tracking arm can operate autonomously through communication with a network control unit located within the block power conversion station.

Figure 3.4: Typical Nextracker 72-cell c-Si configuration: 85 m row with 80 panels mounted in portrait

The tracking angle achieved is +/- 60 degrees, with the modules starting the day facing due east and finishing to the west in the late afternoon. The system is also capable of backtracking to avoid self-shading and there are various automated tracking regimes possible to utilise incident irradiation during different operating scenarios.

Indicative elevations and tracking angles of the Nextracker system are shown Figure 3.5. The torque tube height varies depending on final geotechnical analysis and site topography.

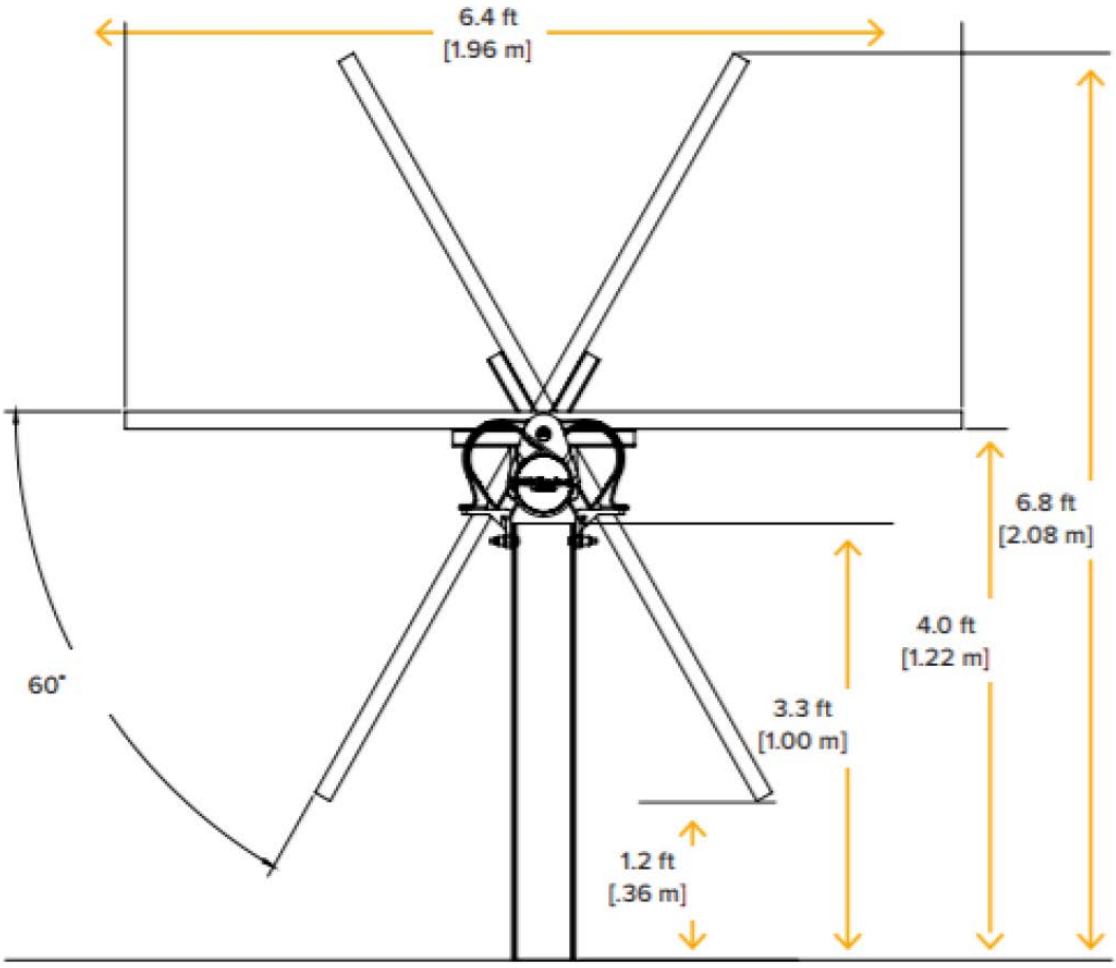

Figure 3.5: Nextracker indicative elevations and tracking angles

The Nextracker system was first installed in Australia at the Moree Solar Farm in northern NSW (Figure 3.6). This 56 MWac project comprised about 2,800 trackers and was commissioned in February 2016.

Figure 3.6: Example of Nextracker system at the Moree Solar Farm in northern NSW

SunPower – Oasis 3

The SunPower Oasis system is a four-panel single-axis tracking system, utilising a more compact design to deliver higher watts per installed square metre. The Oasis system utilises proprietary SunPower high efficiency panels, and each tracking table operates as an unlinked system, with each unit able to operate individually.

The system is mounted on piles which are either screw or pile driven, depending on final geotechnical studies, similar to the system described above. A typical tracker table is 45 metres long and four metres wide, which is shorter and wider than other tracking systems, resulting in a flexible design and efficient site utilisation.

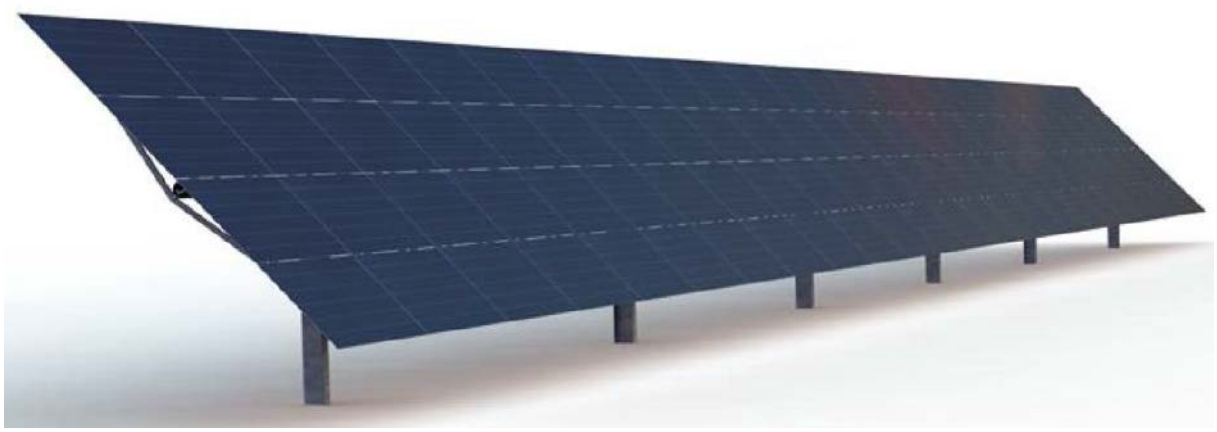

Figure 3.7: Typical Oasis tracking table

Figure 3.8 below shows the typical tracker dimensions. The torque tube is approximately two metres high. The greatest height of the array is four metres, which occurs when the tracker is at maximum angle (60 degrees).

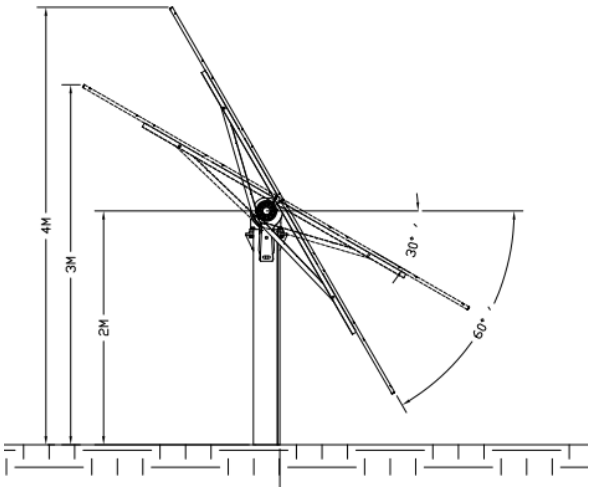

Figure 3.8: Tracker dimensions

The Oasis tracker also utilises built in DC cable management and station hubs to remove the need for combiner boxes and DC cable trays.

3.2.3 Power conversion stations

The proposal would use centralised power conversion stations. These collect and invert 1,500 V DC electricity from the module strings and convert it to 33 kV AC electricity transferred by buried circuit to the substation.

The preliminary design consists of either 2.75 MVA or 5.5 MVA power conversion stations. Each power conversion station contains one or two inverters and a single medium voltage transformer. Each power conversion station container also contains the tracker network control unit (NCU), the SCADA system and other components which form the data management system of the solar farm.

Figure 3.9 shows an indicative SMA power conversion stations. This configuration consists of two 2.75 MVA (2750 CE) SMA inverters and a single 5.5 MVA medium voltage Siemens Transformer. This containerised power conversion station is mounted on a concrete pad or piles.

Each power conversion station would be interlinked via a buried 33 kV circuit for transfer of electricity to the solar farm substation and switchyard.

The power conversion stations have an indicative height of 3.5 metres, and would have a total elevation of no more than four metre above ground including foundations.

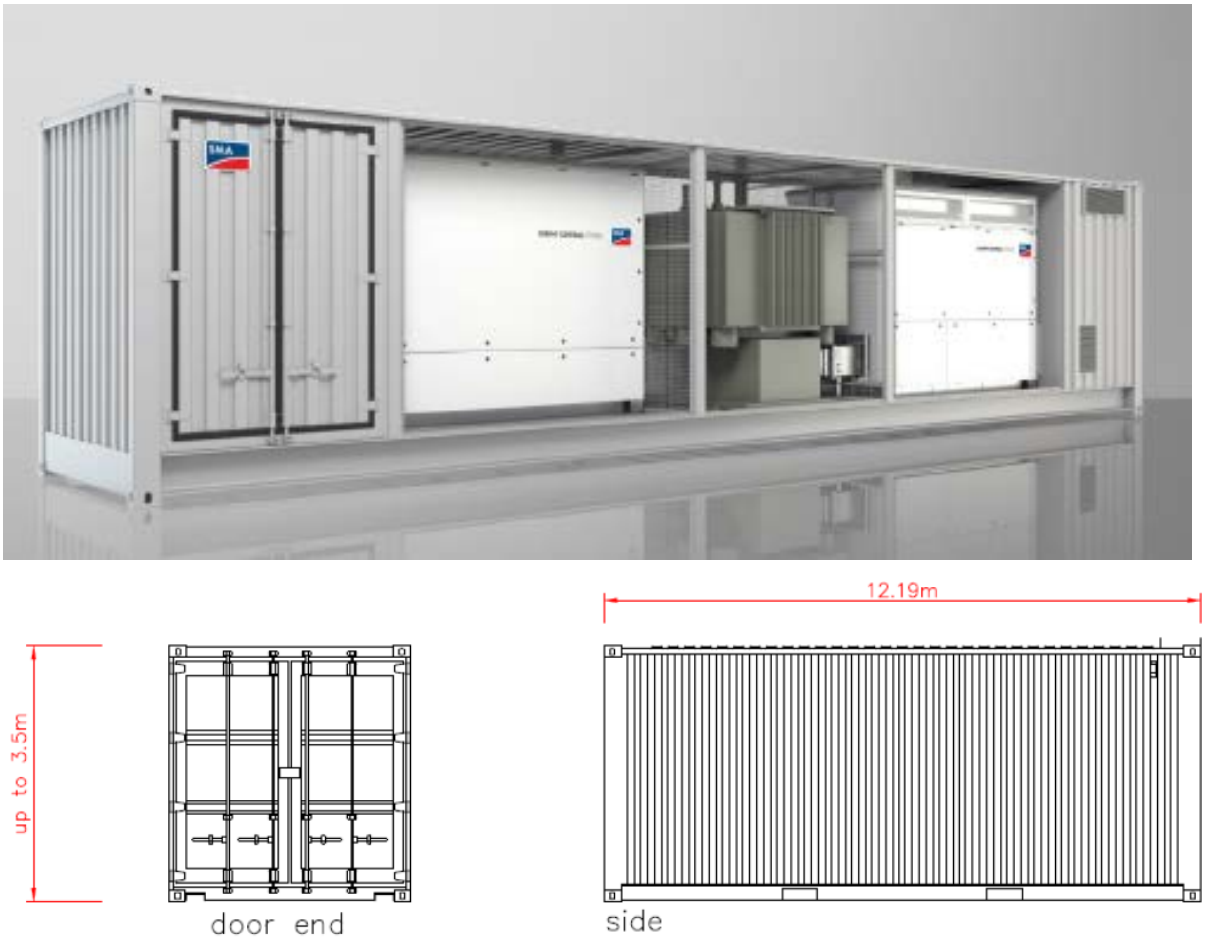

Figure 3.9: Indicative SMA medium voltage power conversion station

3.2.4 Substation and switchyard

The proposal would connect the solar farm to the electricity network via a new substation and switchyard built on site. The substation and switchyard are being developed in collaboration with TransGrid. The indicative footprint would be about 100 metres by 100 metres.

Each of the power conversion stations would be interlinked via underground 33 kV cables back to the substation and switchyard for connection to the proposed 132 kV transmission line. The incoming 33 kV cables would terminate in the switchyard.

A transformer in the substation would convert the internal 33 kV electricity to 132 kV electricity for export to the electricity network. The transformer would be the largest single piece of plant on the site. The likely final transformer design would be for an oil filled unit, with appropriate bunding in place to contain oil in the unlikely event of a leak.

The design of the electrical protection and components is ongoing. Photographs in Figure 3.10, Figure 3.11 and Figure 3.12 are indicative of typical primary plant used in similar projects.

Figure 3.10: Power transformers being installed at the Wirsol owned Hamilton Solar Farm

Figure 3.11: Electrical switchgear and gantry at the Wirsol owned Hamilton Solar Farm

Figure 3.12: Aerial photograph of TransGrid Wagga North 66/132 kV Substation

Aerial photograph © NSW Government (Land and Property Information) 2012

3.2.5 Transmission line and easement acquisition

Transmission line

The proposal involves constructing a new transmission line between the site substation and the TransGrid Wagga North substation, about 3.5 kilometres long. Two corridor options, within which the transmission line and easement would be located, are shown in Figure 1.2. The construction of the new transmission line is the most efficient option from both a commercial and technical perspective.

The voltage of the transmission line is expected to be 132 kV.

The transmission line may be overhead or underground or a combination of these, to be determined during detailed design and in accordance with TransGrid transmission design standards.

The two transmission line corridor options shown in Figure 1.2 are each 90 metres wide to allow for design flexibility during detailed design of the easements. The final width of the easements would be substantially less than 90 metres.

For overhead sections of the transmission line, the easement width would be 30 to 45 metres, and the indicative height of the transmission line poles would be 30 metres. An indicative

example of a 132 kV transmission pole is shown in Figure 3.13. The easement width for any underground sections of the transmission line would likely be seven to 11 metres.

The ultimate ownership of the transmission line would be determined during detailed design. Ownership would be retained either by the project owner or the transmission network (TransGrid).

Figure 3.13: Indicative example of an existing 132 kV pole on site

Easement acquisition

An easement for the proposed transmission line would be required on the properties listed in Table 3.1. The table details the land uses within the proposed easement areas. These areas are indicative only and may change once boundaries are finalised during detailed design.

Table 3.1: Proposed easement acquisition

Lot and DP	Current owner	Land use	Indicative easement area (ha)	LEP zone	Total area of property (ha)
Lot 3 DP594679	Private property	Agriculture and private access road	4	RU1	42
Lot 22 DP1085826	Council property	Agriculture / tree plantings	8	IN1 RU1 RE1	89
Lot 1 DP1115229	TransGrid substation lot	Substation	1	RU1	4

3.2.6 Battery storage system

The proposal would include a battery storage system to:

- manage electricity output to meet demand
- improve the reliability of electricity output
- provide frequency control and ancillary services to the electricity network.

The battery storage system would consist of modular units on pad mounted foundations, located near the proposed electrical switchyard and substation. The storage system would be containerised and bunded.

The output and storage capacity of the battery system are notionally 10 MW and 40 MWh respectively, however the recent announcement of the National Energy Guarantee (NEG) and subsequent requirements would influence the ultimate design of the proposal. The battery technology type, system size and location would be further refined during the design process. Currently there are a number of suitable technologies in the market that provide a range of benefits to the proposal and the wider electricity market.

The battery storage system would be located adjacent to the proposed on-site substation.

The most likely battery storage system would be lithium-ion technology, specifically the Tesla Powerpack or similar.

Figure 3.14: Tesla Powerpack system (40 MW) installed in California USA

3.2.7 Control building

The control building footprint would be about 15 metres by 30 metres. The building would have a height of between three and 5.5 metres high, depending on final design and plant requirements. The control building would contain the site office and warehouse/workshop facilities, and would have a steel structure similar to that shown in Figure 3.15.

Figure 3.15: Example of a control building structure type

The site office within the control building would contain:

- information technology systems and primary interface with the site SCADA system
- staff amenities including bathrooms and kitchen
- first aid kits and other safety equipment
- one or two static water supply tanks filled by delivered water, with a combined capacity of 20,000 litres, located within four meters of the control building hard stand (or one of the internal all weather access tracks) for firefighting purposes
- separate water tanks, filled by rainwater or delivered water, will supply potable water for the staff amenities
- septic system
- control building power would be provided either from a direct connection to the local distribution network (11 kV or single-wire earth return), or through the auxiliary supply of the medium voltage transformer
- a permanent car park would be provided next to the control building and would cater for up to 10 light vehicles. The carpark would have a surface of crushed granite or similar
- waste would be managed using an on-site skip bin, which would be emptied weekly or as required. No permanent or long-term storage of waste would occur on site.

The warehouse/workshop facilities within the control building would include:

- operation and maintenance workshop facilities
- solar farm spare parts
- first aid kit, safety equipment and personal protective equipment
- emergency solar blankets and firefighting equipment.

3.2.8 Internal DC and AC cabling

DC cabling

DC cabling would run aboveground along the back of the modules in cable trays or fixings flush against the modules. DC cabling from each string would run to a combiner box which would contain fuses and circuit breakers. The combiner box would then have a consolidated run of DC cabling back to the power conversion station.

The cable run from the combiner box to the power conversion station would most likely be buried in trenches. The final buried cable depth would be subject to detailed design; however, the likely buried depth is up to 0.9 metres. Sand would be used to backfill the trenches around the cables, and spoil excavated from the trench would be placed over the sand. The trench would be backfilled to match adjacent ground levels.

All DC cabling is anticipated to be between four millimetres and 10 millimetres thick. The maximum DC system voltage would be 1500 V.

AC cabling

The AC cabling would run between the power conversion stations and the on-site substation. The internal AC voltage is likely to be 33 kV, however, the voltage could also be 11 kV or 22 kV, subject to final design.

AC cabling would be buried in trenches, with all junctions and turning points clearly marked with cable warning markers. Depth of cabling would be determined during detailed design, but is likely to be up to 0.9 metres. Sand would be used to backfill the trenches around the cables, and spoil excavated from the trench would be placed over the sand. The trench would be backfilled to match adjacent ground levels.

AC cable diameters are being finalised as part of the detailed design, however indicatively these will be three core XLPE cables with diameters of between 70 mm and 300 mm.

3.2.9 Trahairs Road access

Access to the proposal site during construction and operation would be along Trahairs Road from Byrnes Road (see Figure 1.2). The western 400 metres (immediately east of Byrnes Road) is a sealed two-lane road, while the eastern 1,400 metres is an unsealed one-lane road.

For the purpose of construction access to the proposal site, the single unsealed lane width of four metres would provide sufficient access for semi-trailers, with no requirement for vegetation removal.

The following measures, which have been discussed with Council, would be required to make the road suitable for use during construction:

- minor grading work along the unsealed section of Trahairs Road to a width of four metres to make the unsealed section of the road suitable for use during construction
- a UHF radio protocol would be implemented for vehicles to give way to oncoming vehicles already on the road
- signage would be erected at either end of the unsealed section of road detailing the UHF radio protocol
- an extension would be made to the existing gate into Lot 110 DP751405. The new gate would have a minimum width of five metres
- a new gate would be provided as an exit point for semi-trailer vehicles from Lot 2 DP590756. The gate would have a minimum length of 13.5 metres, at an appropriate location east of the existing dam.

3.2.10 Internal access roads

Internal vehicular access would be all-weather access roads with an indicative width of four metres. The internal access roads would have a total length of up to 16 kilometres. Passing lanes and turning circles would be provided in line with the bushfire management plan.

Access roads would be clearly marked on the site environmental management plan. All construction roads not retained as permanent internal access roads would be removed and remediated.

A permanent car park would be provided next to the control building and would cater for up to 10 light vehicles. The carpark would have a surface of crushed granite or similar.

3.2.11 Bushfire management

Asset protection zones 20 metres wide would be provided around the perimeter of the solar array and around areas of protected native vegetation within the site. The asset protection zone would include trafficable defendable space.

Static water supplies for firefighting/bushfire management would be provided at the site as follows:

- one 20,000 L or two 10,000 L potable water and static water supply tank(s) located within four metres of the control building hard stand or all weather access roads
- tank(s) to be constructed of steel or concrete
- fittings would be compliant with Rural Fire Service truck requirements.

Static water supplies would be filled through water delivery by trucks.

A bushfire management plan will be prepared in consultation with the Rural Fire Service. This is further discussed in Section 6.5.

3.2.12 Security

Security fencing would be installed around the perimeter of the site. The indicative height of the security fencing would be up to 2.2 metres, subject to final design which would seek to minimise the visual impact of the fencing while ensuring that it is appropriate for security and safety purposes.

Contiguous security video coverage would be maintained via a series of security cameras installed on the perimeter fencing. These cameras would be fitted with infrared sensors and motion sensors to provide constant surveillance of the site boundary. The security cameras would be remotely monitored.

Permanent perimeter lighting would not be installed, however motion and/or manually activated surprise lighting may be installed in certain locations to deter intruders.

It is not expected that external overnight lighting at the facility would be required. Occasional maintenance tasks may be scheduled overnight and would require limited temporary lighting for safe operation.

3.2.13 Landscape plan

The proposed draft landscape plan is shown in Figure 3.16 and provides the indicative locations of proposed screening vegetation. The aim of the plan is to minimise the visual impacts of the proposal (in particular the modules and the ancillary infrastructure) on adjacent landowners.

Substantial plantings of native vegetation are already present around much of the perimeter of the proposal site. Additional vegetation would be planted around the perimeter of the site in locations where views to the site are proposed to be screened and there are gaps in the existing vegetation. Plantings would consist of locally native tree and shrub species. Species selection would also consider fire resistant and retardant plants to reduce the risk of the landscape plantings contributing to bushfire hazards. Where screening is proposed, vegetation would be

planted to ensure the screening vegetation comprises two staggered rows. The position and selection of screening vegetation would ensure that the survival of vegetation is maximised.

Nearby property owners are being consulted on the draft landscape plan to confirm its likely effectiveness and acceptability. Following this consultation, a more detailed landscape plan would be developed in consultation with the property owners and other stakeholders such as the Rural Fire Service to confirm the location and type of vegetation screening to be implemented on site.

Screening vegetation would be maintained for the life of the solar farm. This would include replacing any vegetation that does not survive.

3.2.14 Meteorological stations

The solar farm would have two spatially distinct meteorological stations on site to monitor local climatic conditions and solar farm performance.

The meteorological stations would monitor:

- horizontal irradiation
- incident irradiation
- diffuse irradiation
- solar radiation flux density
- wind speed
- rainfall
- ambient temperature
- reference cell temperature.

All data streams would be collected and retained by the solar farm SCADA system. Additional anemometers would be situated around the site perimeter to measure prevalent and gusting wind speeds. In the event of extreme wind events, the SCADA system would instruct the trackers to move into stow position to avoid system damage.

An example of a meteorological station is shown in Figure 3.17.

538,000 539,000 540,000 541,000

6,123,000 6,122,000 6,121,000 6,120,000 6,119,000

Olympic Highway
Dukes Creek
Trahairs Road
Byrnes Road
Dampier Street
East Bomen Road
Dunns Road
Windmill Road

R04 R05 R12 R13 R14 R15 R16 R94 R17 R08 R09 R10 R11

Trees to be protected
Northern solar farm development area
Southern solar farm development area
Enirgi administration building
Transmission line corridor

LEGEND

- Proposal site
- Indicative pipeline easement
- Indicative subtransmission line easement
- Proposed indicative planting areas for vegetation screening
- Disturbance area
- Indicative subtransmission line under construction
- Existing subtransmission line
- Existing gas pipeline
- Road
- Drainage line/stream
- Residence
- Industrial
- Dam
- Vegetation to be protected
  - Covenant
  - Development Control Plan

Paper Size A3

0 100 200 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 10 Apr 2018

Landscape plan

Figure 3.16

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig3-16 Landscape plan.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government: Hydrolines, residences and roads - 2012, aerial photograph - 2017; Wagga Wagga City Council: Vegetation protection areas - 2017. Created by:afoddy

Figure 3.17: MEA met station mast showing inclined pyranometer

3.2.15 Subdivision

Subdivision of the following lots is proposed to allow the purchase of the required land for the proposal site:

- Lot 11 DP 1130519
- Lot 2 DP 590756
- Lot 174 DP 751405
- Lot 108 DP 751405.

The plans of proposed subdivision are shown in Appendix B and more detail regarding the proposed lots is set out in Section 5.2.2.

3.3 Construction activities

3.3.1 Indicative timeline

Construction of the proposal is expected to take about nine to 12 months and would commence in the third quarter of 2018 subject to the design and approval process.

3.3.2 Indicative work methodology

The main construction activities would include:

- site establishment and preparation including:
  - geotechnical investigations

  - minor upgrade of the unsealed section of Trahairs Road (road grading work to a width of four metres)
  - constructing internal access roads
  - installing perimeter fencing
  - removing existing internal fence lines (if required)
  - establishing construction compound and laydown areas
  - installing environmental controls
- installing the steel post foundation system for the trackers (driven piling)
- installing the trackers on the steel posts
- installing the solar modules on the trackers
- constructing the power conversion stations
- constructing the substation and switchyard
- constructing the transmission line between the substation and the TransGrid Wagga Wagga North substation
- constructing the control building
- installing the battery storage system
- installing underground cabling (trenching) and connecting communications equipment
- installing ancillary facilities and infrastructure
- landscaping works
- removing temporary construction facilities and rehabilitation of disturbed areas.

3.3.3 Construction hours, machinery and equipment

Proposed construction hours, and plant and equipment likely to be used during construction are detailed in Table 3.2. This equipment list is indicative and would be confirmed during detailed design and construction planning.

Standard working hours (DECC 2009) are:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and public holidays: no work.

Out of hours work may be required for some construction activities as detailed in Table 3.2. This would involve delivering solar farm components and assembling modules and structures outside standard working hours, if required.

Nearby residents would be notified of certain noise-generating works outside of standard working hours. This would involve justifying why works are required outside the standard hours and outlining the timing, duration and potentially expected noise levels.

Table 3.2: Hours of work, machinery and equipment for proposed construction activities

Construction activities	Construction location	Construction hours	Construction equipment
Site establishment/ Trahairs Road upgrade/ internal access road construction/ vegetation clearing/ civil earthworks	Trahairs Road and northern and southern solar farm development areas	Standard (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)	• Grader • Dozer • Dump truck • Roller • Water truck • Hand tools • Chainsaws, tree clearing and mulching equipment
Installing steel post foundations	Northern and southern solar farm development areas	Standard (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)	• Impact pile driver • Hand tools • Crane
Construction of hardstand areas, solar arrays, substation, control building, power conversion stations, battery storage area	Northern and southern solar farm development areas	Standard (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)	• Generator • Forklifts • Crane • Concrete truck and pump • Grader • Bobcat • Hand tools • Trenching machines • Semi-trailers and delivery trucks
Construction of overhead transmission line	Transmission line corridor (option 1 and option 2)	Standard (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)	• Excavator • Crane • Winch • Bored piling rig
Construction of underground transmission cables	Transmission line corridor (option 1 and option 2)	Standard (Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm)	• Under bore equipment • Cable drums and cable winch • Excavator • Water cart and dump truck
Out of hours work (Saturdays and Sundays daytime), including all activities above except piling works and construction of the transmission line	Northern and southern solar farm development areas	Outside of standard construction hours (Saturdays 1 pm to 6 pm and Sundays 8 am to 6 pm)	• Generator • Forklifts • Crane • Concrete truck • Grader and dozer • Hand tools

Construction activities	Construction location	Construction hours	Construction equipment
Out of hours work (evenings/nights), including all activities above except piling works and construction of the transmission line	Northern and southern solar farm development areas	Outside of standard construction hours (Sunday to Thursday 6 pm to 7 am, Friday and Saturday 6 pm to 8 am)	• Generator and crane (central work area only, shown in Figure 1.2) • Concrete truck (central work area only, shown in Figure 1.2) • Grader and dozer (central work area only, shown in Figure 1.2) • Electric forklift (all areas, except within 250 m of the southern solar farm boundary, installing trackers and modules) • Hand tools (all areas, except within 250 m of the southern solar farm boundary, installing trackers and modules)

3.3.4 Vegetation removal

The proposal would involve removing scattered paddock trees and plantings along internal fences, where required. Introduced groundcover vegetation would also be removed for the construction of some parts of the proposal, such as the substation, battery storage system, control building, hardstand compound area, internal roads, any transmission line poles, and areas where earthworks are required. Soil material and stripped groundcover vegetation with the potential to contain the priority weed Silverleaf Nightshade (*Solanum elaeagnifolium*) would not be removed from the proposal site (see section 6.2).

As required to comply with the Wagga Wagga Biodiversity Certification, some areas of native vegetation in the proposal site would be protected (see Figure 1.2), as these have been identified by Council for conservation under the *Wagga Wagga Development Control Plan 2010*.

3.3.5 Earthworks

Minor earthworks would be required for:

- minor grading of the unsealed section of Trahairs Road to a width of four metres
- potentially decommissioning three existing farm dams, which would involve filling the dams with soil excavated from other parts of the proposal site. If necessary, earthworks would also be carried out to construct additional water storage on the site to maintain existing runoff characteristics
- levelling the ground for structures such as the office and substation, as well as for the construction compound and laydown areas
- limited grading for installation of tracking systems
- construction of internal access tracks
- excavating cable trenches to a depth of up to one metre – the trenches would be backfilled to match the adjacent land surface
- excavating pole footing holes for construction of any overhead transmission line sections to a depth of about three metres
- excavating trenches or underboring for underground sections of the 132kV transmission line
- levelling small areas where there are substantial changes in the land slope.

Buried and surface rock would be removed to allow for construction of the proposal where necessary and practicable (subject to geotechnical investigations), including an area in the south-western corner of the southern solar farm development area.

3.3.6 Construction compound and laydown areas

Construction compound

A temporary construction compound would be established on site and would include a site office and amenities. The location of the compound would be determined during the detailed design phase. It would be within the proposal site and would avoid all identified constraints.

The staff amenities building would include the following facilities:

- toilet blocks consisting of water flush systems connected to holding tanks. Tanks are equipped with high level alarms and pumped out regularly
- change rooms

- dining room
- administrative office
- undercover storage area.

This building would be a prefabricated structure which can be brought to site on the back of a truck and removed from site when required.

Parking areas would also be provided in the vicinity of the amenities building.

Laydown areas

Hardstand areas would be required for the laydown and storage of construction materials. These areas would be temporary and would be progressively rehabilitated throughout construction.

The hardstand areas may be graded and would have gravel or similar material laid to allow the temporary storage of heavy construction material.

Topsoil removed during establishment of hardstand areas would be stockpiled and used to progressively rehabilitate the areas throughout construction.

Laydown areas would be located within the proposal site. The footprint of the laydown areas would be minimised as much as possible and would avoid identified constraints. All the laydown areas would be made good by the end of construction.

3.3.7 Construction workforce

It is anticipated that a maximum of 200 construction personnel (including labourers, construction supervisors and technicians) would be required during the four month peak construction period. About 50 personnel would be required during the site establishment and demobilisation phases.

3.3.8 Construction traffic and access

Transport route

The proposal site would be accessed via Byrnes Road and Trahairs Road (see Figure 1.2). The transport route to site for the majority of materials would be by truck from Sydney or Port Kembla via the Sturt Highway. The likely route from the Sturt Highway to Byrnes Road would be via Eunony Bridge Road (see Figure 1.1), avoiding the needed to travel through the Wagga Wagga central business district.

Construction traffic volumes

Expected construction traffic volumes are as follows:

- during the peak of construction it is expected that there would be up to 200 construction personnel on site, with about 170 inbound light vehicle movements in the morning peak period and 170 outbound light vehicle movements in the evening peak period, with some personnel carpooling
- during peak construction periods, there would be up to 30 heavy vehicle movements per day, including both inbound and outbound movements.

Vehicles may occasionally need to access the proposal site outside standard construction hours.

Trahairs Road

Minor grading work along the unsealed section of Trahairs Road to a width of four metres would be required to make the unsealed section of the road suitable for use during construction.

Temporary site access tracks

Temporary internal access tracks may be required in the proposal site during construction. These roads would be formed for all-weather access and would be wide enough to facilitate construction vehicle and plant movements. The width of the temporary access tracks would be about four metres subject to the construction management plan and final design.

All temporary access roads not retained in the final site design would be remediated following the commissioning of the solar farm.

Construction parking

All vehicles would park within the site in designated areas which would be determined during detailed design. These areas would be outlined in the traffic management plan for the proposal.

3.3.9 Source and quantity of materials

The bulk of the construction materials consists of:

- about 400,000 modules
- about 4,500 trackers/structures
- up to 44 containerised power conversion stations
- materials for the substation, transmission line, battery storage system, control building and fencing.

About 20,000 cubic metres of gravel would be required for hard stands and internal access roads. About 500 cubic metres of sand would be required to bury cables in about 3.5 kilometres of trenches.

Water would be required during the construction phase primarily for dust suppression purposes but also for other activities such as vehicle washing. It is estimated that about two megalitres of water would be required during construction. This would potentially be sourced from a Council water filling station or a similar alternative location. All water would be trucked to the site.

3.4 Commissioning of the proposal

Commissioning of the proposal is expected to take about one month and would commence following the completion of the construction period.

The commissioning phase would involve the testing of all aspects of the proposal and would include the final connection of the proposal to the electricity network via the proposed transmission line.

3.5 Operation of the proposal

3.5.1 Hours of operation and days per year

Daily operations and maintenance activities (see section 3.5.3) by site staff would be undertaken during standard working hours:

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

Operation and maintenance work may occasionally extend beyond daylight hours for corrective and preventative activities.

The solar farm would generate electricity during daylight hours, which means that during summer months when days are longer, it would operate after 6 pm and before 7 am. The

trackers would potentially operate outside standard working hours during summer months. The trackers may also operate during storm or high wind events when they stow the modules to avoid impacts from wind.

The solar farm is anticipated to be staffed from 7am until 5pm, most days of the year. The site would also be remotely monitored 24 hours a day, every day of the year. On some days, the site may not be staffed, but a remote crew would be ready to respond in the event of an incident.

3.5.2 Workforce

The operational workforce would consist of about three to five full time positions, and up to five to 10 full time positions during the initial defect liability period of operation (estimated two years).

The workforce would be likely to include a site manager, high voltage electrician and maintenance staff. Asset management staff and contractors would also be on site periodically.

3.5.3 Operations and maintenance activities

Operations and maintenance activities would likely include:

- continuous monitoring of solar farm performance and operation of equipment
- weekly and monthly inspections (electrical, civil and environmental) and infrastructure works as required
- preventative maintenance activities as outlined in the operations and maintenance management plan
- upgrading equipment as technology improves
- vegetation management (in line with various management plans)
- cleaning activities (modules, meteorological station etc)
- other activities as defined in the operation and maintenance management plans.

Corrective maintenance activities would likely include:

- testing and replacing faulty plant components (modules, fuses etc)
- any other corrective actions.

3.5.4 Operation traffic

During normal operation, only light vehicles would access the site.

3.5.5 Source and quantity of materials

Water would be required during the operation of the proposal as it would be needed to clean the panels during maintenance works. It is estimated that up to 500 kilolitres of water would be required per year. This would potentially be sourced from a Council water filling station or a similar alternative location.

3.6 Decommissioning the proposal

At the end of its operational life (about 30 years), the proposal site would decommissioned. Decommissioning would involve removing all above ground infrastructure and would take about 12 months to complete. Key elements of proposal decommissioning would include:

- the solar arrays would be removed, including the foundation poles, with the materials to be reused or recycled where possible

- all site amenities and equipment would be removed and materials recycled or reused, wherever possible
- poles and cabling would be removed and recycled (some infrastructure 300 mm or more below ground may be left in place)
- fencing would be removed (some fencing may be retained, if it is requested by the landowner)
- the transmission line would be removed
- rehabilitation of the site to comply with requirements that would be agreed during consultation with the landholder.

Traffic required for decommissioning would be similar in type to that required for the construction phase.

4. Stakeholder consultation

4.1 Overview

4.1.1 Renew Estate's Engagement Strategy

Renew Estate's mission statement is to deliver authentic, effective and comprehensive stakeholder and community consultation for its proposal and all its projects. Its Board-approved strategy to drive and deliver its engagement program is set out in its Landowners, Government & Community Engagement Strategy ("Engagement Strategy").

Renew Estate's objectives in the Engagement Strategy are to:

- Deliver an honest, innovative, flexible and transparent engagement process with all landowners, Government and community stakeholders relevant to a project, throughout the life cycle of the project.
- Inform and consult with the communities that are local to each project so that they have a deep understanding of both the impact of, and the benefits from, each project.
- Engage at all times in respectful and transparent communications that take community needs and preferences into account.
- Ensure that the host community directly benefits from the project in a tangible and identifiable way.
- Engage in a manner that ensures approval and broad social acceptance of its projects by the local community and all other stakeholders (a social licence).

These objectives are achieved by the following eight principles of community engagement:

- Mutual benefit - Creating shared outcomes of mutual benefit for the host community and landowners
- Relationship building - Building local networks and relationships based on trust
- Transparency - Being transparent at all times across all aspects of the project, processes and decisions
- Authenticity - Being authentic and engaging in active listening in all communications
- Mutual Respect - Using mutually respectful and dignified dialogue
- Appropriateness - Proposing projects that are appropriate for the local context
- Ongoing engagement - Delivering ongoing engagement throughout the project
- Responsiveness - Being responsive in a timely fashion to stakeholders' issues.

Compliance with NSW DP&E Guidelines & SEARS

The Engagement Strategy was designed and delivered to ensure alignment with NSW DP&E Draft Community and Stakeholder Engagement Guidelines (June 2017). It also satisfies the requirements for consultation set out in the SEARs (Appendix A).

4.1.2 Project Engagement Plan

Renew Estate has developed a Landowner, Government & Community Engagement Plan for the Project that reflects Renew Estate's Engagement Strategy, the identified stakeholders (refer section 4.1.4) and the Draft Community and Stakeholder Engagement Guidelines (DP&E, 2017). This plan sets out the methods of engagement, the stakeholder's engaged, the timing of

each activity and the outcomes of the consultation. The Engagement Plan is a live document and is updated progressively as engagement activities are undertaken and feedback provided. Forming part of the Engagement Plan is an Engagement Register which is a record of all significant meetings and telephone conversations with stakeholders and their contact details.

4.1.3 Shared benefits for the community

Renew Estate has committed to share the benefits of the project with the community in a number of ways. The following proposed benefits are being offered:

- A community fund: A fund of $100,000 is proposed to be paid for the benefit of the community. The community will be invited to write down ideas on how this fund would be best used at our community information drop-in session to be held during the EIS exhibition period.
- Opportunity for relevant skills training, up-skilling and scholarships: The community will be invited to speak to a Renew Estate staff member about this at future community information sessions.
- Maximised participation of local businesses in the construction and operation of the project: Renew Estate encourages enquiries from any local businesses, contractors, service providers or potential employees who were interested in learning about the scope of work and types of services that will be required during the construction and operational stages of a solar farm development. The community will be invited to speak to a Renew Estate staff member about this and/or fill in the Local Service Opportunities form at future community information sessions. There is also a Contractor Enquiry form available on the project website.

4.1.4 Stakeholder identification

Renew Estate identified a list of relevant stakeholders at the beginning of the proposal's planning phase. This list will continue to evolve throughout the various stages of the planning application and consent process. The identified categories are:

1. Landowners and residents, including:
   – landowners or residents whose property adjoins the proposal site; and
   – other local landowners or residents who are likely to be directly affected by the proposal or are on or near the proposal's likely transport routes ("Local landowners")
2. Aboriginal people, Aboriginal organisations or their representatives with cultural or heritage connections with the proposal area
3. The industrial neighbours to the proposal site
4. Wagga Wagga City Council – General Manager and Manager of City Strategy
5. Wagga Wagga City Council Councillors
6. The Hon. Daryl Maguire MP (Member for Wagga Wagga)
7. The Hon. Michael McCormack (Member for Riverina)
8. NSW Department of Planning & Environment
9. NSW Office of Environment and Heritage
10. NSW Environment Protection Authority
11. Other regulators via the DP&E
12. Murrumbidgee Landcare

13. NSW Rural Fire Service
14. The Eunony Valley Association
15. The Wagga Business Chamber
16. The Committee for Wagga
17. Regional Development Australia
18. NSW Department of Industry
19. Local media

4.2 Summary of engagement

4.2.1 Engagement activities undertaken during early project planning, EIS scoping and EIS preparation

Renew Estate is committed to front-of-project, frequent and local consultation. As such, Renew Estate commenced its engagement activity early with telephone calls and face to face meetings with the local landowners, industrial neighbours, and government agencies. Engagement activities have continued throughout the development of the EIS.

Table 4.1 summarises the engagement activities undertaken to date, from early planning phases, through to EIS scoping and completion of the EIS.

A project website (www.bomensolarfarm.com.au) was established in January 2018 and is continuously updated with new project information. Information currently available on the website includes:

- a description of Renew Estate, its people and partners
- the project's location
- the proposed size of the project
- the proposed operational lifetime of the project
- the proposed planning and construction timeline
- a link to the project's Preliminary Environmental Assessment and SEARs
- Renew Estate's community engagement ethos and vision
- an online contractor enquiry form for local businesses, contractors or service providers to express an interest in the project
- A telephone number and online form for the community to provide feedback
- links to project newsletters as they become available.

A link to this EIS will also be provided on the website during its public exhibition phase, as well as details on a community information drop-in session which will take place during the exhibition period.

Table 4.1: Summary of engagement during early planning, EIS scoping and EIS preparation

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
Regulators and industry stakeholders			
NSW DP&E	Meeting	Project briefing to introduce the project prior to applying for SEARs. Information shared included: • A description of Renew Estate and its partners • A map showing the project's proposed location • The rationale for the proposed size and site location	DP&E highlighted items they wanted to see in the PEA (application for SEARs) including environmental constraints, information on anticipated traffic generated, and evidence of a community consultation plan and early engagement activities.
	Telephone and email	• Receipt of SEARs • Provision of updates on EIS status	The SEARs were issued on 21 November 2017 and are addressed in this EIS (refer Appendix A).
Wagga Wagga City Council	Meeting	Initial project briefing to Council representatives. Information shared included: • A description of Renew Estate and its partners • The strategic justification for the project as well as proposed size and site location • Renew Estate's community engagement ethos	Wagga Wagga City Council representatives gained an understanding of the proposed project and its potential contributions to regional investment and employment in the local area. Council representatives highlighted their objectives from a planning and economic growth perspective and outlined the local planning intent and context of the Bomen precinct.
	Meeting	The potential use of Council land for electrical infrastructure easements Information shared included: • Proposed electrical easement route options relating to a parcel of Council land (Lot 22 DP1085826)	Wagga Wagga City Council representatives gained an understanding of the potential easement route options proposed for the project. Council representatives highlighted their potential suitability and outlined the required process for securing an easement on Council land.
	Telephone and email	GHD consulted with Council on the works required to upgrade Trahairs Road.	In discussion, it was agreed that for construction access, minor upgrade works along the unsealed section of Trahairs Road (as described in section 3.2.9) would be likely to meet Council requirements.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
	Telephone and email	GHD consulted with Council on the status of the plantings along Trahairs Road and areas of native vegetation in the proposal site.	Initial advice indicates that the trees along Trahairs Road are likely to be protected by a covenant under section 88B of the Conveying Act 1919 as per conditions of consent for the former Riverina Wool Combing plant. These areas would not be impacted (refer Section 6.3 and Appendix D). Areas of native vegetation within the proposal site have been identified for conservation under the Wagga Wagga Development Control Plan 2010. These areas would be protected (refer Section 6.3 and Appendix D).
	Email	Renew Estate provided Council with an outline plan for providing renewable energy to industrial users in the Bomen precinct to benefit businesses and catalyse precinct growth.	Wagga Wagga City Council representatives gained an understanding of the potential benefits to local industry which could be provided by a renewable energy project. Council representatives outlined their aspirations to create a thriving industrial hub in the Bomen precinct.
NSW Environment Protection Authority	Telephone and email	GHD consulted with the Environment Protection Authority (EPA) on whether any licensed monitoring points are located in the proposal site.	The EPA confirmed that no licensed monitoring points are present within the proposal site.
Regional Development Australia – Riverina NSW (RDA)	Meeting	Initial project briefing to RDA representatives. Information shared included: • A description of Renew Estate and its partners • A map showing the project's proposed location • Renew Estate's community engagement ethos	RDA representatives gained an understanding of the proposed project and its potential contributions to regional investment and employment in the local area. RDA representatives highlighted the objectives of their organisation and provided an overview of current programs and opportunities for collaboration.
TransGrid	Meetings, telephone and email	Detailed and ongoing collaboration with TransGrid on the technical aspects of the project. Information shared included: • A description of Renew Estate and its partners • A description of the project and proposed location • Renew Estate's community engagement ethos • Commercial details to satisfy TransGrid prudential requirements • All technical aspects of the project electrical design • Proposed generator performance standards	TransGrid representatives gained an understanding of the proposed project and its proposed connection into the electricity network. TransGrid representatives highlighted the objectives of their organisation and outlined the process for connection approval. Renew Estate and TransGrid discussed the importance of network stability and security, and the aspects of the project's design which could achieve this. The project has a Connection Processes Agreement with TransGrid and is currently working through the detailed scoping and design phase of the connection to the National Electricity Market (NEM).

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
Australian Energy Market Operator (AEMO)	Telephone and email	Ongoing collaboration with AEMO over project technical performance standards and network security. Information shared included: • A description of Renew Estate and its partners • A description of the project and proposed location • Renew Estate's community engagement ethos • Commercial details to satisfy AEMO prudential requirements • Details of the generator and electrical design • Renew Estate statements of commitment and capability • Proposed generator performance standards • Project website and press release • Details of the project land right arrangements	AEMO representatives gained an understanding of the proposed project and its proposed role as a generator in the National Electricity Market. AEMO representatives outlined the process for approval. The project is currently being registered with AEMO as a generator in the NEM. Network modelling is underway to satisfy AEMO performance and security requires as per the National Electricity Rules.
Rural Fire Service (RFS) NSW	Telephone	Initial project briefing. Information shared included: • A description of Renew Estate and its partners • A description of the project and proposed location • Renew Estate's community engagement ethos • Proposed bushfire protection facilities	RFS representatives gained an understanding of the proposed project, including its location and design features. RFS representatives outlined the key firefighting facilities required for the project. Renew Estate has undertaken to regularly communicate with RFS on an ongoing basis, including annual inspections and independent access to the site and static water supplies.
Murrumbidgee Landcare	Telephone	Initial project briefing. Information shared included: • A description of Renew Estate & its partners • A description of the project and proposed location • Renew Estate's community engagement ethos	Landcare representatives gained an understanding of the proposed project, including its location and site features. Renew Estate and Landcare representatives agreed to further discussions on landscaping and planting selections which could be incorporated in the project and surrounding area.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
Local landowners, industrial neighbours and community organisations			
Local landowners	Meetings and telephone	Initial project briefing and ongoing discussions to identify and understand any concerns or land use conflicts, and to discuss mitigation measures for potential impacts. Information shared included: • A description of Renew Estate and its partners • Maps showing the project's proposed location • The rationale for the proposed size and site location • The proposed timeline for the project • Renew Estate's community engagement ethos • The project website address • Bomen Solar Farm Fact Sheet	Local landowners gained an understanding of the proposed project, including its location, proposed site and an overview of Renew Estate's development process, timeline and engagement plan. Throughout various discussions with landowner's, both positive sentiments and concerns were raised. General concerns raised by landowners included: • Impact on the value on surrounding properties • Impact on visual enjoyment of land and surroundings • Construction traffic • Operational noise • Glare from solar panels • Risk of fire caused by the proposal during operation • Weed control • Fencing & security • Flooding. The concerns raised were noted by the Renew Estate team and conveyed to the relevant consultants for consideration in their studies. Issues raised and how they are addressed is described in Table 4.2. Positive sentiments raised by landowners included: • Benefit of renewable energy in reducing greenhouse gas emissions and climate change • Benefits of employment and regional investment • A solar farm project may represent a lower visual/noise impact than other industrial-type developments which might occur in its place.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
	Meetings	As a follow up to the initial project briefing and subsequent discussions with Local landowners, a landowner information session has been organised to discuss the project and share information from studies completed for the EIS. Local landowners will also be invited to attend the community drop-in information session which will be open to the public and take place during the exhibition period (refer Section 4.2.2).	This meeting is scheduled to take place before the EIS exhibition period.
The Eunony Valley Association (EVA)	Meetings and telephone	Initial project briefing and ongoing discussions to identify and understand any concerns and to discuss mitigation measures for potential impacts. • A description of Renew Estate and its partners • A map showing the project's proposed location • Proposed landscaping and screening strategy • The rationale for the proposed size and site location • The proposed timeline for the project • The project website address • Renew Estate's community engagement ethos	As widely represented by local landowners, the EVA engagement outcomes are closely aligned with those of the local landowners above. Through Renew Estate's engagement activities, the EVA gained an understanding of the proposed project proposed project, including its location, proposed site and an overview of Renew Estate's development process, timeline and engagement plan.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
			General concerns raised by the EVA included: • Impact on the value on surrounding properties • Impact on visual enjoyment of land and surroundings. • Construction traffic • Operational noise • Glare from solar panels • Risk of fire caused by the proposal during operation • Weed control • Fencing and security • Flooding The concerns raised were noted by the Renew Estate team and conveyed to the relevant consultants for consideration in their studies. Issues raised and how they are addressed is described in Table 4.2. Members of the EVA indicated that they would like see the project contribute funding to potential benefits for the Eunony Valley Region. Ideas included: • Additional tree plantings to improve the visual amenity of the valley and offer off-site screening. • Contributions to the local Rural Bushfire Brigade The ideas were noted by the Renew Estate team and considered for community benefits funding opportunities.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
Registered Aboriginal Parties (RAPs)	Letters, emails, local media, archaeological site survey.	Consultation with Aboriginal people, Aboriginal organisations or their representatives has been undertaken in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) as part of an Aboriginal Archaeological and Cultural Heritage Impact Assessment.	The RAPs contributed to the Aboriginal Archaeological and Cultural Heritage Assessment undertaken for the project by: • providing relevant information about the cultural significance and values of the Aboriginal objects and places within the proposal site. • influencing the design of the method to assess cultural and scientific significance of Aboriginal objects and places within the proposal site. • actively contributing to the development of cultural heritage management options and recommendations for Aboriginal objects and places within the proposal site. • commenting on draft assessment reports before they are submitted to OEH via DP&E. The detailed results of the Aboriginal heritage consultation process undertaken are provided in Appendix C.
Riverina Oils and Bio Energy (industrial neighbour)	Face to face meetings	Initial project briefing and ongoing discussions to identify and understand any concerns and to investigate the opportunity for ROBE to benefit from the renewable energy project. • A description of Renew Estate and its partners • A map showing the project's proposed location • The rationale for the proposed size and site location • The proposed timeline for the project • Renew Estate's community engagement ethos • The project website address	ROBE representatives gained an understanding of the proposed project and the potential for ROBE to benefit from renewable energy sourced from the project. ROBE representatives expressed their potential interest in securing renewable energy sourced from the project. It was agreed that ROBE and Renew Estate would work together to explore this opportunity. ROBE representatives offered their broad support for the project and acknowledged the potential benefits to the Bomen Precinct.

Stakeholder	Method	Purpose/Information shared	Outcome/Comment
Enirgi (industrial neighbour)	Face to face meetings	Initial project briefing and ongoing discussions to identify and understand any concerns and to investigate the opportunity for Enirgi to benefit from the renewable energy project. • A description of Renew Estate & its partners • A map showing the project's proposed location • The rationale for the proposed size & site location • The proposed timeline for the project • Renew Estate's community engagement ethos • The project website address	Enirgi representatives gained an understanding of the proposed project and the potential for Enirgi to benefit from renewable energy sourced from the project. Enirgi representatives expressed their potential interest in securing renewable energy sourced from the project. It was agreed that Enirgi and Renew Estate would work together to explore this opportunity. Enirgi representatives offered their broad support for the project and acknowledged the potential benefits to the Bomen Precinct.
	Telephone and email	The potential use of Enirgi industrial land for electrical infrastructure easements. Information shared included: • Proposed electrical easement route options relating to a parcel of Council land	Enirgi representatives gained an understanding of the potential easement route options proposed for the project. Enirgi representatives indicated their preferred option for an easement route across their property.
All	Local newspaper article in the Daily Advertiser	• The identity of Renew Estate as the developer • The estimated cost of the project Link to online article: http://www.dailyadvertiser.com.au/story/5150958/150-million-project-latest-solar-submission-in-wagga-region/?cs=148	-
All	Local newspaper article in The Land	• A description of the company& its partners • A map showing the project's proposed location • The rationale for the proposed size & site location Link to online article: http://www.theland.com.au/story/5150958/150-million-project-latest-solar-submission-in-wagga-region/?cs=4951	-
All	Newsletter delivered to local business and via email or post box drop to key stakeholders	• A description of Renew Estate and its partners • A map showing the project's proposed location • Construction & technical methodology of the project • The rationale for the proposed size and site location • The proposed timeline for the project • The project website address • Renew Estate's community engagement ethos	-

4.2.2 Future consultation activities

Renew Estate will continue to regularly engage with the community and stakeholders throughout all stages of the project. In order to ensure a broad saturation of project information and demonstrate presence in the community, Renew Estate also intends to continually inform local media regarding project updates, events and milestones.

EIS exhibition

This EIS will be placed on public exhibition via the NSW Major Projects website for a minimum of 30 days. During this time the public will be able view the EIS and associated specialist studies and make formal submissions on the proposal. Issues raised in submissions will be addressed by Renew Estate in a Response to Submission report.

During the EIS exhibition period, Renew Estate will host a community drop-in information session. This event will be open to everyone and will allow people to view information on the proposal, ask questions, and provide feedback.

Information that will be provided at the drop-in session will include:

- Site location
- Site layout
- Environmental constraints considered
- Visual impacts
- Proposed landscaping
- Traffic and access
- Construction timeline
- Information on commitment to use local labour & service industries
- Information regarding potential Power Purchase Agreements for the local industry
- Global trends for renewables & export opportunities

Construction phase consultation

During construction of the project, a Community and Stakeholder Consultation Plan will be implemented to manage the concerns of stakeholders and any impacts on local landowners. The plan will include (but not be limited to) the following:

- protocols to keep the community and stakeholders updated about the progress of the project and its benefits
- protocols to inform relevant stakeholders of potential impacts of construction activities such as changes to traffic conditions and night works.
- protocols to allow the community to make complaints or identify any concerns with the project.

Information on how local businesses, contractors or service providers can express an interest in the project will be continually disseminated via various methods throughout the pre-construction and construction phases.

Operation phase consultation

During operation of the project, a Community and Stakeholder Consultation Plan will be implemented to manage the concerns of stakeholders and any impacts on local landowners. The plan will include (but not be limited to) the following:

- protocols to keep the community and stakeholders updated about the operation of the project and its benefits
- protocols to inform relevant stakeholders of potential impacts of scheduled site activities outside of typical operation.
- protocols to allow the community to make complaints or identify any concerns with the project.
- protocols to keep the community and stakeholders updated about the operation of the project and its benefits

Information on how local workers, contractors or service providers can express an interest in the operation of the project will be displayed on the project website. Efforts will be made to engage with local schools, universities and community groups who may be interested in visiting the site or learning more about renewable energy.

4.2.3 Summary of matters raised

Table 4.2: Summary of issues raised

Issue raised	Response
Impact on the value on surrounding properties	The value of any property is influenced by a wide range of property attributes as well as the prevailing market conditions and the preferences of individual buyers. It is difficult to predict the potential impact of the proposed solar farm development, particularly given that the site is designated industrial land which may or may not be used for impactful industrial purposes at some point in the future. Additionally, the project site includes an existing development approval for the construction of a solar farm. There is very little information on the impact of solar farms on property values, as solar farms are relatively new to Australia. However, there are studies into wind farms, which have a longer history in Australia and which may have higher visibility and noise emissions than solar, when operational. The NSW Department of Lands' analysis of property sales (2009) data found that wind farms did not negatively affect property values in most cases. In addition to that, a report commissioned by the Office of Environment and Heritage in 2016 concluded that the available data does not show any significant impact to the value of agricultural properties.
Impact on visual enjoyment of land and surroundings	The majority of views to the site are partially screened by existing vegetation located along road reserves, around residences or scattered vegetation in paddocks. The proposal site is zoned for industrial land uses, and it is possible that industrial development would have similar or greater potential visual impacts compared to the proposal if the site was not developed for a solar farm. Refer to Section 6.4 for the full landscape and visual assessment.

Issue raised	Response
Construction traffic	It is anticipated that Byrnes Road and Trahairs Road can accommodate the construction vehicle activity associated with the proposal and that the construction traffic volumes have a negligible impact road safety. This is for the following key reasons: • Byrnes Road is currently operating well within its functional mid-block capacity • at its intersection with Trahairs Road, Byrnes Road provides a rural auxillary left turn lane and right turn lane to allow through vehicles to pass vehicles turning into Trahairs Road • a minor upgrade of Trahairs Road would be carried out as described above to make it suitable for use by heavy vehicles during construction. Refer to Chapter 6.8 and Appendix G for the traffic impact assessment.
Operational noise	The results of the noise impact assessment indicate that the operation of the proposal will comply with the relevant operational noise emission criteria and is not predicted to adversely impact the acoustic amenity of the surrounding sensitive receivers. Refer to Chapter 6.6 and Appendix F for the noise assessment.
Glare from solar panels	The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is considered to be relatively limited. Photovoltaic solar panels are designed to reflect as little sunlight as possible, resulting in negligible glare. This is because photovoltaic panels are designed to absorb as much solar energy as possible to generate the maximum amount of electricity or heat. The panels would not generally create noticeable glare when compared with an existing roof or building surface. Based on this, the potential impacts of glare on adjacent land uses are considered to be minor. Such impacts are further reduced due to the installation of tracking systems, which result in any reflection of sunlight directly from the panel back into the atmosphere. Refer to Chapter 6.4 for the landscape and visual assessment.
Risk of fire caused by the proposal during operation	Operation of the proposal is unlikely to result in any substantial additional bushfire risks. The proposal would not result in any substantial sources of ignition and all potential risks would be managed through mitigation or the design of the proposal. A bushfire management plan for the project will be prepared in consultation with the Rural Fire Service. This plan will include but not limited to the following: • management of activities with a risk of fire ignition • management of fuel loads on site • storage and maintenance of firefighting equipment • asset protection zones • adequate egress/access to the site • emergency evacuation measures. Refer to Chapter 6.5 and Appendix E for the hazard and risk assessment.

Issue raised	Response
Weed control	The groundcover vegetation in the study area is dominated by introduced species. The potential for further introduction and spread of weeds in the area by will be managed by implementing the safeguards outlined in section 7.2.
Fencing & security	Security fencing would be installed around the perimeter of the site. The indicative height of the security fencing would be up to 2.2 metres, subject to final design which would seek to minimise the visual impact of the fencing while ensuring that it is appropriate for security and safety purposes. Continuous security video coverage would be maintained via a series of security cameras installed on the perimeter fencing. These cameras would be fitted with infrared sensors and motion sensors to provide constant surveillance of the site boundary. The security cameras would be remotely monitored. Permanent perimeter lighting would not be installed, however motion and/or manually activated surprise lighting may be installed in certain locations to deter intruders.
Flooding	The proposal site is not located on land mapped by Council as flood prone and would be unlikely to flood due to its elevation, landform and lack of permanent watercourses. While the proposal involves constructing solar arrays with impervious surfaces, these would not increase runoff from the proposal site, as they would allow rainwater to drain to the ground underneath the arrays and follow similar flow paths to those currently present on the site. The ground surface would absorb runoff similarly to current conditions on site. Refer to Chapter 6.9 for further information.

5. Planning context

5.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulations provide the framework for assessing environmental impacts and determining planning approvals for developments and activities in NSW. The need or otherwise for development consent is set out in environmental planning instruments – State Environmental Planning Policies (SEPPs), Regional Environmental Plans (REPs) or Local Environmental Plans (LEPs).

5.1.1 Part 4 of the EP&A Act

Part 4 of the EP&A Act provides for the control of development that requires development consent. Depending on the circumstances of the proposal, the consent authority may be the local Council or the Minister for Planning.

Part 4, Division 4.1 of the EP&A Act establishes an approval regime for development that is declared to be State Significant Development by either a SEPP or Ministerial Order. In accordance with Section 89E of the EP&A Act, the Minister for Planning is the consent authority for State Significant Development. Pursuant to Clause 8A of Section 78A of the EP&A Act, an EIS is required to support a development application for State Significant Development.

5.1.2 Approval process

State Significant Development to which Division 4.1 of the EP&A Act applies is identified in the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP) and in declarations made by the Minister for Planning. The proposal is considered to be 'State Significant Development' as it is of a type listed in Schedule 1 of the State and Regional Development SEPP (refer to section 5.2.1).

The NSW Minister for Planning is the consent authority for the proposal and a development application is required to be lodged with the NSW Department of Planning and Environment, accompanied by an EIS. Before preparing the EIS, the applicant must request SEARs. The request for SEARs is accompanied by a Supporting Document which outlines the location, nature and scale of the proposal as well as a preliminary assessment to identify key issues for further assessment in the EIS. Renew Estate submitted the request for SEARs for the proposal on 20 October 2017.

The Department of Planning and Environment consulted with relevant public authorities to obtain input to the SEARs. The Department issued SEARs to Renew Estate on 11 November 2017.

The EIS has been prepared to address the SEARs and the form and content requirements set out in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. The EIS will be publicly exhibited for at least 30 days. During the exhibition period, the public and agencies are invited to make submissions. After the exhibition period closes, the Department may request that the proponent respond to issues raised in the submissions.

5.1.3 Existing development consent

Part of the proposal site is the subject of an existing development consent for a 22 MW solar farm (DA16/0135), which was approved by the Southern Joint Regional Planning Panel.

Due to changes in technology and market demand, Renew Estate elected not to rely on this development consent.

Should the Department of Planning and Environment (DP&E) form the view that the development consent is inconsistent with the proposal, a condition requiring its surrender can be imposed as part of the State Significant Development approval.

5.1.4 Ecologically sustainable development

An objective of the EP&A Act is to encourage ecologically sustainable development. The principles of ecologically sustainable development (defined in the NSW *Protection of the Environment Administration Act 1991*) have been considered throughout development of the overall proposal and are considered further below.

The precautionary principle

This principle states *"if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation".*

The assessment of potential environmental impacts as part of this EIS indicates that there would be no threats of serious or irreversible environmental damage as a result of the construction, operation and decommissioning of the proposal. Where potential environmental impacts have been considered likely to occur, safeguards and mitigation measures have been proposed to minimise and manage any environmental impacts during construction and operation of the proposal. If approval is not sought for the continued operation of the proposal, the proposal would be decommissioned at the end of its design life and the proposal site would be restored as close as practicable to pre-existing conditions to enable agricultural land uses to recommence.

Intergenerational equity

The principle states, *"the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations".*

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

The proposal would contribute to reducing greenhouse gas emissions which would assist in limiting the impacts of global warming which has the potential to impact future generations.

Conservation of biological diversity and ecological integrity

This principle states the "*diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival*".

A thorough assessment of the existing local environment was undertaken to identify and manage any potential impacts of the proposal on local biodiversity. The majority of vegetation has been cleared from the site through previous agricultural land use. Impacts on vegetation would be mostly limited to paddock trees and impacts to grass cover. Where possible, vegetation removal would be avoided as part of the proposal.

Improved valuation, pricing and incentive mechanisms

This principle requires "*costs to the environment should be factored into the economic costs of a project".*

This principle requires that costs to the environment should be factored into the economic costs of a proposal. The basis for this principle is the concept that pricing and other financial arrangements relating to the proposal should reflect the social and environmental costs of the use of the resource on which it is based, including consideration of future values that may exceed current values as the resources become scarcer.

This EIS has assessed the likely environmental impacts of the proposal. The proposal has taken into account these potential impacts and has identified safeguards and mitigation measures to be implemented to minimise the risk of significant adverse impacts. The implementation of these environmental measures would increase the capital construction, operating and decommissioning costs of the proposal. This signifies that the environmental costs have been included in the costs of the proposal.

5.2 Environmental planning instruments

Environmental planning instruments (EPIs) are prepared under the EP&A Act to regulate land use and development. EPIs determine the relevant part of the EP&A Act under which a development proposal must be assessed and therefore determine the need or otherwise for development consent. EPIs consist of SEPPs, REPs and LEPs.

5.2.1 State environmental planning policies

State Environmental Planning Policy (State and Regional Development) 2011

The State and Regional Development SEPP identifies development:

- to which the State Significant Development assessment and approval process under Part 4 of the EP&A Act applies
- that is State Significant Infrastructure and critical State Significant Infrastructure.

Development that is specified in Schedule 1 or Schedule 2 is declared to be State Significant Development. Clause 20 of Schedule 1 relates to electricity generating developments and states that the following development is State Significant Development:

> *Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:*
>
> *(a) has a capital investment value of more than $30 million, or*
>
> *(b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance.*

As the proposal is for an electricity generating facility and has a capital investment of over $30 million, it is State Significant Development.

State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State through increased regulatory certainty and improved efficiency and flexibility in the location of infrastructure and service facilities, while also providing for adequate stakeholder consultation.

Clause 34(7) of the Infrastructure SEPP states that:

> *Except as provided by subclause (8), development for the purpose of a solar energy system may be carried out by any person with consent on any land.*

Subclause (8) relates to photovoltaic electricity generating systems in prescribed residential zones. As the proposal is not located in a prescribed residential zone, subclause (8) is not applicable to the proposal.

As the proposal would be a solar energy system, it is permissible with consent under clause 34(7) of the Infrastructure SEPP.

State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) applies to any proposal which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'. If not controlled appropriately some activities within these industries may create an off-site risk or offence to people, property or the environment thereby making them potentially hazardous or potentially offensive.

A Preliminary Hazard Analysis has been prepared to identify if the proposal is potentially hazardous using the SEPP 33 risk screening process or potentially offensive using licensing requirements (see section 6.5).

5.2.2 Local environmental plans

Wagga Wagga Local Environment Plan 2010

Zoning

The proposal is located within the Wagga Wagga Local Government Area (LGA). The *Wagga Wagga Local Environment Plan 2010* (Wagga Wagga LEP) therefore applies to the proposal site.

The proposal is located within the following LEP zones:

- IN1 General Industrial – the northern and southern solar farm development areas, Trahairs Road and part of the transmission line corridor
- RU1 Primary Production – part of the transmission line corridor
- RE1 Public Recreation – part of the transmission line corridor.

The proposal is permissible with consent in these zones due to the application of the ISEPP (see section 5.2.1).

Subdivision

Renew Estate has a call option with the landowner to purchase the land on which the proposed solar farm is located (see section 1.2.1). Subdivision of four lots is proposed to allow for the purchase of the required land for the proposal site (see section 3.2.15). The existing lots and proposed new lots are outlined in Table 5.1.

Clause 2.6(1) of the Wagga Wagga LEP provides that: "Land to which this Plan applies may be subdivided, but only with development consent". Clause 4.1(3) states that: "The size of any lot resulting from a subdivision of land to which this clause applies is not to be less than the minimum size shown on the Lot Size Map in relation to that land". There is no minimum lot size which applies to the proposal site under the applicable Lot Size Maps (Sheets LSZ_003 and LSZ_003E).

Table 5.1: Existing lots to be subdivided and proposed new lots

Existing lot	Proposed new lots	
Lot 11 DP1130519 (67.5 ha)	1	26.5 ha
	2	41 ha
Lot 2 DP590756 (140.7 ha)	1	96 ha
	2	44.7 ha
Lot 174 DP751405 (87ha)	1	8.3 ha
	2	78.8 ha
Lot 108 DP751405 (9.5 ha)	1	1.5 ha
	2	8 ha

Note: Lot areas are approximate and will be confirmed through a cadastral survey.

The proposal site is an "urban release area" for the purposes of the Wagga Wagga LEP under the Urban Release Area Map (Sheet URA_003 and Sheet URA_003C). Clause 6.3(2) states that: "Development consent must not be granted for development on land in an urban release area unless a development control plan … has been prepared for the land." Section 7.3 of the *Wagga Wagga Development Control Plan 2010* imposes the following controls with respect to minimum subdivision size for industrial developments (noting the proposal site is zoned "IN1 General Industrial" under the Wagga Wagga LEP): "An acceptable minimum lot size for industrial development is considered to be 2,000m^2 with a minimum frontage of 30m."

Therefore, there are no restrictions under the Wagga Wagga LEP or *Wagga Wagga Development Control Plan 2010* with respect to lot size that would prohibit the proposed subdivision of the relevant lots (given the size of all proposed new lots is greater than 2,000m^2 (ie. 0.2 ha)).

Clause 6.1(3) of the Wagga Wagga LEP provides that: "If there was no minimum lot size specified for the land immediately before the land became, or became part of, an urban release area, development consent must not be granted for the subdivision of the land unless the Director-General has certified in writing to the consent authority that satisfactory arrangements have been made to contribute to the provision of designated State public infrastructure in relation to that lot."

Under the Wagga Wagga LEP, "designated State public infrastructure" means "public facilities or services that are provided by, or financed by, the State (or if provided or financed by the private sector, to the extent of any financial or in-kind contribution by the State) of the following kinds:

- State and regional roads;
- bus interchanges and bus lanes;
- land required for regional open space; [and]
- land required for social infrastructure and facilities (such as land for schools, hospitals, emergency services and justice purposes)."

Accordingly, for the purposes of the Wagga Wagga LEP, the proposed subdivision of the relevant lots is not permitted without certification by the Director-General under clause 6.1(3) of the Wagga Wagga LEP.

While the Wagga Wagga LEP prohibits the subdivision of the relevant lots without certification by the Director-General, section 4.38(3) of the EP&A Act allows for development consent to be

granted for development which is partly prohibited in the context of State Significant Development:

> *Consent for State significant development (cf previous s 89E)*
> *……..*
> *(3) Development consent may be granted despite the development being partly prohibited by an environmental planning instrument.*

This means that consent may be granted to the proposed subdivision as part of this SSD 17_8835 application despite the provisions of the Wagga Wagga LEP and *Wagga Wagga Development Control Plan 2010* set out above.

Biodiversity Certification of the Wagga Wagga LEP

Biodiversity Certification of the Wagga Wagga LEP was gazetted on 24 December 2010. The Biodiversity Certification Area covers about 10,655 hectares of current and future urban and industrial land around Wagga Wagga.

Within the Biodiversity Certification Area activities under Part 4 and Part 5 of the EP&A Act are deemed not to have a significant impact on NSW-listed threatened species, populations or ecological communities and their habitats, provided they are undertaken in accordance with the Wagga Wagga LEP and the Order of Biodiversity Certification.

The proposal is located on land inside the Biodiversity Certification Area (see Figure 1.2). The 'Order Conferring biodiversity certification on the Wagga Wagga Local Environmental Plan 2010' requires that areas of native vegetation proposed for protection under the draft Bomen Development Control Plan are protected. Such areas are now protected under Part E, Section 13 – 'Bomen Urban Release Area' in the *Wagga Wagga Development Control Plan 2010*, which requires protection of any low conservation value treed native vegetation within the mapped (biodiversity) sensitive area shown on the 'Natural Resources Sensitivity Map – Biodiversity'.

No areas of biodiversity sensitivity are currently mapped as occurring within the proposal site. However, some areas of native vegetation in the proposal site have been identified by Council for conservation. It is understood that these areas will be included in the 'Natural Resources Sensitivity Map – Biodiversity' in the near future.

As the proposal is located on land inside the Biodiversity Certification Area, and vegetation that has been identified by Council for conservation under the *Wagga Wagga Development Control Plan 2010* would not be impacted (see Figure 1.2), biodiversity assessment under the BC Act is not required (see section 5.3.3).

5.3 Other NSW legislation

5.3.1 Legislation to be applied consistently

Under Section 89K of the EP&A Act, the following authorisations cannot be refused if they are necessary for carrying out State Significant Development that is authorised by development consent, and are to be substantially consistent with the consent:

- *Protection of the Environment Operations Act 1997* – an EPL under Chapter 3 of the Act
- *Roads Act 1993* – a permit under Section 138 to impact on public roads.

Roads Act 1993

The *Roads Act 1993* is administered by Roads and Maritime Services, local councils or the Department of Industry - Land. Roads and Maritime Services has jurisdiction for classified

roads, local councils for non-classified roads and the Department of Industry - Land for road reserves or Crown roads.

Under Section 138 of the *Roads Act 1993*, a person must not impact or carry out work on or over a public road otherwise than with the consent of the appropriate roads authority.

The proposal involves works along the unsealed section of Trahairs Road, and a transmission line crossing of East Bomen Road. A permit is required from Council for these works.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes, among other things, the procedures for issuing of licences for environmental protection on aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an environment protection licence (EPL) and comply with the conditions of that licence.

Schedule 1 of the POEO Act outlines the activities which are considered to be scheduled activities to which an EPL is required to be obtained. Electricity generating works (Clause 17 of Schedule 1) with the capacity to generate over 30 megawatts require an EPL. However, as outlined in Clause 17(1) of Schedule 1, general electricity works do not include the generation of electricity through solar and wind power. As the proposal would generate power from solar energy, an EPL is not required for the proposal.

5.3.2 Approvals that do not apply

Section 89J of the EP&A Act specifies certain approvals that are not required for State Significant Development authorised under a development consent. If not for the application of this provision, an Aboriginal heritage impact permit under Section 90 of the NSW *National Parks and Wildlife Act 1974* would be required for the proposal due to the impacts of the proposal on Aboriginal objects and/or places. For State Significant Development, impacts to Aboriginal objects and/or places are typically managed under Aboriginal Cultural Heritage Management Plans (ACHMPs). ACHMPs are statutorily binding once approved by DP&E. The need for a ACHMP is outlined in Section 10.0 of Appendix C and is included as a measure in Section 6.2.4.

5.3.3 Other relevant legislation

Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) came into effect on 25 August 2017, replacing the *Threatened Species Conservation Act 1995* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*. The aim of the Act is to conserve biodiversity and deliver ecologically sustainable development though a market-based approach particularly for higher risk projects. Ecological outcomes for lower risk projects would be achieved through self-assessment of risk. The market based approach has a regional and state focus rather than a local focus on biodiversity.

The BC Act establishes a new biodiversity assessment method (BAM) for the calculation of biodiversity credits. The BAM applies to State Significant Development that will impact biodiversity values, including paddock trees and remnant vegetation. Where the BAM applies, a Biodiversity Development Assessment Report (BDAR) is required. The BDAR must identify the biodiversity values to be impacted by a development, detail the avoidance methods undertaken to minimise impacts, and identify any offset requirements. The BC Act also places an explicit

requirement on the Minister for Planning to consider biodiversity impacts before deciding whether to approve a project and if any relevant conditions should be imposed.

Clause 8.4(2) of the BC Act states that for development (including State significant development) under Part 4 of the EP&A Act on biodiversity certified land, an assessment of the likely impact of the development on NSW-listed biodiversity is not required. The proposal is located within the Wagga Wagga LEP Biodiversity Certification Area (see section 5.2.2). Areas of native vegetation in the proposal site identified by Council for conservation under the *Wagga Wagga Development Control Plan 2010* would be protected (see Figure 1.2), as required to comply with the Wagga Wagga Biodiversity Certification. Assessment of impacts to NSW-listed species, populations and ecological communities is not required, and therefore application of the Biodiversity Assessment Method and preparation of a Biodiversity Development Assessment Report are not required. The SEARs for the proposal require that the biodiversity impacts of the proposal should be identified in this EIS. These impacts are described in section 6.3.3.

Crown Lands Act 1989

The *Crown Lands Act 1989* (CL Act) contains provisions which regulate the occupation, use, sale, lease and licence of Crown land, along with its proper management, having regard to the principles contained in the CL Act.

Cadastral data provided by the NSW government (DFSI, 2017) identifies Trahairs Road easement as shared Crown/Council land. As Trahairs Road is managed by Council, proposed minor upgrade work along Trahairs Road will require a permit from Council under the *Roads Act 1993* (see section 5.3.1).

Water Management Act 2000

Temporary dewatering and construction activities that interfere with aquifers are generally identified as aquifer interference activities in accordance with the *Water Management Act 2000* and the *NSW Aquifer Interference Policy* (DPI, 2012). However, the aquifer interference approval provisions of the Water Management Act have not commenced, and licensing of these activities is carried out under Part 5 of the *Water Act 1912*. A licence under Water Act is required for dewatering activity that would require the extraction of more than three megalitres of groundwater per year.

The proposal is not considered to result in the dewatering of more than three megalitres of groundwater per year and therefore a licence a licence is unlikely to be required.

5.4 Commonwealth legislation

5.4.1 Environment Protection and Biodiversity Conservation Act 1999

The primary objective of the EPBC Act is to 'provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance (NES matters).

Environmental approvals under the EPBC Act may be required for an 'action' that has, will have or is likely to have a significant impact on:

- NES matters
- the environment on Commonwealth land (whether or not the action is occurring on Commonwealth land)

- the environment anywhere in the world, where the action is to be undertaken by a Commonwealth agency.

Approval for such an action may be required from the Australian Government Minister for the Environment.

An 'action' is considered to include a project, development, undertaking, activity or series of activities. NES matters include:

- world heritage areas
- national heritage places
- wetlands of international importance (ie Ramsar wetlands)
- nationally listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

If the proponent considers that an action will have, or is likely to have, significant impacts on an NES matter or on Commonwealth land, a referral is made to the Commonwealth Department of the Environment and Energy. A proponent may also, but is not required to, submit a referral to the Commonwealth Department of the Environment and Energy where an action will not have, or is not likely to have, a significant impact. If it is determined through the referral process by the Commonwealth Department of the Environment and Energy that an action is likely to have a significant impact on a NES matter, or on Commonwealth land, then the project is a 'controlled action' and approval from the Minister would be required.

An EPBC Act protected matters search was carried out on 21 December 2017 which identified NES matters that may occur in, or may relate to, the proposal site. Table 5.2 provides a summary of the results.

Table 5.2: EPBC protected matters search results

NES matters	Results
World heritage areas	None
National heritage places	None
Wetlands of international significance (Ramsar sites)	Four wetlands including Banrock Station Wetland Complex, Hattah-Kulkyne Lakes, Riverland and the Coorong, and Lake Alexandrina and Albert Wetland. All of these wetlands are located at least 400 kilometres downstream of the proposal site. The proposal would not impact on these wetlands.
Commonwealth marine areas	None
Great Barrier Reef Marine Park	None
Threatened ecological communities	Three communities including the following: • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Weeping Myall Woodlands • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

NES matters	Results
Threatened species	21 species including the following: • nine bird species • three fish species • one frog species • three mammal species • three plant species • two reptiles species.
Listed migratory species	10 species including the following: • one marine bird • three terrestrial species • six wetland species

The proposal would not impact upon any world heritage areas, national heritage places, or wetlands of international importance.

The proposal is unlikely to significantly affect any Commonwealth marine areas, the Great Barrier Reef Marine Park, threatened species, threatened ecological communities, or migratory species that are listed under the EPBC Act (refer to section 6.3.3).

The proposal is unlikely to cause a significant impact on any NES matter or on Commonwealth land and therefore it has not been referred to the Commonwealth Department of the Environment and Energy.

5.4.2 Native Title Act 1993

The objectives of the *Native Title Act 1993* are to:

- recognise native title rights and sets down basic principles in relation to native title in Australia
- provide for the validation of past acts which may be invalid because of the existence of native title
- provide for a future regime in which native title rights are protected and conditions imposed on acts affecting native title land and waters
- provide a process by which native title rights can be established and compensation determined, and by which determinations can be made as to whether future grants can be made or acts done over native title land and waters
- provide for a range of other matters, including the establishment of a National Aboriginal and Torres Strait Islander Land Fund.

Searches of the *Schedule of Applications (unregistered claimant applications), Register of Native Title Claims, National Native Title Register, Register of Indigenous Land Use Agreements* and *Notified Indigenous Land Use Agreements* were undertaken in January 2018, with no relevant listings identified for the study area.

5.4.3 Renewable Energy (Electricity) Act 2000

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

- encourage the additional generation of electricity from renewable sources
- reduce emissions of greenhouse gases generated by the electricity sector
- ensure that renewable energy sources are ecologically sustainable.

Section 17 of the *Renewable Energy (Electricity) Act 2000* defines renewable energy sources eligible under the Commonwealth Government's renewable target scheme, including solar.

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 they acquire.

In January 2011, following changes to the scheme, renewable energy certificates were reclassed as either large-scale generation certificates or small-scale technology certificates. The proposal will be the subject of an application to the Clean Energy Regulator under the *Renewable Energy (Electricity) Act 2000* and would receive large scale generation certificates.

6. Environmental assessment

6.1 Environmental constraints

Figure 6.1 provides an overview of the key environmental constraints in the vicinity of the proposal site:

- remnant vegetation to be conserved under the *Wagga Wagga Development Control Plan 2010* in the northern solar farm development area and near the proposed transmission line corridor. This vegetation would be protected, as required to comply with the Wagga Wagga Biodiversity Certification
- tree plantings at the former Riverina Wool Combing property immediately north and south of Trahairs Road that are likely to be protected by a covenant under section 88B of the *Conveying Act 1919* as per conditions of consent for the facility
- potential scarred tree along the northern boundary of the northern solar development
- existing transmission and subtransmission lines and the associated easements running:
  - through the northern solar farm development area
  - along the western edge of the southern solar farm development area
  - through the southern end of the proposed transmission line corridor options
- existing gas pipelines and the associated easement running through the centre of the proposal site
- Enirgi administration building near the proposed transmission line
- drainage lines
- registered groundwater monitoring bores.

The design of the proposal has considered, and will continue to consider, these constraints to minimise impacts where possible.

The likely impacts of the proposal in relation to these constraints are assessed in this chapter.

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Olympic Highway
Dukes Creek
R04
R05
Trahairs Road
Trees to be protected
GW400120
GW400121
GW400092
Northern solar farm development area
GW403041
GW403040
GW403038
GW400123
GW400122
GW400093
R12
Trahairs Road
Trees to be protected
Trahairs Road
GW400114
Trees to be protected
Byrnes Road
R13
R14
R15
R16
GW415965
GW415966
Southern solar farm development area
GW415964
GW415968
R94
Trees to be protected
R17
Enirgi administration building
R08
Transmission line corridor
R09
Dunns Road
Option 1
East Bomen Road
Option 2
Windmill Road
Dampier Street
R10
R11

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LEGEND

- Proposal site
- Indicative pipeline easement
- Indicative subtransmission line easement
- Disturbance area
- Existing transmission line
- Indicative subtransmission line under construction
- Existing subtransmission line
- Existing gas pipeline
- Residence
- Industrial
- Groundwater monitoring bore
- Road
- Drainage line/stream

Aboriginal heritage item
- Axe Quarry
- Open Artefact Site
- Potential Scarred Tree

Vegetation to be protected
- Covenant
- Development Control Plan

Paper Size A3

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 09 Apr 2018

Environmental constraints

Figure 6.1

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig6-1 Environmental constraints.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wgamail@ghd.com W www.ghd.com

Data source: NSW Government: Hydrolines and roads - 2012, aerial photograph - 2017 and groundwater monitoring bores - 2010; TransGrid: Transmission lines - 2017; Essential Energy: Subtransmission lines - 2017; APA Group: Gas pipeline - 2017; Wagga Wagga City Council: Vegetation protection areas - 2017. Created by:afoddy

6.2 Aboriginal heritage

A specialist Aboriginal heritage assessment was prepared to assess the potential impacts of the proposal and is provided in Appendix C.

6.2.1 Methodology

The Aboriginal heritage assessment was undertaken in accordance with OEH's *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011), *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b).

Consultation

A detailed overview of the Aboriginal community consultation undertaken for the proposal is outlined in Section 3.0 of Appendix C. All consultation was undertaken in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.

Field survey

Two archaeologists and representatives from four Registered Aboriginal Parties (RAPs) completed the archaeological survey of the study area over four days including 16, 17, 30 January and 7 February 2018. All survey was conducted on foot, with a total of 15 transects executed across the study area.

Archaeological test excavations

Following the initial field survey (outlined above), a two day program of archaeological test excavations was undertaken in areas of high sensitivity (ie the tributary traversing the southern solar farm development area) on the 6 and 7 February 2018.

Archaeological test excavation was undertaken in two phases. Phase 1 of the test excavation program involved the excavation of 20 50 x 50 cm (0.25 m²) test pits along two transects positioned parallel to, and on either side of, the tributary. Test pits were placed at 20 m intervals along each transect.

Phase 2 of the test excavation program involved a 0.75m² expansion around one of the above mentioned test pits (TP#3), to better characterise the nature and extent of the subsurface archaeological deposit in this area.

All test pitting was undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b).

Further discussion about the excavation is located in Section 7.7 of Appendix C.

6.2.2 Existing environment

Registered sites

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on the 30 November 2017 for an area centred on the proposal site.

The search identified a total of 29 previously recorded sites which comprise of 20 open artefact sites (ie artefact scatters and isolated artefacts), six scarred trees, and three stone quarries. Of these 29 previously recorded sites, five are located within the Aboriginal heritage study area. These items are outlined in Table 6.1.

Table 6.1: AHIMS sites within the study area

AHIMS Site ID	Site name	Site type	Current AHIMS status
56-1-0109	BIF1	Isolated artefact	Valid
56-1-0045	East Bomen IF1	Isolated artefact	Valid
56-1-0044	East Bomen IF2	Isolated artefact	Valid
56-1-0043	East Bomen 1	Axe quarry	Valid
56-1-0437	Bomen Solar IS01	Isolated artefact	Valid

Survey results

An archaeological survey was undertaken on site on the 16 to 18 January 2018 and 7 February 2018.

The survey identified a total of 36 individual stone artefacts which have not been previously identified in the study area.

These 36 artefacts have been recorded as part of nine new Aboriginal archaeological sites which comprise of eight open artefact sites including six isolated artefact sites and two artefact scatters. In additional to the artefact sites, one potential Aboriginal scarred tree was recorded during the survey.

Each of the new nine Aboriginal archaeological sites are outlined in Table 6.2. The location of these items is shown on Figure 6.2.

Table 6.2: Aboriginal archaeological sites within the study area

AHIMS Site ID	Site name	Site type
Pending	BSF-IA1-18	Isolated artefact
Pending	BSF-IA2-18	Isolated artefact
Pending	BSF-IA3-18	Isolated artefact
Pending	BSF-IA4-18	Isolated artefact
Pending	BSF-IA5-18	Isolated artefact
Pending	BSF-IA6-18	Isolated artefact
Pending	BSF-AS1-18	Artefact scatter
Pending	BSF-AS2-18	Artefact scatter
Pending	BSF-ST1-18	Scarred tree

In addition to the items identified during the survey, seven additional sites were identified and registered (on AHIMS) by the RAP group who participated in the survey. These items are outlined in Table 6.3 and shown on Figure 6.2.

Table 6.3: RAP Recorded Sites

AHIMS Site ID	Site name	AHIMS centroid coordinates (MGA 55)		Site type	Current AHIMS status	Reference
56-1-0543	Bomen 540568	540568	6120270	Open artefact site	Valid	Mark Saddler
56-1-0536	Bomen 539015	539015	6119445	Open artefact site	Valid	Mark Saddler
56-1-0535	Bomen 539004	539004	6119382	Open artefact site	Valid	Mark Saddler
56-1-0034	Bomen 538732	538732	6119148	Open artefact site	Valid	Mark Saddler

AHIMS Site ID	Site name	AHIMS centroid coordinates (MGA 55)		Site type	Current AHIMS status	Reference
56-1-0538	Bomen 539071	539071	6118591	Open artefact site	Valid	Mark Saddler
56-1-0532	Bomen 539085	539085	6118460	Open artefact site	Valid	Mark Saddler
56-1-0533	Bomen 539070	539070	6118506	Open artefact site	Valid	Mark Saddler
56-1-0537	Bomen 539072	539072	6119150	Open artefact site	Valid	Mark Saddler

Subsurface archaeological potential

Figure 6.3 outlines the archaeological sensitively of the proposal area based on the following:

- a review of the findings of previous archaeological investigations in analogous landforms in the surrounding area
- nature and extent of visible surface artefacts across the study area
- on-site observations of post-depositional processes
- historic ground surface disturbances.

The archaeological sensitivity is rated as being nil, low or high, with Table 6.4 providing an overview of how these ratings have been applied to the proposal site. Areas of low sensitivity have been associated with areas of slope within the study area as well as those areas subjected to historic disturbances such as ploughing. Areas of high archaeological sensitivity have been linked to crests and creekline flats. Areas of nil archaeological sensitivity area are associated with areas of high levels of disturbance.

Table 6.4: Rating scheme for archaeological sensitivity

Rating	Definition	Finding
Nil	Land with no potential for subsurface archaeological deposit(s) due to past ground disturbance(s).	Areas of damming, built structures and roads have been identified as having no potential for subsurface deposit
Low	Subsurface archaeological deposit(s) may be present. Relative to areas of high sensitivity, lower artefact counts, densities and assemblage richness values expected. Integrity of deposit(s) will be dependent on the nature of localised land disturbances.	The majority of the study area has been assessed as being of low archaeological sensitivity due to slope and historic disturbance such as ploughing.
High	Subsurface archaeological deposit(s) may be present. Relative to areas of low sensitivity, higher artefact counts, densities and assemblage richness values expected. Integrity of deposit(s) will be dependent on the nature of localised land disturbances.	Areas of high archaeological sensitivity have been linked to crests and creekline flats within the study area.

Figure 6.2: Aboriginal heritage sites within the proposal site

Figure 6.3: Areas of archaeological sensitivity

Results of test excavations

A total of 22 items which satisfied the criteria as artefacts were recovered from the Phase 1 test pits undertaken on the proposal site. These items were dominated (ie 73 per cent) by flake debitage which included complete flakes, proximal flakes and flake chatter. Non-flake debitage items (ie angular shatter) account from the remainder of the items founds. No formed objects (ie cores or tools) were found.

Phase 2 test pitting at test pit 3 was undertaken with the area of the pit expanded. This further investigation identified an additional seven artefacts which resulted in a total of 10 artefacts in the test pit 3.

The total mean artefact density for the Phase 1 testing is 4.4 artefacts per square metre. The total mean artefact density for test pit 3 is 10 artefacts per square metre.

Further detail of the results of the test excavations are located in Section 7.7 of Appendix C.

6.2.3 Potential impacts

The establishment of the solar development area (both north and south) would result in the direct impact on eight open artefact sites consisting of two artefact scatters and six isolated artefacts. These items would be wholly impacted due to their position within the area of impact for the solar development areas. Table 6.5 outlines the items which are proposed to be impacted.

In addition to the eight items to be impacted by the solar development area, both transmission line corridor options have the potential to result in impacts on Aboriginal heritage. Option 1 would result in impacts to up to three isolated artefact sites and Option 2 would result in impacts to up to three isolated artefact sites with site BSF-IA4-18 potentially impacted by both options. The items to be impacted by each option are outlined in Table 6.5

The proposal would avoid any impacts to the Bomen Axe Quarry.

Table 6.5: Impacted Aboriginal heritage sites

AHIMS Site ID	Site name	Site type
Solar farm development		
Pending	BSF-IA1-18	Isolated artefact
Pending	BSF-IA2-18	Isolated artefact
Pending	BSF-IA3-18	Isolated artefact
Pending	BSF-AS1-18	Artefact scatter
Pending	BSF-AS2-18	Artefact scatter
56-1-0109	BIF1	Isolated artefact
56-1-0437	Bomen Solar IS01	Isolated artefact
56-1-0043	Bomen 538732	Isolated artefact
Transmission line – option 1		
Pending	BSF-IA6-18	Isolated artefact
Pending	BSF-IA4-18	Isolated artefact
56-1-0536	Bomen 539015	Artefact scatter
Transmission line – option 2		
56-1-0532	Bomen 539085	Open artefact site
56-1-0045	East Bomen IF1	Isolated artefact
Pending	BSF-IA4-18	Isolated artefact

Cumulative impacts on Aboriginal heritage

The cumulative impacts on known Aboriginal items is considered to be a moderate impact with the proposal to impact upon a maximum of 11 of the 52 registered items which are located in a 20 by 20 kilometres area centred on the proposal site. While this is considered to be a moderate impact, consideration of the character of these sites, all of which have been assessed as being of low scientific significance, alongside a consideration that the majority of land within this region has not been physically inspected for Aboriginal sites, suggests that this impact may not be as significant as it appears.

When considering the availability of land within the region which is considered to have potential for items. The proposal is considered to only result in an impact of 0.8 per cent of the region's potential open artefact resource. The proposal is therefore considered to have a low cumulative impact on the region's Aboriginal archaeological resources.

6.2.4 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.8 would be implemented to minimise potential impacts on Aboriginal heritage in accordance with the management strategy recommended in the AACHIA (Appendix C).

Table 6.6: Aboriginal heritage mitigation measures

Impact	Environmental safeguards	Timing
Impacts on Aboriginal heritage items	An Aboriginal Cultural Heritage Management Plan would be developed for the proposal. The plan is to be developed in consultation with RAPs, and to the satisfaction of OEH and DP&E. The plan would contain procedures for consultation and involvement of the RAPs in the management of Aboriginal cultural heritage values. The plan would include details of all the below mitigation measures.	Pre-construction
	An archaeological salvage program should be undertaken for the Project prior to the commencement of any ground disturbance works within the proposal site. This would include the following: • surface collection of all impacted open artefact sites • program of archaeological test excavation and potentially open area excavation along the selected transmission line corridor where it is positioned within areas of identified high Aboriginal archaeological sensitivity. A detailed research design to be developed for the components of the salvage program.	Pre-construction
	An Aboriginal cultural heritage awareness training package should be developed for use throughout the life of the Project. This package should be developed in consultation with RAPs and completed prior to the commencement any ground disturbance works within the proposal site. A register of all persons having completed the training package should be maintained throughout the life of the Project. Aboriginal cultural awareness training should be mandatory for all staff and contractors whose	Construction

Impact	Environmental safeguards	Timing
	roles may reasonably bring them into contact with Aboriginal sites and/or involve consultation with local Aboriginal community members. Training should also be offered on a voluntary basis to all other mine staff and contractors.	
Salvaged items	All Aboriginal objects salvaged as part of the excavation program should be curated in an appropriate manner, as determined through consultation with RAPs, OEH and DP&I during preparation of the ACHMP. Temporary off-site storage of salvaged objects should be allowed for the purposes of analysis and recording.	Pre-construction
	Aboriginal Site Impact Recording (ASIR) forms for all salvaged sites should be submitted to OEH at the completion of the salvage program.	Pre-construction
Protection of items not within impact area	All Aboriginal sites not impacted by the Project but within the proposal site should be conserved in-situ. The potential scarred tree site should be protected via permanent stock-proof fencing and appropriate associated signage. Site fencing is to be erected after consultation with a qualified archaeologist and RAP representatives.	Construction
	All relevant staff and contractors are to be made aware of the nature and locations of all sites as well as Renew Estate's legal obligations with respect to them. Protected sites will need to be identified on all relevant site plans. Details for the care of protected sites should be incorporated into the ACHMP.	Construction

Impact	Environmental safeguards	Timing
Identification of potential human remains	In the event that potential human skeletal remains are identified within the study area at any point during the life of the Project, the following standard procedure should be followed. 1. All work in the vicinity of the remains should cease immediately; 2. The location should be cordoned off and the NSW Police notified. 3. If the Police suspect the remains are Aboriginal, they will contact the Office of Environment and Heritage and arrange for a forensic anthropologist or archaeological expert to examine the site. Subsequent management actions will be dependent on the findings of the inspection undertaken under Point 3. • If the remains are identified as modern and human, the area will become a crime scene under the jurisdiction of the NSW Police; • If the remains are identified as pre-contact or historic Aboriginal, OEH and all RAPs are to be formally notified in writing. Where impacts to exposed Aboriginal skeletal remains cannot be avoided an appropriate management mitigation strategy will be developed in consultation with OEH and RAPs; • If the remains are identified as historic non-Aboriginal, the site is to be secured and the NSW Heritage Division contacted; and • If the remains are identified as non-human, work can recommence immediately.	Construction
Identification of previous unknown item	AHIMS sites cards will be completed and submitted to OEH for all newly recorded sites within the study area at the completion of the assessment. In the event that a previously unidentified Aboriginal site is discovered within the study area at any point during the operational life of the Project, an AHIMS site card for that site should be submitted to OEH as promptly as possible. Timing protocols for the submission of AHIMS site cards should be included in the ACHMP for the Project.	Construction

6.3 Biodiversity

A specialist biodiversity assessment was prepared to assess the potential impacts of the proposal and is provided in Appendix D.

6.3.1 Methodology

Desktop assessment

A desktop review was carried out to identify threatened flora and fauna species, populations and ecological communities listed under the BC Act and EPBC Act that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present.

The desktop review included a review of publicly available databases for a 10 kilometre radius around the proposal site. The list of those databases searched is provided in section 2.1 of Appendix D.

Field survey

A one-day field survey was undertaken by an ecologist on 18 December 2017. The survey method is described in section 3.2 of Appendix D and included:

- flora surveys including plot/transect surveys (see Figure 6.6)
- vegetation mapping
- a hollow-bearing tree survey
- flora and fauna habitat assessment, including threatened species
- opportunistic fauna observations (targeted fauna surveys were not necessary due to the small extent of habitat removal and degraded nature of the proposal site).

Likelihood of occurrence assessment and assessments of significance

An assessment of the likelihood of occurrence and possibility of impact was completed for listed species, populations and ecological communities with the potential to occur in the study area.

In assessing which of these species, populations and ecological communities are likely to occur in the study area the following factors were taken into consideration:

- the presence of potential habitat within the study area
- condition and approximate extent of potential habitat within the study area
- species occurrence within the locality and region (including results of current and previous surveys and results of database searches and literature review).

For each species, population or ecological community listed under the EPBC Act with a likelihood of occurrence category of recorded, high or moderate, and likely to be impacted by the proposal, a significance assessment was completed in line with the EPBC Act Policy Statement Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1' (DotE 2013). No assessments of significance were completed for species, populations or ecological communities listed under the BC Act due to the proposal site being located in the Biodiversity Certification Area of the Wagga Wagga LEP (see Figure 1.2). Development under Part 4 of the EP&A Act is deemed not to have a significant impact on these matters (see section 5.2.2).

6.3.2 Existing environment

Vegetation

Plant community types

The majority of the proposal site has been extensively used for cropping and grazing and is largely devoid of native vegetation. Figure 6.6 shows the vegetation in the proposal site. Two NSW plant community types are present in the proposal site, described in Table 6.7.

Table 6.7: Plant community types and conservation status

Plant community type	Description
PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (see Figure 6.4)	Within the proposal site, this community occurs as a tree planting of White Box (*Eucalyptus albens*) in the south of the proposed transmission line corridor. The planting is of a uniform age and about four to six metres high. Due to past clearing, predominantly for cropping and grazing, the groundcover is dominated by introduced species including Wild Oats (*Avena fatua*) and Flatweed (*Hypochaeris radicata*). The priority weed Silverleaf Nightshade (*Solanum elaeagnifolium*) is also common in this area. This community is consistent with White Box Yellow Box Blakely's Red Gum Woodland, which is listed as an endangered ecological community under the BC Act. In the proposal site, the community does not meet the classification criteria for the critically endangered form of the ecological community listed under the EPBC Act.
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (see Figure 6.5)	This community occurs as sparse woodland dominated by Yellow Box (*Eucalyptus melliodora*), predominantly in the north-western section of the proposal site. Other tree species that occur include Grey Box (*Eucalyptus microcarpa*) and White Cypress Pine (*Callitris glaucophylla*). Due to past clearing, predominantly for cropping and grazing, the groundcover is dominated by introduced species including Common Wheat (*Triticum aestivum*), Witchgrass (*Panicum capillare*) and Wild Oats. Silverleaf Nightshade is common in the northern section of the study area. This community is consistent with White Box Yellow Box Blakely's Red Gum Woodland, which is listed as an endangered ecological community under the BC Act. In the proposal site, the community does not meet the classification criteria for the critically endangered form of the ecological community listed under the EPBC Act.

Figure 6.4: Planted White Box woodland in the transmission line corridor

Figure 6.5: Remnant Yellow Box woodland in the northern development area

Mixed plantings are located along paddock boundaries in the proposal site and in neighbouring properties. These are mostly comprised of non-locally endemic species such as various eucalypts and Melaleucas. Mugga Ironbark (*E. sideroxylon*), River Sheoak (*Casuarina cunninghamiana*) and acacias including Silver Wattle (*Acacia dealbata*) and Cootamundra Wattle (*Acacia baileyana*) also feature in plantings in the study area. These plantings do not conform to any plant community type.

Initial consultation with Council indicates that tree plantings at the former Riverina Wool Combing property north and south of Trahairs Road are likely to be protected by a covenant under section 88B of the *Conveying Act 1919*, as per conditions of consent for the plant. Several other plantings and patches of remnant vegetation in the study area are identified for conservation under the *Wagga Wagga Development Control Plan 2010* (see Figure 6.6). These areas are to be protected, as required to comply with the Wagga Wagga Biodiversity Certification.

Plant community type

- PCT 266 - White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (planting - Box-Gum Woodland BC Act)
- PCT 277 - Blakey's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (Box-Gum Woodland BC Act)
- Mixed planting

Northern solar farm development area

Southern solar farm development area

Transmission line corridor

Option 1

Option 2

Trees to be protected

P1

P2

Trahairs Road

Byrnes Road

East Bomen Road

Webb Street

Lewington Street

Bomen Road

Jersey Street

Windmill Road

538,000 539,000 540,000 541,000

6,123,000 6,122,000 6,121,000 6,120,000 6,119,000

LEGEND

Flora plot survey
Hollow-bearing tree
Remove
Retain
Drainage line/stream
Road
Rocky outcrop
Dam
Proposal site
Study area
Vegetation to be protected
Covenant
Development Control Plan

Paper Size A3

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 23 Feb 2018

Flora surveys, plant community types, rocky outcrops and hollow-bearing trees

Figure 6.6

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wgamail@ghd.com W www.ghd.com

Data source: NSW Government (LPI): Hydrolines and roads - 2012 and aerial photograph - 2017; Wagga Wagga City Council: Vegetation protection areas - 2017. Created by:mjcotterill

Groundwater dependent ecosystems and riparian land

The Atlas of Groundwater Dependent Ecosystems (BOM 2018a) mapping shows that no native vegetation with high or moderate potential to be a groundwater dependent ecosystem is present in the proposal site. The Yellow Box woodland in the northern solar farm development area is mapped as having low potential to be a groundwater dependent ecosystem.

No riparian land is present in the proposal site.

Flora species

Sixty-eight flora species were identified within the study area during the field survey. This comprised 44 introduced species and 24 native species. No threatened flora species were identified during the field survey.

One flora species listed as a priority weed for the Riverina region (DPI 2017) was recorded during flora surveys; Silverleaf Nightshade. The control duty listed for this species is '*prohibition on dealings*', which means the plant must not be imported into the State or sold. The species is common in the northern section of the study area, north of Trahairs Road, and generally occurs in isolated patches in the cropped areas.

Fauna

Fauna habitats

Woodland

Fauna habitat in the study area is largely limited to roadside vegetation, scattered paddock trees and native tree plantings. The remainder of the study area has previously been cleared for agriculture and is dominated by introduced groundcover species, including large areas of crops.

Remnant vegetation provides potential roosting, movement and foraging habitat for a range of fauna groups including birds, bats, mammals, and to a lesser extent, reptiles. Woodland and plantings also allow for some transient use by mammals such as kangaroos.

Mature eucalypt trees are present in the study area as isolated paddock trees and in patches of woodland along road reserves. No regeneration of canopy species was observed during surveys in the proposal site. The mature trees in the study area would be used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats.

Hollow-bearing trees occur in the proposal site and study area. Hollow-bearing trees located in or near the proposal site are shown in Figure 6.6. Hollow-bearing trees in the study area are likely to provide roosting and nesting habitat for microchiropteran bats and a range of woodland birds.

Woodland areas with woody debris and leaf litter, although minimal, would provide habitat for reptiles such as snakes and skinks, as well as foraging habitat for woodland birds.

Relatively young tree plantings within the study area provide foraging, movement and breeding woodland habitat. The plantings contain shrub species such as acacias, which provide foraging habitat particularly for bird species.

Native grassland

Native grassy areas in the study area are very limited and restricted to the road reserve. However, they provide foraging habitat for common mammals such as the Eastern Grey Kangaroo (*Macropus giganteus*). Grassy areas also provide foraging habitat for woodland birds, including threatened species such as the Diamond Firetail (*Stagonopleura guttata*).

Rocky outcrops

Rocky outcrops exist in two main areas in the proposal site (see Figure 6.6):

- in the south-western corner of the southern solar farm development area
- midway along the transmission line corridor
- at the southern end of the transmission line corridor.

These rocky outcrops are mostly comprised of large embedded rocks. They provide limited value as fauna habitat including roosting sites for birds and potential basking/sheltering sites for reptiles. They are common in the study area and locality.

Aquatic habitat

No permanent watercourses occur in the study area. Three unnamed ephemeral drainage lines intersect the proposal site in the central and southern sections. A number of farm dams are also located in the proposal site. The drainage lines and dams have little or no fringing or emergent aquatic vegetation, and have limited value as habitat for fauna. However, they provide potential habitat for frogs such as the Eastern Sign-bearing Froglet (*Crinia parinsignifera*). Aquatic habitat also provides foraging and breeding habitat for wetland birds, such as ducks and herons.

Fauna survey results

Twenty-six fauna species were recorded during field surveys, including:

- twenty-three bird species, 22 species of which were native such as the Galah (*Eolophus roseicapilla*), Australian Magpie (*Cracticus tibicen*) and the Eastern Rosella (*Platycercus eximius*). The introduced species was the Common Starling (*Sturnus vulgaris*)
- three mammal species including the Eastern Grey Kangaroo (*Macropus giganteus*), the introduced European Rabbit (*Oryctolagus cuniculus*) and introduced European Hare (*Lepus europaeus*).

No reptiles or amphibians were recorded during the field surveys.

No threatened species or populations were observed in the study area during field surveys.

Two threatened fauna species are known or likely to use habitats in the study area, including:

- Superb Parrot (*Polytelis swainsonii*) – listed as vulnerable under the BC Act and EPBC Act
- Flame Robin (*Petroica phoenicea*) – listed as vulnerable under the BC Act.

6.3.3 Potential impacts

Construction – direct impacts

Vegetation removal

Most of the vegetation proposed to be removed would be introduced groundcover vegetation for the construction of the solar farm infrastructure. Native vegetation removal would include:

- up to 0.2 hectares of a White Box planting, which classifies as Box-Gum Woodland under the BC Act
- sixteen remnant trees, including ten hollow-bearing trees
- up to 1.4 hectares of native tree plantings.

The ten hollow-bearing trees proposed to be removed contain 54 hollows.

Introduced groundcover vegetation would also be removed for the construction of some parts of the proposal, such as the substation, battery storage system, control building, hardstand compound area, transmission line towers, and areas where earthworks are required.

Rocky habitat removal

The rocky outcrop in the south-western corner of the southern solar farm development area (see Figure 6.6) would potentially be removed. The outcrop consists of about 1.5 hectares of large deeply embedded rocks that provide limited habitat value for fauna in the agricultural landscape. Similar rocky outcrops are common in the study area and locality. The removal of the rocks is unlikely to cause a substantial impact to native fauna.

Aquatic habitat removal

Three existing farm dams would potentially be decommissioned, which would involve filling the dams with material excavated from other parts of the proposal site. Dams are common in the study area and locality. The potential removal of these dams from the agricultural landscape would be unlikely to cause a substantial impact to native fauna.

Injury and mortality

During construction, death or injury may occur to any fauna present during the clearing of trees. If birds are present but not nesting during construction they will generally move away from the proposal site to escape the disturbance. Clearing of hollow-bearing trees carries the risk of injury to hollow dependent fauna that may be using hollows at the time of clearing.

Potential impacts to fauna would be reduced through the implementation of safeguards outlined in section 7.2.

Construction – indirect impacts

Invasion and spread of weeds

The groundcover vegetation in the study area is dominated by introduced species. The proposal has the potential to further introduce and spread weeds in the study area through movement of machinery and light vehicle traffic during construction.

One priority weed species was identified during field surveys; Silverleaf Nightshade. The proposal has the potential to cause the further spread of priority weeds such as Silverleaf Nightshade in the proposal site and study area.

The spread of weeds would be managed by implementing safeguards identified in section 7.2.

Sedimentation

Vegetation removal and earthworks have the potential to lead to minor erosion of drainage lines, and sedimentation, impacting on water quality during periods of rainfall.

Sedimentation has the potential to affect flora and fauna, including frogs, turtles and macroinvertebrates through runoff to waterways and dams. Potential impacts from sedimentation would be managed by implementing safeguards identified in section 7.2.

Water quality

Potential accidental spills of contaminants such as fuel or chemicals could impact on aquatic fauna and flora in dams or drainage lines during periods of flow. Due to the limited habitat value of the waterways in the proposal site, impacts on water quality are unlikely to substantially affect any aquatic flora and fauna.

Potential water quality impacts would be minimised through the implementation of safeguards outlined in section 7.2.

Invasion and spread of pathogens and disease

The proposal has the potential to result in the spread of pathogens such as bacteria and fungi. This could occur through the spread of soils on vehicle tyres and staff footwear. Impacts of pathogens include spread of known diseases that are detrimental to fauna such as the amphibian chytrid fungus and psittacine circoviral (beak and feather) disease.

The potential spread of pathogens would be minimised through the implementation of safeguards outlined in section 7.2.

Operation – indirect impacts

Impacts on biodiversity during operation would be minimal. Potential impacts would be limited to the spread of weeds within the proposal site through maintenance activities. Given the highly disturbed nature of the proposal site, this would be unlikely to further substantially alter the vegetation present. Safeguards would be implemented to minimise the spread of weeds during operation.

Key threatening processes

The proposal may involve four key threatening processes listed under the BC Act and EPBC Act:

- clearing of native vegetation – the proposal would remove up to 0.2 hectares of a White Box planting classified as Box-Gum Woodland, up to 1.4 hectares of additional native plantings, and 16 remnant native paddock trees from the proposal site
- loss of hollow-bearing trees – the proposal would remove about ten hollow-bearing trees from the proposal site
- removal of dead wood and dead trees – the proposal would remove two dead trees
- removal of bush rock – the proposal would potentially remove the rocky outcrop in the south-western corner of the southern solar farm development area.

The impacts of key threatening processes would be minimised through the implementation of safeguards detailed in section 7.2.

Assessments of significance

NSW legislation

The assessment of likelihood of occurrence found that the proposal may potentially impact upon one ecological community (Box-Gum Woodland) and two bird species (Superb Parrot and Flame Robin) listed under the BC Act.

Due to the proposal site being located within the Wagga Wagga LEP Biodiversity Certification Area, it is deemed not to have a significant impact on NSW-listed ecological communities, threatened species, or populations and their habitats provided that the development or activity is undertaken in accordance with the Wagga Wagga LEP and Order of Biodiversity Certification. Therefore, assessments of significance (5 part tests) under section 7.3 of the BC Act were not completed for Box-Gum Woodland, the Superb Parrot or the Flame Robin.

Commonwealth legislation

The assessment of likelihood of occurrence found that the proposal may potentially impact upon one bird species listed as threatened under the EPBC Act; the Superb Parrot. The EPBC Act Policy Statement 'Matters of National Environmental Significance: Significant impact guidelines 1.1' (DotE 2013) was reviewed when determining if a significant impact is likely on the species.

The significance assessment concluded that the proposal is unlikely to have a significant impact on the Superb Parrot primarily due to:

- the small area of habitat being removed in relation to habitat available in the locality
- tree removal being limited to isolated paddock trees and plantings in introduced grassland
- there being areas of higher quality habitat value in patches outside the study area.

A referral to the Commonwealth Minister for the Environment is therefore not required.

6.3.4 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.8 would be implemented to minimise potential impacts on biodiversity.

Table 6.8: Biodiversity mitigation measures

Impact	Environmental safeguards	Timing
Loss of native vegetation and fauna habitat	A flora and fauna management plan will be prepared as part of the Construction Environmental Management Plan (CEMP) to minimise the ecological impacts of the proposal, which will include: • plans for the construction site and adjoining area showing native vegetation, flora and fauna habitat and threatened ecological communities • plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (including the hollow-bearing tree near the control building and areas of vegetation identified for conservation under the *Wagga Wagga Development Control Plan 2010*) • a landscaping plan showing areas for planting of locally native vegetation to replace vegetation removed by the proposal.	Pre-construction
	Pre-clearing surveys will be undertaken to identify exclusion zones and specific habitat features to be retained (including the hollow-bearing tree next to the southern boundary of the northern solar farm development area and trees identified for protection).	Construction
	Temporary exclusion fencing will be erected to prevent encroachment and clearing of remnant vegetation and protected areas beyond the construction footprint.	
	Staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained.	

Impact	Environmental safeguards	Timing
	Where practicable, vegetation removal will occur between January and August, outside the main fauna breeding season, to avoid potential breeding disturbance to fauna.	
	If tree removal is required during the breeding season, an ecologist will investigate if any of the hollows are being used for breeding by threatened species such as the Superb Parrot during pre-clearing surveys. Controls to prevent breeding disruption will be implemented as necessary.	
Spread of weeds	Priority weed control measures will be implemented as part of the CEMP to prevent their spread in the study area.	Pre-construction
	Declared priority weeds will be managed according to requirements of the NSW *Biosecurity Act 2015*.	Construction Operation
	Soil material and stripped groundcover vegetation with the potential to contain Silverleaf Nightshade will not be removed from the proposal site.	Construction Operation
	Soil disturbance will be avoided as much as possible to minimise the potential for spreading weeds.	Construction Operation
Disturbance of aquatic habitat	Disturbance of aquatic habitat in dams will be minimised if possible.	Construction
Loss of hollows	Felled limbs with hollows will be placed in woodland or plantings along the boundary of the development area. The woody debris retained will be spread in a fashion that replicates the natural occurrence of woody debris in the environment and will not be stacked.	Construction
Impacts to fauna	Fauna handling during vegetation removal will be undertaken by a qualified ecologist or Wildlife Information, Rescue and Education Service (WIRES) representative.	Construction
Water quality, chemical and fuel impacts on flora and fauna	Any herbicides used for weed control will be applied to the manufacturer's specifications and as outlined in the manufacturer's Material Safety Data Sheet.	Construction
Pathogen spread and establishment	Vehicle wash down facilities will be provided should evidence of pathogens or fungus such as Phytophthora or Chytrid be found.	Construction

6.4 Landscape and visual

6.4.1 Methodology

The methodology used to undertake the landscape character and visual impact study is summarised as follows:

- reviewing the concept design and supporting material to gain an appreciation of the overall proposal
- identifying the visual catchment of the solar farm and transmission line through the preparation of a viewshed analysis

- describing the landscape character and identifying visually sensitive receivers with views of the proposal and grouping receivers into key viewpoints where appropriate
- evaluating visual impact of the overall proposal by comparing the sensitivity of viewpoints and the magnitude of the impact of the overall proposal upon them.

Visual impact assessment

The potential visual impact of the overall proposal has been assessed in relation to the impacts on each of the viewpoint.

Visual impact is determined based on a combination of the following:

- sensitivity rating – the sensitivity of the viewpoint (ie receivers) to changes in the visual landscape
- magnitude rating – the nature of the proposed changes resulting from the proposal including the physical size and scale of the proposal within the viewpoint.

The above two ratings are then combined using the matrix outlined in Figure 6.7 to determine the overall level of impacts on each of the viewpoint.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High impact	High to moderate impact	Moderate impact	Negligible
	Moderate	High to moderate impact	Moderate impact	Moderate to low impact	Negligible
	Low	Moderate impact	Moderate to low impact	Low impact	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 6.7: Visual impact assessment grading matrix

6.4.2 Existing environment

Landscape character

The proposal site is currently used for agricultural purposes (primarily cropping) which has resulted in it being largely devoid of trees and shrubs. The proposal site is considered to be visually consistent with the surrounding rural properties, which are used for similar agricultural purposes, with the exception of industrial facilities located along Byrnes Road, west of the proposal site. Figure 6.8 shows a typical view of the landscape character of the proposal site. The proposed solar farm development areas are zoned IN1 General Industrial. Future land use in the proposal site is likely to be similar in nature to the existing industrial developments along Byrnes Road.

Isolated paddock trees and patches of trees are located in the proposal site. Rows of trees have been planted along the edges of the proposal site and along internal fence lines. Trees and shrubs have also been planted along Byrnes Road, adjacent to the north-western boundary of the proposal site. The plantings provide some screening from surrounding residences and Byrnes Road. Dense planted vegetation is also present on either side of Trahairs Road west of the central portion of the proposal site.

The study area surrounding the proposal site generally slopes east away from Byrnes Road, which runs along a low ridge. West of Byrnes Road, the landscape slopes south towards a small valley between two ridges west of Byrnes Road south of Trahairs Road.

Three high points are located south of the proposal site as shown in the contours on Figure 6.9, with one of these being located near the south-west corner of the proposal site.

An existing subtransmission line runs along the western edge of the proposal site and crosses the northern development area. A new subtransmission line is being constructed to replace this line. The new subtransmission line will be located along the western boundary of the southern development area and will cross the northern development area parallel to the existing line. The alignment of these subtransmission lines, and another existing transmission line located further west, are shown in Figure 1.2.

Due to the semi-rural nature of the locality, sensitive visual receivers are limited, with concentrations located to the east/south-east and west of the proposal site. The location of all nearby visually sensitive receivers is shown in Figure 6.9.

Figure 6.8: Representative viewpoint (looking south across northern solar farm development area with industrial development in background)

Viewshed analysis

Methodology

A viewshed analysis was carried out to determine where the proposal site would be visible from in the surrounding landscape. Two separate viewshed analyses were undertaken, including one for the proposed solar farm and one for the proposed transmission line options. These components of the proposal have different heights and were separated in the analyses to avoid either component influencing the accuracy of the assessment of visual impacts for the other.

The transmission line may be wholly or partially underground, subject to detailed design. For the purpose of this viewshed analysis, it has been assessed as an overhead line to describe the scenario with the greatest potential impact on visual amenity.

Details of the components of the proposal assessed in each viewshed are outlined in Table 6.9.

Table 6.9: Details of viewshed analysis

Viewshed	Overview of the components of the proposal assessed
Solar farm site (Figure 6.9)	The viewshed analysis for the solar farm site involved the assessment of the following infrastructure (including their assumed maximum heights) located within the northern and southern solar farm development areas: • battery storage system (2.3 metres) in location shown in Figure 1.2 • substation (five metres) in location shown in Figure 1.2 • control building (5.5 metres) in location shown in Figure 1.2 • solar panels, including inverter containers (four metres), these were assumed to be across the entire northern and southern development areas excluding those areas for the items above.
Transmission line options 1 and 2 (Figure 6.10)	The viewshed analysis for the transmission line considered a 30 metre high transmission line located along the boundary of the two transmission line assessment corridor areas currently being considered (as shown on Figure 1.2). As previously mentioned, this assessment conservatively assumes that the entire transmission line would be aboveground.

A conservative approach has been taken in nominating the heights of the infrastructure, to capture all potential views of the proposal.

The viewshed analyses assess views based on the terrain only, and do not consider existing vegetation screening. The description below is considered to be conservative and many areas assessed as having views of the proposal site may not have a view of the site, or views may be partially screened.

Solar farm viewshed analysis

Figure 6.9 shows the results of the viewshed analysis for the areas that would have views of the proposed northern and southern solar farm development areas.

As shown in Figure 6.9, the solar farm would be visible from most of the area east of the site. This is largely due to the proposal being located near the top of a ridge.

The solar farm would generally not be visible from most of the area to the south-west due to three high points located south of the proposal site. The solar farm would be visible from the area immediately to the south, north of East Bomen Road. West of Byrnes Road and south of Trahairs Road, the solar farm would generally not be visible due to these properties being located in a shallow valley between Byrnes Road and a ridge further west. The solar farm would be visible from this ridge. The northern solar farm development area would be visible from areas north of Trahairs Road.

Based on the viewshed analysis, a number of visually sensitive receivers were identified for further assessment. These receivers, or groups of receivers, are described further below (see sub-section title 'Viewpoints' in this section below).

Transmission line viewshed analysis

Figure 6.10 shows the results of the viewshed analysis for the areas that would have views of the proposed transmission line. The transmission line (either option) would be visible from

broader areas than the solar farm (see Figure 6.9). This increase in the visual catchment is largely due to the height of the transmission line (30 metres), compared to the much lower heights of the solar farm infrastructure (up to about 5.5 metres). The transmission line would be visible from most of the surrounding area. It would not be visible in some small areas behind localised high points to the south and west.

Viewpoints

Overview

Based on the viewshed analyses, a number of viewpoints were identified. These viewpoints were generally identified by grouping similar groups of visually sensitive receivers (ie type, distance and direction of proposal) which were identified as likely to have views of the proposal. The following viewpoints were identified in the vicinity of the proposal site (see Figure 6.9 and Figure 6.10):

- Viewpoint 1 – residences south of the proposal site and north of East Bomen Road
- Viewpoint 2 – residences east of the proposal site
- Viewpoint 3 – residences north-east of the proposal site
- Viewpoint 4 – residences south-east of the proposal site
- Viewpoint 5 – residences south-west of the proposal site
- Viewpoint 6 – residences west of the proposal site along the Olympic Highway
- Viewpoint 7 – industrial buildings west of the proposal site
- Viewpoint 8 – users of the transport corridor along Byrnes Road, including road users and trains along the Sydney to Melbourne Rail Line.

Viewpoint 1 - residences south of the proposal site and north of East Bomen Road

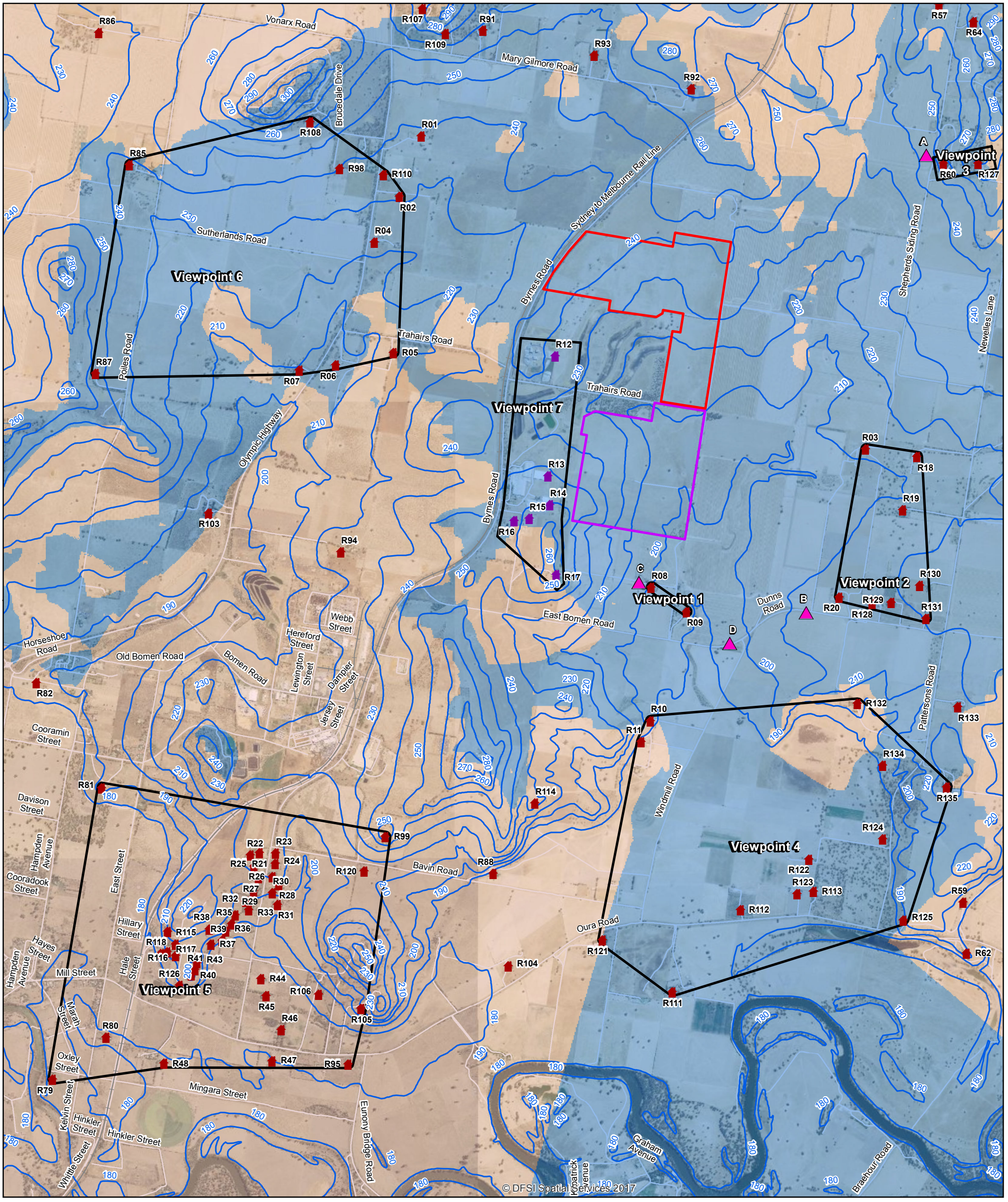
This viewpoint consists of two residences located between the proposal site and East Bomen Road. The nearest of these two residences is located about 465 metres south of the proposed southern development area and 785 metres east of the transmission line option 2 alignment.

Views from this viewpoint are primarily of the southern development area. The views are partially screened by vegetation around the residences, as well as vegetation along the southern boundary of the proposal site.

Figure 6.11 shows the views of the proposal site from the northern side of nearest residence (at viewpoint C). Views from the residence are screened to a greater degree than appear in the photo, as the photo was taken from the edge of the vegetation surrounding the residence.

The residences in this viewpoint may also have views of the proposed transmission line.

Figure 6.11 shows the view from East Bomen Road west of Windwill Road (at viewpoint D) to the south of the two residences which are located in viewpoint 1.



LEGEND

- Photo Point
- Residence
- Industrial
- Elevation contour (10m)
- Road
- Viewpoint location
- Northern solar farm development area
- Southern solar farm development area
- Views not available of proposal
- Views available of proposal

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number 23-16243
Revision 0
Date 09 Apr 2018

Solar farm viewshed analysis

Figure 6.9

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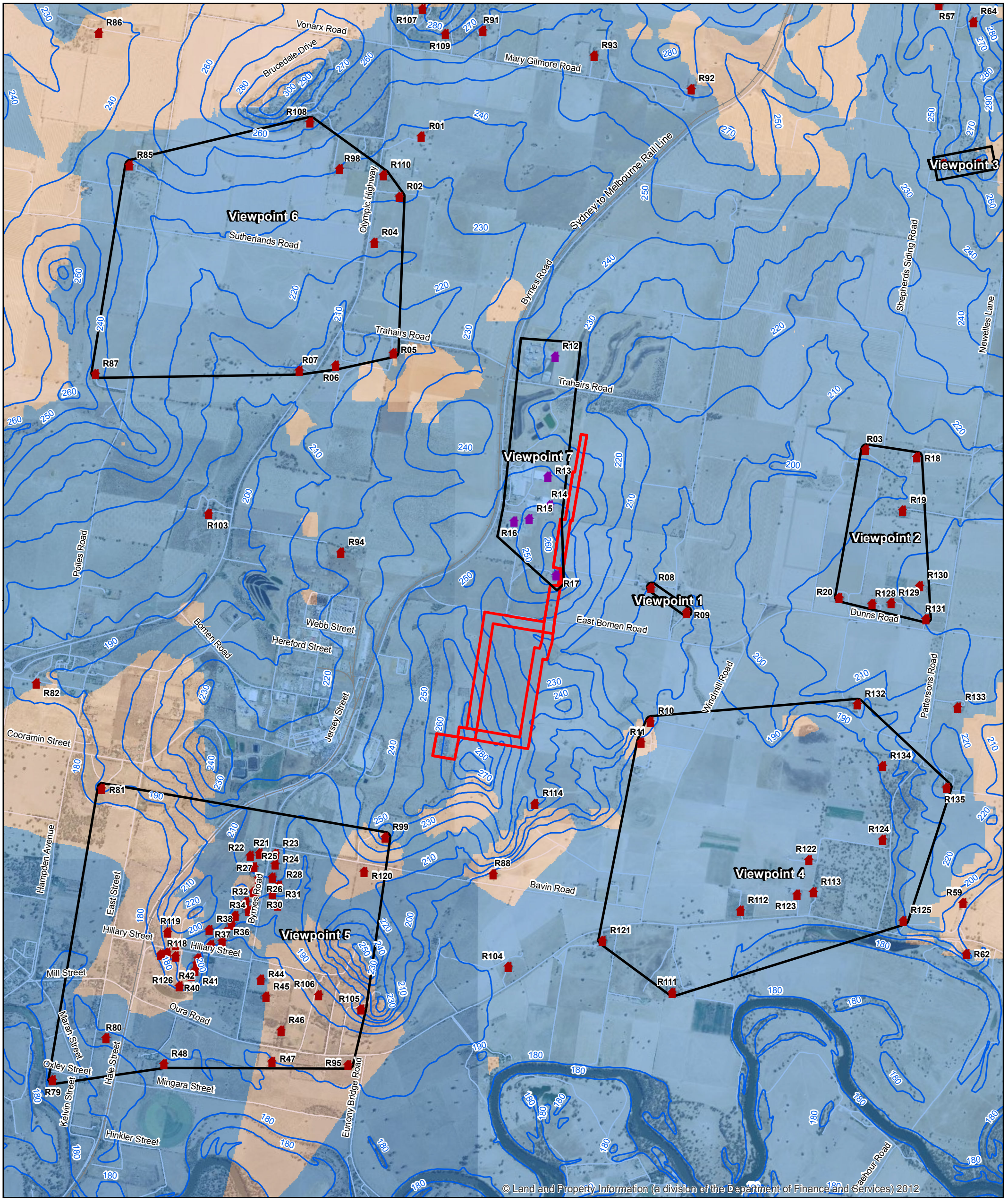
Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Hydrolines, dams, rail lines, lot boundaries, residences, elevation contours, lot boundaries and roads - 2012 and aerial photograph - 2017. Created by:afoddy



LEGEND

Residence
Industrial
Elevation contour (10m)
Road
Viewpoint location
Transmission line corridor
Views not available of proposal
Views available of proposal

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number	23-16243
Revision	0
Date	10 Apr 2018

Transmission line viewshed analysis

Figure 6.10

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\Viewshed\BomenSolarFarmEIS_TransmissionLine_Viewshed.mxd Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Hydrolines, dams, rail lines, lot boundaries, residences, elevation contours, lot boundaries and roads - 2012 and aerial photograph - 2017. Created by:afoddy

Figure 6.11: View from representative location from viewpoint 1 with extent of proposal site visible from nearest residence

Photograph taken from photo point C (see Figure 6.9).

Figure 6.12: View from the rear of viewpoint 1 with extent of proposal site visible from nearest residence

Photograph taken from photo point D (see Figure 6.9).

Viewpoint 2 - residences east of the proposal site

This viewpoint consists of residences east of the proposal site, the nearest of which is about 1.4 kilometres from the proposal site. Figure 6.13 and Figure 6.14 provides an indicative view of the proposal site from this viewpoint (shown in yellow). These photos were taken from the road reserve on Dunns Road adjacent to the nearest residence.

As shown in Figure 6.13 and Figure 6.14, the southern development area is visible from properties to the east due to its location on the side of the ridge that runs along Byrnes Road. Views from these properties are predominantly of the southern development area. The views of the site are partially screened by vegetation around the residences and plantings along paddock boundaries. Remnant trees and plantings along the eastern boundary of the proposal site also offer some screening of the areas of the proposal site closest to the receivers.

Figure 6.13: View from representative location from viewpoint 2 with extent of proposal site visible from Dunns Road

Photograph taken from photo point B (see Figure 6.9).

Figure 6.14: View from representative location from viewpoint 2 with extent of proposal site visible from Dunns Road

Photograph taken from photo point B (see Figure 6.9).

Viewpoint 3 - residences north-east of the proposal site

This viewpoint consists of views from two residences on Shepherds Siding Road north-east of the proposal site. These residences are located about two kilometres from the north-eastern corner of the proposal site. A low rise in the landscape shields views of the northern development area from the receivers. Parts of the southern development area are just visible from the receivers (see Figure 6.15 and Figure 6.16). Views from the residences towards the proposal site are heavily screened by vegetation in the immediate surrounds.

Figure 6.15: View from representative location from viewpoint 3 with extent of proposal site visible from Shepherds Siding Road

Photograph taken from photo point A (see Figure 6.9).

Figure 6.16: View from representative location from viewpoint 3 with extent of proposal site visible from Shepherds Siding Road

Photograph taken from photo point A (see Figure 6.9).

Viewpoint 4 - residences south-east of the proposal site

This viewpoint comprises a number of residences located south-east of the proposal site. The two closest residences are located about 1.6 kilometres south of the solar farm site and 980 metres east of the transmission line option 2 alignment. Views of the northern and southern development areas from these residences are distant, with views obscured by vegetation.

The two nearest residences would be unlikely to have views of the proposed transmission line due to elevation variations in the local landscape. Other residences would have very distant views of the transmission line.

Viewpoint 5 - residences south-west of the proposal site

This viewpoint comprises a collection of residences located south-west of the proposal site near the southern end of Byrnes Road. These residences are located over three kilometres from the proposal site and would be unlikely to have views of the solar farm due to a number of localised high points.

The transmission line would potentially be visible from these residences, as it is located closer to the residences and is not located behind the high points in the area. Any potential views of the transmission line area are also likely to contain existing electricity infrastructure near the TransGrid substation.

Viewpoint 6 - residences west of proposal site along the Olympic Highway

This viewpoint consists of residences located west of the proposal site. The closest of these residences is located about 1.3 kilometres from the western boundary of the proposal site. All other residences are located at greater distances. The closest residence is modelled in the viewshed analysis as not having any view of the site due to a localised high point, however due to the position of the property, views from this location are considered possible. Views from all residences are distant and somewhat screened by vegetation on properties and along Byrnes Road and the Olympic Highway. Many of the residences also have views of Byrnes Road and the existing industrial developments along the road.

Viewpoint 7 - industrial buildings west of the proposal site

This viewpoint consists of the industrial buildings directly west of the proposal site. This view is not considered to be a sensitive view, however has been considered due to its proximity to the proposal site. Workers at these facilities would have views of the proposal site. Views of parts of the proposal site from these developments are partially screened by existing vegetation, particularly dense plantings along Trahairs Road.

Viewpoint 8 - users of the transport corridor along Byrnes Road, including road users and trains along the Sydney to Melbourne Rail Line

This viewpoint consists of road users along Byrnes Road and passengers on trains on the Sydney to Melbourne Rail Line. The proposal site is visible along part of this corridor, with partial screening by vegetation and industrial developments. Views are short-term in nature, as receivers travel past the proposal site. A dense planting along Byrnes Road screens much of the northern solar farm development area from the road.

Aircraft

Wagga Wagga Airport is located about 11.5 kilometres south of the proposed solar farm development areas. It is used by commercial airlines travelling to and from Melbourne, Sydney and Brisbane. The runway is orientated south-west to north-east. As such, commercial aircraft

landing and taking off at Wagga Wagga do not typically fly over the proposal site. Smaller aircraft occasionally use the airspace in the vicinity of the proposal site.

6.4.3 Potential impacts

Construction

During the construction of the proposal, surrounding properties would have views of the proposal site and associated activities. Potential visual impacts would include the following:

- presence and movement of vehicles, materials, plant and equipment around the site
- presence of temporary site offices on site
- movement of vehicles to site on Trahairs Road, which typically conveys relatively low number of vehicles each day
- generation of dust which would be visible to residents of surrounding properties.

These potential impacts would be low due to the implementation of safeguards detailed in section 6.4.4, and the short-term nature of the construction phase.

Operation

The proposal would be visible from surrounding areas, including a number of residences. The proposal would change land use at the site from agricultural production to solar power generation, and this would change the visual character of the site. The majority of views to the site are partially screened by existing vegetation located along road reserves, around residences or scattered vegetation in paddocks. The proposal site is zoned for industrial land uses, and it is possible that industrial development would have similar or greater potential visual impacts compared to the proposal if the site was not developed for a solar farm.

Impacts on viewpoints due to solar farm

Viewpoint 1 - residences south of the proposal site and north of East Bomen Road

Viewpoint 1 includes the most affected visually sensitive residences due to the proximity of these residences to the proposal site (450 to 600 metres from the proposal site). This viewpoint is considered have a moderate sensitivity as these residences have existing views of a rural landscape, however these views do already contain some existing industrial development located adjacent to the site therefore reducing the sensitive nature of this view.

The proposal would result in a change to the visual landscape from this viewpoint due to the construction of the solar farm. Views of the proposal from these properties would include the southern development area. The proposed infrastructure in the southern development area would limit views of the northern development area.

Views from these properties of the new infrastructure would be partially screened by existing vegetation along the southern boundary of the proposal site and vegetation on the adjacent properties surrounding the receivers.

As shown in the draft landscape plan (Figure 3.16), additional vegetation is proposed to be planted along the southern boundary to complement the existing vegetation. As outlined in section 6.4.4, the draft landscape plan would be further developed through further consultation with nearby land owners to determine suitable methods of providing screening.

Due to the above the magnitude of impacts on viewpoint 1 are considered to be moderate largely as the new infrastructure would be positioned in the middle ground of views and would be partially screened.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 1 are considered moderate.

Viewpoint 2 - residences east of the proposal site

Viewpoint 2 is considered to have a moderate sensitivity as residences in this viewpoint have existing views of a rural landscape, however these views already contain some existing industrial development located adjacent to the site therefore reducing the sensitive nature of this view.

The proposal would result in increased development within the middle ground views of these residences. In general, views from these receivers would focus on areas closer to the respective property (within one kilometre). Views would not focus on the proposal site, which is located in most cases over 1.4 kilometres from the receivers.

A change in elevation from east to west results in large parts of the proposal site being visible from properties to the east. These views would remain, regardless of whether additional screen planting is provided along the eastern boundary of the site. Existing vegetation located around the residences or within paddocks provides some screening of the proposal site for receivers in viewpoint 2.

As shown in the draft landscape plan in Figure 3.16, additional planting of vegetation is proposed along the eastern boundary to complement existing vegetation screening along this boundary. As outlined in section 6.4.4, the draft landscape plan would be further developed following further consultation with nearby land owners to determine suitable methods of providing screening. Based on the above the magnitude of impacts are considered to be moderate.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 2 are considered moderate.

Viewpoint 3 - residences north-east of the proposal site

Viewpoint 3 is considered have a high sensitivity as residences in this viewpoint have existing views of a rural landscapes. The existing industrial facility adjacent to the proposal is located in the background views from this viewpoint and therefore does not reduce the sensitivity of the view.

Views of the proposal from the residences within viewpoint 3 would primarily be limited to infrastructure in the southern development area as the slope of the land means the northern development area is hidden from this location. The proposed infrastructure would be positioned in the background of any views from this location. Due to existing vegetation around both properties located within viewpoint 3, and the distance to the proposal, views would not be substantially altered by the introduction of the new infrastructure. Based on the above the magnitude of impacts are considered to be low.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 3 are considered moderate.

Viewpoint 4 - residences south-east of the proposal site

Viewpoint 4 is considered have a high sensitivity as residences in this viewpoint have existing views of a rural landscapes. The existing industrial facility adjacent to the proposal is located in the background views (or is not visible from some residences) from this viewpoint and therefore does not reduce the sensitivity of the view.

Views from residences within viewpoint 4 would include views of the southern development area and some areas of the northern development area. Due to the distances of these receivers from the proposal site and existing vegetation at residences or on properties, views from these receivers are considered minimal and limited to background views. Based on the above the magnitude of impacts are considered to be negligible.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 4 are considered negligible.

Viewpoint 5 - residences south-west of the proposal site

Viewpoint 5 is considered have a moderate sensitivity as residences in this viewpoint have existing views of a rural landscapes, however these residences also have some views of the industrial area located north of the residences in the middle ground.

Residences within viewpoint 5 are not expected to have views of the northern and southern development areas, due to localised high points and the position of these receivers between two low ridges. The magnitude of impacts are therefore considered negligible.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 5 are considered negligible.

Viewpoint 6 - residences west of the proposal site along the Olympic Highway

Viewpoint 6 is considered have a moderate sensitivity as residences in this viewpoint have existing views of a rural landscape, however these views do already contain some existing industrial development located adjacent to the site in the background views. The presence of this facility reduces the sensitivity nature of this view.

Views of the solar farm from within viewpoint 6 would be limited. The proposal site would be in the background of any views due to these receivers being at least 1.3 kilometres from the proposal site. Any potential long distance views would be partially screened by existing vegetation around receivers, in paddocks or along Byrnes Road. The magnitude of impacts are therefore considered negligible.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 6 are considered negligible.

Viewpoint 7 - industrial buildings west of the proposal site

Viewpoint 7 is considered to have a negligible sensitivity as industrial facilities are not considered to be sensitive receivers. Workers are likely to be focused on their work activities and any views of the site would be short-term and of low importance in relation to their employment.

The solar farm would be visible from viewpoint 7 due to its close proximity to the proposal. Views would include the solar panels and power conversion stations. The proposed substation and battery storage system would be visible due to their locations on the western boundary of the proposal site. Views of the proposal site and substation would be uninterrupted from some locations within the industrial buildings. Views of parts of the proposal site from these developments are partially screened by existing vegetation, particularly dense plantings along Trahairs Road. The magnitude of impacts are considered to be high due to the proximity of the proposal to this viewpoint.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 7 are considered negligble.

Viewpoint 8 - users of the transport corridor along Byrnes Road, including road users and trains along the Sydney to Melbourne Rail Line

Viewpoint 8 is considered to have a low sensitivity as receivers within this viewpoint are short term in nature as they travel past the site. The users of these two corridors (in particularly along Byrnes Road) are also generally focused on the task of driving and therefore the sensitivity of the view is reduced even though views would be relatively close to this viewpoint.

Views for motorists travelling along Byrnes Road and for passengers/drivers along the train line would be altered, as the proposal would be visible from the road and rail line in some locations. Much of the eastern side of the road reserve contains vegetation which screens views to the site. Proposed vegetation screening (refer to Figure 3.16) along the northern boundary of the proposal site would be considered to minimise any views from the road and other properties located to the north/north-west of the proposal site. Based on the proposed new infrastructure the magnitude of the changes is considered to be high.

Overall based on the sensitivity of the viewpoint and the magnitude of impacts, visual impacts on viewpoint 8 are considered moderate.

Summary of visual impact

Table 6.10 provides a summary of the visual impacts to be experienced within each of the viewpoints for the solar farm.

Table 6.10: Summary of visual impacts

Viewpoint	Sensitivity	Magnitude	Visual impact
1	Moderate	Moderate	Moderate
2	Moderate	Moderate	Moderate
3	High	Low	Moderate
4	High	Negligible	Negligible
5	Moderate	Negligible	Negligible
6	Moderate	Negligible	Negligible
7	Negligible	High	Negligible
8	Low	High	Moderate

Impacts at viewpoints due to transmission line

The proposed transmission line would be visible at greater distances than the solar farm due to the transmission poles being higher than other infrastructure for the solar farm. Viewpoints 1, 4, 5 and 7 are considered likely to be the most impacted by the construction of the transmission line due to their proximity to the proposed transmission line and largely uninterrupted views. While the new infrastructure would be visible, visual impacts are considered to be minimal for the following reasons:

- the new transmission line would be positioned within an area containing existing transmission lines and therefore would be consistent with the existing character of the area. Further, the new transmission line will run to the North Wagga substation in the same general direction as the existing transmission line (and its replacement currently under construction) west of the proposal site, which will help ensure consistency with the existing character of the area.
- the proposed poles, while tall, would not be overly bulky, and their visibility would decrease with distance.

All poles would be designed in accordance with required guidelines and standards, and where possible, detailed design would seek to minimise their visual prominence.

The inclusion of the transmission line into each of the views for viewpoints 1, 4, 5 and 7 are not considered to make a notable different in the ratings outlined in the above sections due to the relatively minor impact of the introduction of the transmission line.

Glare and reflectivity of solar panels

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is considered to be relatively limited. Photovoltaic solar panels are designed to reflect as little sunlight as possible, generally around two per cent of the light received (Spaven Consulting 2011), resulting in negligible glare. This is because photovoltaic panels are designed to absorb as much solar energy as possible to generate the maximum amount of electricity or heat. The panels would not generally create noticeable glare when compared with an existing roof or building surface (DoP 2010). Based on this, the potential impacts of glare on adjacent land uses are considered to be minor. Such impacts are further reduced due to the installation of tracking systems, which result in any reflection of sunlight directly from the panel back into the atmosphere. Planting trees and shrubs along the boundary of the proposal site (see Figure 3.16) would also act to reduce any potential glare from the proposal site. The proposal is unlikely to cause a safety risk through glare or reflectivity for traffic on Byrnes Road or trains on the Sydney to Melbourne Rail Line.

Any glare from solar panels is likely to be reflected back into the atmosphere due to the tracking system, which orientates the panels so that they are perpendicular to the incoming direction of solar radiation. Impacts from glare are unlikely for large aircraft, as the position and orientation of the runway at Wagga Wagga Airport mean that very few aircraft (particularly commercial flights) fly in the vicinity of the proposal site. Some small aircraft may use the airspace in the vicinity of the proposal, however due to the low expected levels of glare.

Potential glare impacts from other infrastructure on the proposal site (eg the substation) are considered to be minimal and would be similar to existing structures on nearby properties, in particular the large industrial buildings along the western boundary of the proposal site. Where necessary, design of the structures would seek to minimise the likelihood of glare or reflections.

Impacts of lighting

During construction, some lighting may be required during periods of night-time work in the central work area (shown in Figure 1.2). Lighting would be focused on small areas, and would be short-term. Due to the distance of the central work area from the nearest sensitive receiver (1.2 kilometres), this would be unlikely to cause any substantial light spill on adjacent properties or impacts to residents.

During operation, there is potential for some lighting on site around structures such as the substation and control building. Permanent perimeter lighting would not be installed, however motion and/or manually activated surprise lighting may be installed in certain locations to deter intruders. Temporary lighting of the solar panel arrays would be required during occasional night-time maintenance activities. This lighting would be limited in nature and would be unlikely to result in any substantial light spill on adjacent properties or impacts to residents. The lighting would be similar to that of a residence on a rural property.

6.4.4 Safeguards and mitigation measures

Safeguards and management measures in Table 6.11 would be implemented to minimise potential visual impacts.

Table 6.11: Visual impact mitigation measures

Impact	Environmental safeguards	Timing
Visual impacts of solar farm	A landscape plan (see draft in Figure 3.16) will be further developed to outline the location and type of plantings to assist in minimising impacts on views of the proposal site from nearby properties. The landscape plan will be prepared in consultation with all impacted nearby property owners. The plan will outline the species to be used on site and will use species from native vegetation communities found in the local area. All selected species will be determined in consultation with Riverina Local Land Services, the Rural Fire Service and property owners (where required).	Detailed design
	A review of the landscaping plan will be carried out within two months of operation commencing. This will include consultation with nearby landowners to discuss requests for further screening.	Operation
Visual impacts of structures (including glare)	The materials and colour of on-site infrastructure will, where practical, be non-reflective and be of a colour that will blend with the landscape.	Detailed design
	Security fencing posts and wire will be non-reflective.	Detailed design
Visual impacts during construction	All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and shall be removed from the site following the completion of construction.	Construction Post-construction
	Work sites shall be kept tidy at all times.	Construction Post-construction

Draft landscape plan

A draft landscape plan has been developed for the proposal. This plan considers the positioning of additional screening vegetation on the proposal site to minimise any visual impacts to nearby visually sensitive receivers, including residences and Bomen Road users. The draft landscape plan is shown in Figure 3.16.

Nearby property owners are being consulted on the draft landscape plan to confirm its likely effectiveness and acceptability.

Following consultation with nearby property owners, a more detailed landscape plan would be developed to confirm the location and type of vegetation screening to be implemented on site.

Community landscaping fund

As part of the proposal, a community landscape fund will be provided to improve the visual character of the project surrounds and offer enhanced visual screening to nearby property owners. Prior to construction, Renew Estate will work with local stakeholders, such as the Eunony Valley Association, to guide the location and selection of plantings and the disbursement of funds.

6.5 Hazard and risk

A specialist preliminary hazard analysis (PHA) was prepared to assess the potential impacts of the proposal in line with the requirements of SEPP 33 and is provided in Appendix E.

6.5.1 Methodology

The PHA methodology involved initially identifying hazards through a desktop qualitative risk screening assessment. This included all possible events that could lead to a hazardous incident and their potential causes and health, safety and environmental consequences (in qualitative terms).

Under SEPP 33, if any of the screening thresholds are exceeded, the proposed development should be considered a 'potentially hazardous industry' and a PHA is required. The results of the dangerous goods and transport screening indicate that the proposal does not exceed any of the thresholds. However, based on industry knowledge of the battery storage technology and taking into account that the lithium-ion batteries are a new technology that may not have been considered during the initial process determined for SEPP 33, the proposal should be considered 'potentially hazardous'. A level 2 PHA was considered appropriate to assess the proposal.

The PHA followed the risk assessment process shown in Figure 6.17, which complies with the DoP Multi-level Risk Assessment Guideline (DoP 2011b).

Operational and organisational safeguards were developed to prevent hazardous events from occurring or, should they occur, to mitigate the impact on the proposed solar farm, its equipment, people and the surrounding environment.

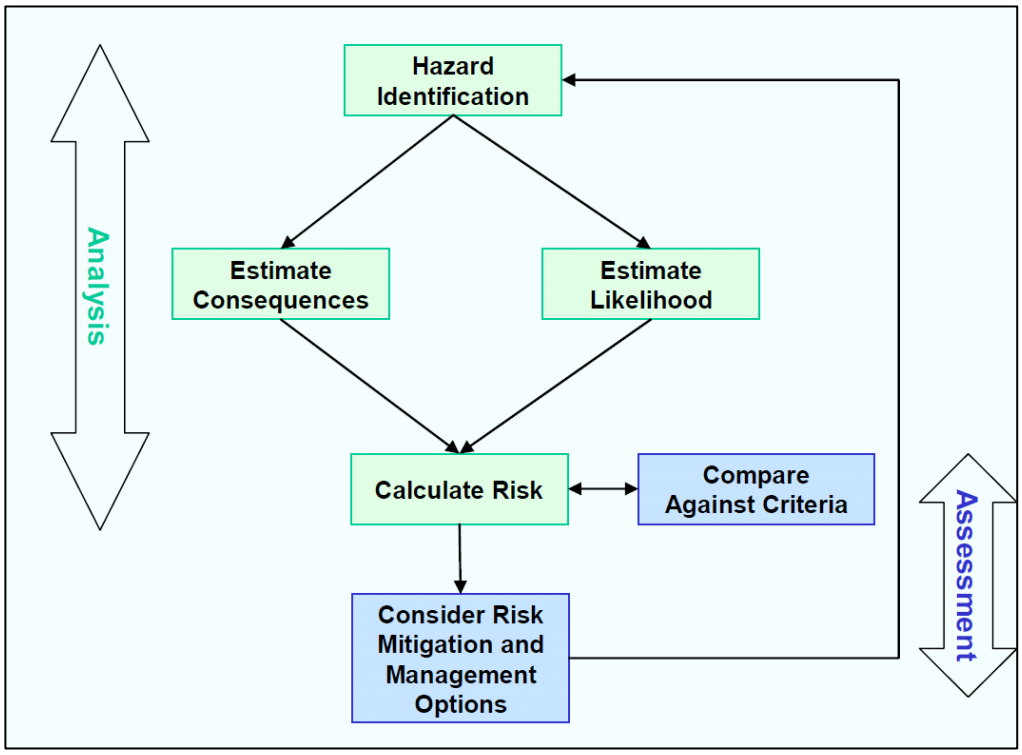


Figure 6.17: Risk assessment process

6.5.2 Existing environment

Bushfire prone land

The proposal site is agricultural land with native vegetation having been cleared from the majority of the site. Due to the lack of vegetation, the bushfire risk of the site is considered to be low. This is reflected in bushfire mapping in Figure 6.18 which shows that the site is not considered to be bushfire prone land. The nearest bushfire prone land is located about two kilometres north-west of the proposal site.

The site is predominantly cropland and grassland, which is typically dry during the summer months. Although it is not mapped as bushfire prone land, there is a risk of grassfires. Grassfires have the potential, where grass height is allowed to develop, to threaten life and property, including solar farm assets.

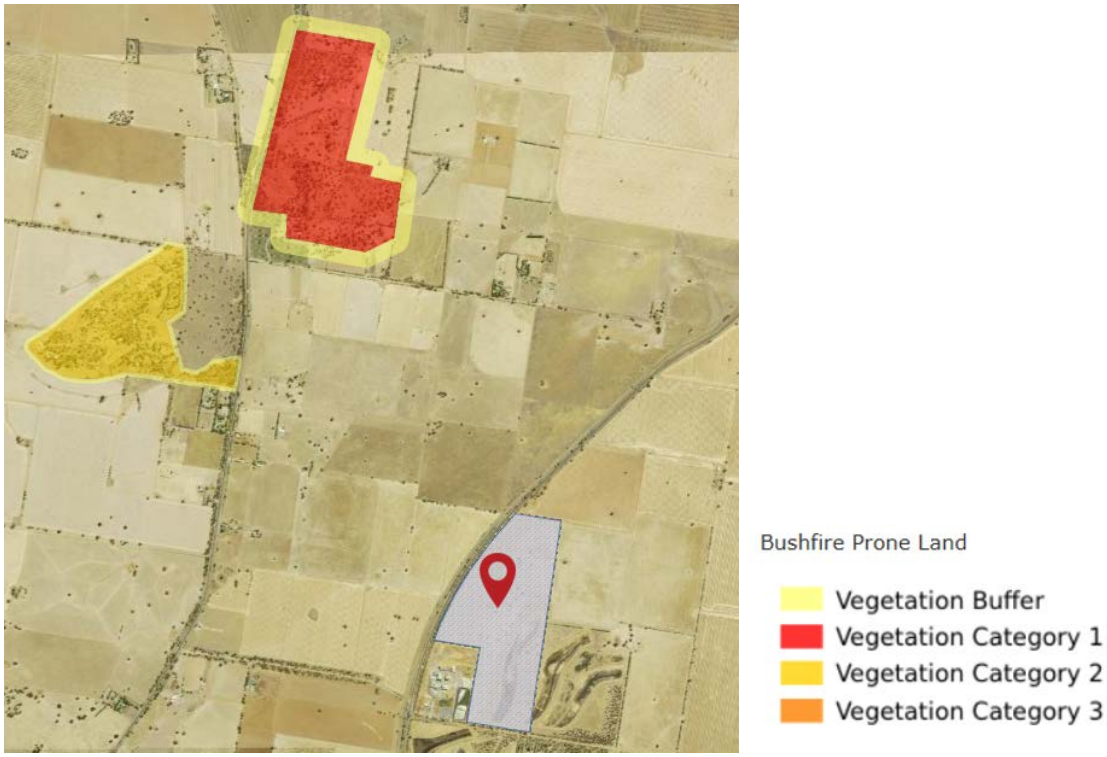


Figure 6.18: Location of bush fire prone lands in relation to proposal site

Source: NSW Planning Portal mapping tool. Red marker is located in the north-west of the proposal site

Existing bushfire hazards

In addition to the limited vegetation located on the proposal site, the existing subtransmission line running through the proposal site is a risk due to its potential to start a fire. This risk is considered to be relatively minor as there is limited vegetation in close proximity to the subtransmission line and therefore the likelihood of arcing between the line and vegetation is limited. The vegetation within the corridor is currently managed in accordance with Essential Energy's procedures to maintain safe electrical and operational clearances between vegetation and the conductors.

The proposal site is at risk of fire from ignition in the vegetated corridor along Byrnes Road on the north-western boundary. Some of the main hazards along the road which have the potential to result in a fire include car accidents and incorrect disposal of cigarettes and other rubbish from vehicles.

As the site is located within the Wagga Wagga local government area it is within the Riverina Bush Fire Management Committee Area. The Riverina Bush Fire Risk Management Plan (Riverina Bush Fire Management Committee 2010) states that the main sources of fires in the area are:

- lightning, particularly from late spring and summer storms
- machinery, particularly agricultural machinery involved in harvesting and haymaking
- escapes from legal burning off

- incendiarism (arson) has been identified as the ignition cause of some bushfires
- accidental ignition.

6.5.3 Potential impacts

Overview of hazards

An overview of potential hazards associated with the proposal is provided in Table 6.12. The risk of these hazards occurring would be managed by implementing the safeguards and mitigation measures identified in section 6.5.4.

Table 6.12: Potential hazards associated with the proposal

Hazard Scenario	Cause	Consequence	Potential for off-site impact
Vehicle interactions	Vehicle movements in vicinity of personnel	Personal injury	No
Natural hazards	Flooding, earthquake, lightning, bushfire	Personal injury Plant shut down Possible fire	No
External fire (adjacent to site)	Fire or explosion from adjacent land users	Asset damage Plant shut down Personal injury	No
Loss of containment of chemicals, including dangerous goods	Damage to storage containers (eg due to external impact) Wear & tear Overheating	Environmental damage Personal injury	No
Contact with chemicals, including dangerous goods	Maintenance of batteries	Personal injury	No
Fall from heights	Working at height	Personal injury / fatality	No
Contact with electricity	Contact with live electrical source Cranes impacting overhead lines Hitting underground services	Personal injury / fatality	No
Mechanical or chemical damage of Lithium-ion battery assemblies	Rapid heating of individual cells (eg lack of venting, thermal runaway reactions) Vehicle impact into batteries	Release of fluorinated hydrocarbons Personal injury / fatality Asset damage	Yes
Overheating of lithium batteries	Thermal runaway reactions	Release of fluorinated hydrocarbons Personal injury / fatality Asset damage	Yes

Bushfire

Bushfire risks at the proposal site can be classified into two components; those starting off site and impacting the property, and those starting on site from activities and moving off site.

Direct bushfire impacts

The most likely scenario for a fire to impact the proposal site is through a fire starting from arson, lightning, agricultural activities or powerlines. Due to the predominance of westerly winds, a grassfire would most likely enter the proposal site from the south-west, west or north-west under hot dry winds. While grassfires are not as intense as forest fires, they can, where grasses are not grazed or slashed and significant quantities of grass are present, be intense enough to kill or severely injure people, cause cars in the open to catch fire or set fire to vulnerable buildings. Characteristically, such fires are very fast moving and potentially provide little opportunity for warnings. Parts of the proposal site and personnel may be subject to radiant heat and direct flame contact.

Off-site bushfire impacts

The proposal also has the potential to cause bushfire, particularly if fuel loads are not managed (crash grazed, grazed or slashed) and allows a fire to escape from the site under hot dry winds, or where infrastructure such as powerlines contact vegetation. This may enable the spread of a fire that could move off site and cause potential consequential impacts on private property assets to the north-east, east and south-east.

Construction and decommissioning

Construction of the proposal has the potential to increase the risk of fires due to:

- hot works resulting in ignition of surrounding vegetation
- equipment or vehicles being used in long grass
- construction workers smoking or rubbish left at the site
- storage of combustible materials and liquids on site.

These activities have the potential to ignite a bushfire which could have an impact on the proposal site. Due to the low quantities of vegetation on site, construction of the proposal is unlikely to pose a significant bushfire risk.

There is also a risk of impacts from an off-site bushfire entering the proposal site during construction.

A bushfire management plan would be developed to outline the procedures to be implemented in the event of a bushfire.

Overall, bushfire risks during the construction and decommissioning phases are considered to be low and would be managed by implementing safeguards and mitigation measures detailed in section 6.5.4.

Operation

Operation of the proposal is unlikely to result in any substantial additional bushfire risks. The proposal would not result in any substantial sources of ignition and all potential risks would be managed through mitigation or the design of the proposal. Maintenance activities have the potential to result in ignition if hot works are required. These impacts are considered to be unlikely as hot works would be required infrequently and a bushfire management plan would be implemented to minimise potential risks.

Maintenance of the site would ensure that groundcover below the solar arrays is appropriately managed to minimise build-up of fuel loads.

Preliminary hazard analysis

Hazardous materials

Lithium-ion batteries are the only material with the potential to cause off-site impacts from a release of the contents. The refrigerant used in the batteries could form a range of fluorinated hydrocarbons of small quantities of hydrofluoric acid upon release and partial combustion.

Lithium-ion batteries can pose unique safety hazards since they contain a flammable electrolyte and may be kept pressurised. If a battery cell is charged too quickly, it can cause a short circuit, leading to explosions and fires.

Lithium-ion battery hazard scenarios

The following potential hazard scenarios were identified:

- latent battery failure in situ from manufacturing fault
- thermal runaway from overcharging
- thermal runaway from overheating within cabinets
- release of coolant or refrigerant during thermal runaway

Lithium-ion battery heat radiation consequence determination

A summary of the determined heat radiation consequences is provided in Table 6.13.

Table 6.13: Summary of heat radiation consequences

Release Scenario	Maximum Distance Downwind of Release to Heat Radiation (m)		
	4.7 kW/m^2 (injury)	12.6 kW/m^2 (fatality)	23 kW/m^2 (property damage)
Single cabinet battery thermal runaway (cabinet reaches 400 °C)	Approx. 3 m	Approx. 1.5 m	Approx. 0.7 m

Likelihood estimation

The results of likelihood estimation calculations are provided in Table 6.14.

Table 6.14: Likelihood estimation results

Scenario	Probability per year	Interval years	Comment
Manufacturing fault leading to thermal runaway. Frequency of gas release (per annum)	4.65 x 10-03	215	Based on a 2170 cell size format, see Appendix B of PHA for calculation
Excessive charging leading to fire (per annum) (cumulative value of all cabinet chargers on site)	4.60 x 10-03	200	Conservative figure, more likely about 10% of this value and 1 in 2,000 years (data on charger failure rate has to be estimated)

Risk assessment

While there may be events where smoke and heat may occur, the relative frequency of these events is quite low. The off-site effects are low, unless there is a strong wind to carry the smoke

laterally. Heat radiation is low, based on the distance to the boundary, and the likely temperature of the container during an event.

With the low potential for off-site effects, and the low likelihood, the risks associated with lithium-ion batteries posed by the facility do not exceed the threshold levels of SEPP 33.

PHA conclusion

The PHA determined that the risk arising from the dangerous goods stored and used on site does not exceed the individual fatality or injury risk criteria specified in NSW DoP publication HIPAP No. 4 'Risk Criteria for Land Use Safety Planning' (DoP 2011a).

6.5.4 Safeguards and mitigation measures

Safeguards and mitigation measures provided in Table 6.15 would be implemented to minimise potential impacts on land use and rural lands.

Table 6.15: Hazard and risk mitigation measures

Impact	Environmental safeguards	Timing
Vehicle interactions	Prepare a construction traffic management plan including standard traffic rules and signage	Pre-construction
	Implement site speed limits	Construction Operation Decommissioning
	Provide designated pedestrian areas	
	Ensure driver competency	
Natural hazards and external fire (adjacent to site)	A bushfire management plan will be prepared in consultation with the Rural Fire Service. This plan will include but not limited to the following: • management of activities with a risk of fire ignition • management of fuel loads on site • storage and maintenance of firefighting equipment including siting and provision of adequate water supplies (see section 3.2.11) • the below requirements of 'Planning for Bush Fire Protection 2006' (RFS 2006): – identifying asset protection zones (see section 3.2.11) – providing adequate egress/access to the site (see section 3.2.11) – emergency evacuation measures • operational procedures relating to mitigation and suppression of bush fire relevant to the operation of a solar farm	Pre-construction
	Design buildings and structures to appropriate codes and standards	Pre-construction
	Manage fuel for vehicles and machinery on site to appropriate standards	Construction Operation Decommissioning
	Provide fire protection systems	
Loss of containment and contact with chemicals,	Store chemicals in line with appropriate standards	Construction Operation Decommissioning
	Implement a regular inspection and maintenance regime for chemical storage areas	

Impact	Environmental safeguards	Timing
including dangerous goods	Implement standard handling procedures	
	Provide a Safe Work Method Statement detailing methods for handling chemicals	
	Provide spill kits to be used in the event of an incident involving release of chemicals	
	Implement standard transfer and handling procedures	
	Provide a Safe Work Method Statement detailing methods for handling chemicals	
	Provide personal protective equipment (PPE) to all staff	
Fall from heights	Implement working at heights procedures	Construction Operation Decommissioning
	Ensure all staff working at heights have completed the necessary training	
	Use fall prevention equipment	
Contact with electricity	Implement isolation procedures	Construction Operation Decommissioning
	Install fit for purpose electrical systems	Construction
	Follow underground utility identification protocols, including Dial Before You Dig	Construction Decommissioning
Mechanical or chemical damage of lithium-ion battery assemblies	Ensure batteries are Quality Assured	Construction Operation
	Install bollards/protective barriers around key battery areas	Construction
	Batteries will be stored as per suppliers specifications	Construction Operation
	The battery system will be containerised and bunded	Construction
	Implement a regular inspection and maintenance regime for the battery assemblies	Operation
Overheating of lithium batteries	Provide ventilation systems in cabinets	Construction
	Batteries will be stored as per suppliers specifications	Construction Operation
	Provide insulation around batteries.	Construction Operation

6.6 Noise and vibration

A specialist noise and vibration assessment was prepared to assess the potential impacts of the proposal and is provided in Appendix F.

6.6.1 Methodology

Assumed background noise levels

Due to the likely low noise impacts of the proposal, background noise monitoring was not carried out. In accordance with the 'NSW Noise Policy for Industry' (EPA 2017), the minimum assumed Rating Background Level (RBL) during the daytime is 35 dBA and 30 dBA for the evening and night periods.

Construction noise assessment

A quantitative assessment was carried out with consideration of the 'Interim Construction Noise Guideline' (ICNG) (DECC 2009). Assumptions used in the modelling are outlined in section 4.2.2 of Appendix F.

Operational noise assessment

A quantitative assessment was undertaken for the operational phase of the proposal. Modelling included the solar array panels and single-axis tracking systems, the power conversion stations and the 132 kV substation. Assumptions used in the modelling are outlined in section 5.1.2 of Appendix F.

6.6.2 Existing environment

Sensitive receivers

Noise sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Fourteen isolated residential receivers have been identified as being potentially impacted by construction and/or operational noise associated with the proposal and are homesteads on agricultural properties. The results of the noise assessment for these receivers are considered applicable for other nearby residences that have not been included in the assessment. Thirty-two residential receivers have been identified as being potentially impacted by construction/operational road noise traffic associated with the proposal. In addition, six industrial receivers have been identified in the study area. These sensitive receivers are tabulated in Table 6.16 and Table 6.17 and are shown on Figure 6.19 and Figure 6.20.

Table 6.16: Identified noise sensitive receivers – construction and operational

Rec. ID	Receiver Type	Planning zone	Direction from proposal site	Distance to nearest solar farm boundary (metres)
R1	Residential	RU1 – Primary Production	North-west	1,654
R2	Residential	RU1 – Primary Production	West	1,530
R3	Residential	RU1 – Primary Production	East	1,400
R4	Residential	RU1 – Primary Production	West	1,800
R5	Residential	IN2 – Light Industrial	West	1,465
R6	Residential	IN2 – Light Industrial	West	1,820
R7	Residential	RU1 – Primary Production	West	2,155
R8	Residential	IN1 – General Industrial	South	469
R9	Residential	IN1 – General Industrial	South	640
R10	Residential	RU1 – Primary Production	South	1,670
R11	Residential	RU1 – Primary Production	South	1,850
R12	Industrial	IN1 – General Industrial	West	360
R13	Industrial	IN1 – General Industrial	West	244
R14	Industrial	IN1 – General Industrial	West	200
R15	Industrial	IN1 – General Industrial	West	360
R16	Industrial	IN1 – General Industrial	West	470
R17	Commercial	IN1 – General Industrial	South	494
R18	Residential	RU1 – Primary Production	East	1,885
R19	Residential	RU1 – Primary Production	East	1,825
R20	Residential	RU1 – Primary Production	South-east	1,413

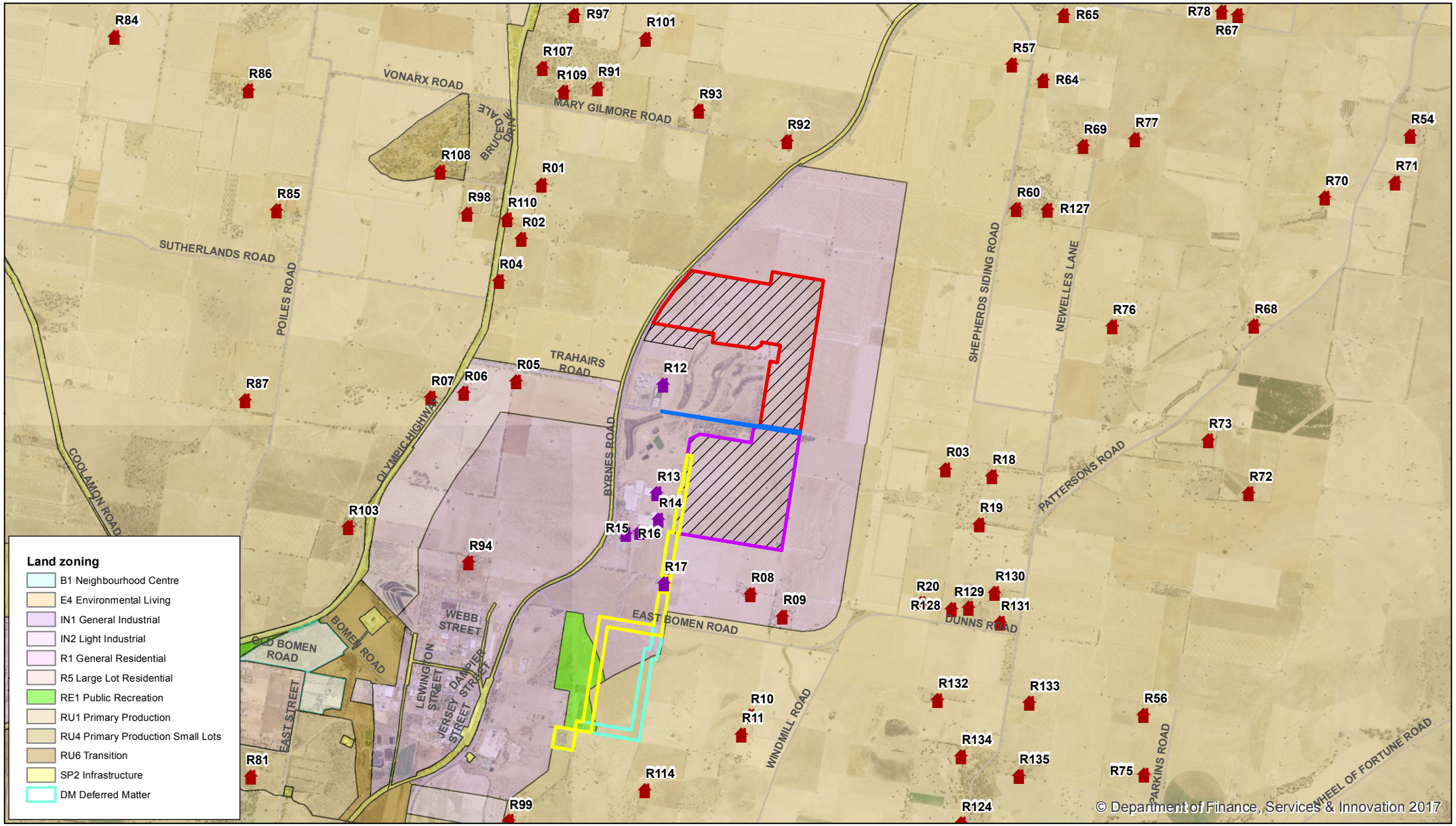
Table 6.17: Identified noise sensitive receivers – residences adjacent to Byrnes Road / Eunony Bridge Road

Receiver ID	Residential address	Nearest road associated with the proposal	Distance from nearest residence façade to road edge
R21	171 Byrnes Road	Byrnes Road	84
R22	169 Byrnes Road	Byrnes Road	140
R23	168 Byrnes Road	Byrnes Road	45
R24	162 Byrnes Road	Byrnes Road	54
R25	155 Byrnes Road	Byrnes Road	94
R26	150 Byrnes Road	Byrnes Road	47
R27	145 Byrnes Road	Byrnes Road	35
R28	136 Byrnes Road	Byrnes Road	122
R29	135 Byrnes Road	Byrnes Road	63
R30	128 Byrnes Road	Byrnes Road	75
R31	126 Byrnes Road	Byrnes Road	129
R32	121 Byrnes Road	Byrnes Road	119
R33	117 Byrnes Road	Byrnes Road	75
R34	103-115 Byrnes Road	Byrnes Road	187
R35	97-101 Byrnes Road	Byrnes Road	204
R36	95 Byrnes Road	Byrnes Road	237
R37	87 Byrnes Road	Byrnes Road	350
R38	85 Byrnes Road	Byrnes Road	382
R39	83 Byrnes Road	Byrnes Road	255
R40	80 Byrnes Road	Byrnes Road	473
R41	78 Byrnes Road	Byrnes Road	442
R42	76 Byrnes Road	Byrnes Road	440
R43	74 Byrnes Road	Byrnes Road	440
R44	58 Byrnes Road	Byrnes Road	105
R45	44 Byrnes Road	Byrnes Road	161
R46	233 Oura Road	Byrnes Road	350
R47	226 Oura Road	Eunony Bridge Road	311
R48	73 Mingara Street	Eunony Bridge Road	596
R49	175 Eunony Bridge Road	Eunony Bridge Road	67
R50	8 Eunony Bridge Road	Eunony Bridge Road	29
R51	4 Eunony Bridge Road	Eunony Bridge Road	29
R52	Cnr. Sturt Highway & Eunony Bridge Road	Eunony Bridge Road	62

6.6.3 Criteria

Construction noise management levels

The 'Interim Construction Noise Guideline' (DECC 2009) is used to assess noise impacts associated with construction works. The guideline recommends standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays. Construction noise management levels at residential receivers identified in the study area are outlined in Table 6.18. For industrial noise receivers in the study area, the noise management level is 75 dBA and for commercial noise receivers within the study area, the noise management level is 70 dBA.



Paper Size A4

0 180 360 720 1,080 1,440

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Residence
- Industrial
- Area of assessment
- Final proposed Northern Development Area
- Final proposed Southern Development Area
- Transmission Line Option 1
- Transmission Line Option 2
- Trahairs Rd Corridor

Renew Estate Pty Ltd
Boman Solar Farm EIS

Site location, transmission line corridor, planning zones, noise sensitive receivers (construction & operational)

Job Number 2316243
Revision A
Date 09 Apr 2018

Figure 6.19

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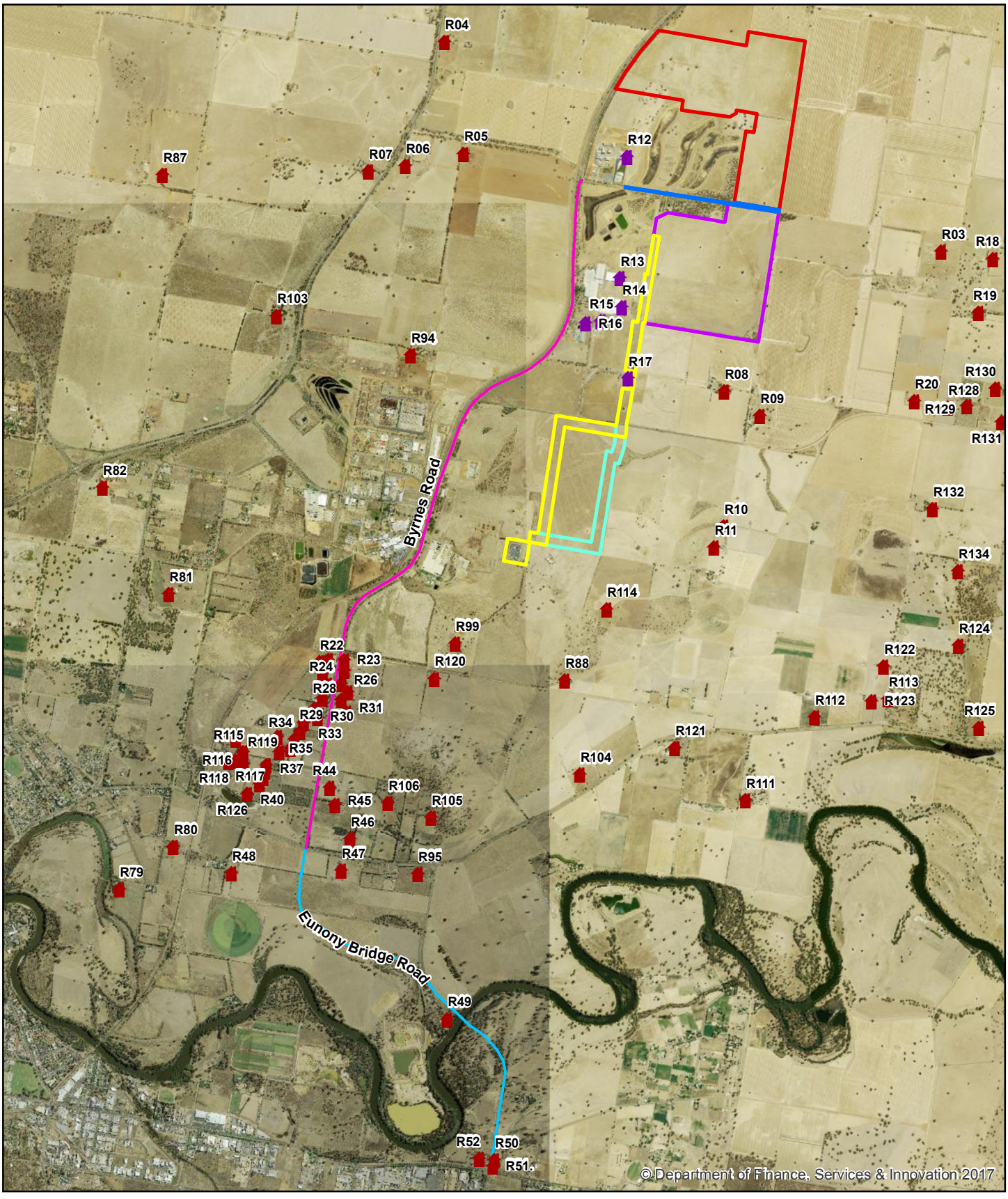
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: Aerial Imagery, Sixmaps 2017. General Topo: NSW LPI 2012. Created by:afoddy



LEGEND

- Residence
- Industrial
- Final proposed Northern Development Area
- Final proposed Southern Development Area
- Transmission Line Option 1
- Transmission Line Option 2
- Trahairs Rd Corridor
- Byrnes Road
- Eunony Bridge Road

Paper Size A4

0 165 330 660 990 1,320

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate Pty Ltd
Boman Solar Farm EIS

Site location, roads and noise sensitive receivers (road noise)

Job Number 23-16243
Revision A
Date 09 Apr 2018

Figure 6.20

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:afoddy

Table 6.18: Construction noise management levels at residences

Time of day	Management level $L_{Aeq(15min)}$	How to apply
Recommended standard hours: • Monday to Friday 7 am to 6 pm • Saturday 8 am to 1 pm • No work on Sundays or public holidays	**45 dBA[1]** Noise affected Rating background level + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	75 dBA Highly noise affected	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
OOHW1 - Outside recommended standard hours – weekends (Saturdays 1 pm to 6 pm, Sundays 8 am to 6 pm)	**40 dBA[1]** Noise affected Rating background level + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.
OOHW2 - Outside recommended standard hours – evenings/nights (Sunday to Thursday 6 pm to 7 am, Fridays and Saturdays 6pm to 8am)	**35 dBA[1]** Noise affected Rating background level + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Note 1: Based on the minimum rating background level (RBL) of 35 dBA for the day period and 30 dBA for the night period as per the 'Noise Policy for Industry'

Operational project noise trigger levels

The proposal-specific operational noise trigger levels are summarised in Table 6.11 and are in accordance with the Noise Policy for Industry. Further discussion of the noise trigger levels can be found in section 3.2 of Appendix F.

For residential receivers, the project noise trigger levels are provided in Table 6.19. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness and project amenity noise levels. Daytime and evening time project noise trigger levels should be achieved, as the solar farm will operate during these time periods. Project noise trigger levels at the sensitive receivers have been determined based on the minimum background noise level thresholds, as no background noise monitoring has been undertaken.

Table 6.19: Project noise trigger levels – residential noise receivers, dBA

Criteria $L_{Aeq(15min)}$	Residential Receivers		
	Day	Evening	Night
Intrusiveness noise level	40	35	35
Project amenity noise level (rural)	48	43	38
Project noise trigger levels	40	35	35

Notes:

- the 'Noise Policy for Industry' defines Day as 7 am to 6 pm Monday to Friday and 8 am to 6 pm Saturday, Sunday and Public Holidays, Evening 6 pm to 10 pm and Night as the remaining periods
- in accordance with the 'Noise Policy for Industry', the minimum assumed Rating Background Level (RBL) during the daytime is 35 dBA and 30 dBA for the evening and night periods (no background noise monitoring was undertaken as part of this assessment)
- noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.

For industrial receivers, the project noise trigger levels are provided in Table 6.20 below.

Table 6.20: Project noise trigger levels – commercial and industrial receivers

Receiver	Time of day	L_{Aeq}, dBA
Commercial premises	When in use	65
Industrial premises	When in use	70

Sleep disturbance criteria

The EPA (2013) 'Noise Guide for Local Government' provides guidelines for assessing sleep disturbance from short-term noise events. To assess potential disturbance during night-time hours (6:00 am to 7.00 am), Section 2.4.5 of the 'Noise Guide for Local Government' recommends that $L_{A1,1min}$ levels outside a bedroom window should not exceed the background level by more than 15 dBA.

Table 6.21 below summarises the background noise level at the nearby residential receivers and the sleep disturbance criterion.

Table 6.21: Sleep disturbance criteria, $L_{A1(1min)}$ dBA

Receiver Type	Night-time shoulder L_{A90} Background Noise Level	Criterion $L_{A1(1min)}$
Nearby Residential Receivers	30	45

Road traffic noise criteria

The NSW 'Road Noise Policy' (DECCW 2011) provides traffic noise target levels for residential receivers in the vicinity of existing roads (Table 6.22).

The 'Road Noise Policy' application notes state that "*for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of or exceeds, the relevant day or night noise assessment criterion.*"

If road traffic noise increases from the development are within 2 dBA of current levels then the objectives of the 'Road Noise Policy' are met and no specific mitigation measures are required.

Table 6.22: Road traffic noise criteria, $L_{Aeq(period)}$ dBA

Type of Development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$

6.6.4 Potential impacts

Construction

Predicted construction noise levels

The predicted construction noise levels of each construction scenario, and relevant noise management levels, are provided in Table 4-3 in Appendix F.

All exceedances of the noise management levels and the highly noise affected criteria at sensitive receivers are presented in Table 6.23.

Table 6.23: Exceedances of noise management levels

Construction Scenario	Exceedance NML, dB	Exceedances - Highly Noise Affected, 75 dBA
S1 - Site establishment/ Trahairs Rd upgrade/ vegetation clearing/ civil earthworks	None	None
S2 - Installing steel post foundations	R8 – 10 dB R9 – 4 dB	None
S3 - Construction of hardstand areas, solar arrays, substation, control building, power stations, battery storage area	None	None
S4 - Construction of overhead transmission lines (option 1)	R17 – 1 dB	None
S4 - Construction of overhead transmission lines (option 2)	R17 – 2 dB	None

Construction Scenario	Exceedance NML, dB	Exceedances - Highly Noise Affected, 75 dBA
S5 - Construction of underground transmission cables	R8 – 6 dB	None
S6 - Out of hours work - Saturdays and Sundays daytime (OOHW1) (see Table 3.2)	R8 – 5 dB	None
S7 - Out of hours work – evenings/nights (OOHW2) (see Table 3.2)	R8 – 4 dB	None

The worst case noise levels are predicted to exceed the noise affected construction noise management levels at the residential receivers R8 and R9 and the commercial receiver R17. The highest exceedances occur when impact piling works (construction scenario S2) are occurring at the proposal boundary closest to the residential receiver at R8. Exceedances of the noise management level at R8 also occur during construction scenarios S5, S6 and S7. These exceedances are expected to be short term in duration and would reduce as the plant and equipment moved further away from the sensitive receiver.

The noise levels are predicted to marginally exceed the noise affected construction noise management levels at the commercial receiver R17 during the construction of the overhead transmission line (S4 option 1 and S4 option 2). This exceedance is expected to be short term in duration and would reduce as the plant and equipment moved further away from the sensitive receiver. Furthermore, it is likely that the transmission line would be underground rather than overhead at areas closest to R17, however a worst case overhead line scenario has been assessed.

Option 1 is predicted to cause marginally less construction noise impact on sensitive receivers, when compared to option 2.

Safeguards and mitigation measures outlined in section 6.5.5 and would be implemented where feasible and reasonable, to reduce noise impacts.

Construction noise contours for the noisiest scenarios S2, S4 (option 1 and option 2) during standard construction hours are provided in Figure 4 and Figure 5 in Appendix F. Construction noise contours for night-time works are provided in Figure 6 in Appendix F.

Sleep disturbance impacts

The noisiest event that could occur during the night-time period and have the potential to cause sleep disturbance at nearby residences is likely to be the use of hand tools during the construction of the solar arrays. Based on a predicted maximum sound power level of 102 dBA for the use of hand tools, the maximum $L_{A1(1min)}$ noise levels due to construction works during the night-time period is predicted to be 37 dBA at R8 (received through an open window at all the nearest residential dwellings) and is below the sleep disturbance criterion of 45 dBA . As such, no sleep disturbance impacts are anticipated on the nearby residents during night-time construction works.

Construction compound

A temporary construction compound would be established on site and would include a site office and amenities. This building would be a prefabricated structure which can be brought to site on the back of a truck and removed from site when required.

Noise impacts from establishing and operating the construction compound are not anticipated due to the large distances between the compound and sensitive receivers (refer to Table 6.16).

Construction traffic noise

Noise levels due to the use of heavy vehicles associated with the proposal are greatest at residential receivers within 30 metres of Eunony Bridge Road, including R50 and R51. At these residences, the day time road noise level is predicted to slightly exceed $L_{Aeq(15\ hour)}$ 60 dBA during peak construction periods. However, the increase in traffic noise levels during peak construction does not increase the existing road noise levels by more than 2 dBA at any residential receiver locations along Byrnes Road or Eunony Bridge Road. As such, the additional construction traffic along these roads complies with the Road Noise Policy criteria.

The road noise levels during peak construction periods are not predicted to exceed the night time road noise criteria of $L_{Aeq(9\ hour)}$ 55 dBA at any residential receiver locations along Byrnes Road or Eunony Bridge Road.

Construction vibration

Pile boring would not be within 10 metres of any sensitive receiver structures during the construction of the overhead transmission lines. As such, no adverse vibration impacts to sensitive receivers are anticipated.

The nearest sensitive receiver would be more than 450 metres from any construction activities within the northern and southern solar farm development zones and as such, no rolling construction activities are predicted to cause adverse vibration impacts on nearby receivers.

Vibration safe working distances for impact piling are not provided in the CNVG, however, vibration levels from impact piling are generally negligible at distances greater than 100 metres. Given the nearest receiver would be more than 450 metres from any impact piling activities, vibration levels from pile driving are not anticipated to adversely impact receivers.

Operation

Predicted operational noise levels

Noise generating equipment and activities on the proposal site during operation would include:

- single-axis tracking systems on which the photovoltaic modules are installed
- power conversion stations containing inverters and a transformer
- a 132 kV substation, with transformer
- approximately 20 light vehicle movements to and from the carpark area per day.

The predicted noise levels for site operations with and without the trackers operating are summarised in Table 5-2 and Table 5-3, respectively, in Appendix F. Noise contour plots of the solar farm at maximum operation, with and without the tracking motors operating are shown in Figure 10 and Figure 11 in Appendix F.

The noise levels are predicted to comply with the noise criteria during all assessment time periods. The noise predictions are considered conservative, as the predictions assume worst-case scenario meteorological conditions for noise propagation during the night period. Noise levels during the day time period and under calm conditions would generally be lower.

Operational road traffic noise

A maximum of 20 light vehicles movements are anticipated during the operation of the proposal per day. These additional vehicle numbers are not significant enough to cause an increase of +2 dBA to the existing road traffic noise levels along Byrnes Road and Eunony Bridge Road. The proposed vehicle movements are predicted to comply with the Road Noise Policy.

6.6.5 Safeguards and mitigation measures

Safeguards and management measures in Table 6.24 would be implemented to minimise potential noise and vibration impacts.

Table 6.24: Noise and vibration mitigation measures

Impact	Environmental safeguards	Timing
Construction noise	A noise management plan will be prepared and implemented as part of the CEMP.	Pre-construction Construction
	All engine covers will be kept closed while equipment is operating.	Construction
	As far as possible, heights from which materials are dropped, into or out of trucks, will be minimised.	Construction
	Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made.	Construction
	To reduce the annoyance associated with reversing alarms, broadband reversing alarms (audible movement alarms) will be used for all site equipment. Satisfactory compliance with occupational health and safety requirements will need to be achieved and a safety risk assessment may need to be undertaken to determine that safety is not compromised. Refer to Appendix C of the ICNG (2009) for more information.	Construction
	Piling works and works to construct the transmission line will not occur during evening/night periods.	Construction
	Apart from works involving installing trackers and modules, all works in evening/night periods will be limited to the central work area (see Figure 1.2).	Construction
	Works involving installing trackers and modules during evening/night periods will not occur in the area between the southern boundary of the solar farm and 250 metres north of the southern boundary. This provides a 700 metre buffer from the residential receiver at R8 and will reduce the noise level to within the noise management level of 35 dBA.	Construction
	During night-works, quiet forklifts (electric – sound power level <100 dBA) will be used for construction activities around the solar array areas.	Construction
	All site workers will be briefed on the potential for noise impacts on local residents and the requirement to implement practical and reasonable measures to minimise noise impacts during the course of their activities. This will include: • avoiding the use of loud radios • avoiding shouting and slamming doors • where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods • keeping truck drivers informed of designated vehicle routes, parking locations and delivery hours • minimising reversing	Construction

Impact	Environmental safeguards	Timing
	• avoiding dropping materials from height and avoiding metal to metal contact on material • keeping engine covers closed while equipment is operating.	
	Once the selection of equipment has been finalised, a review will be carried out to ensure that the noise levels do not exceed the assumed levels in the noise assessment in Appendix F.	Construction
Community impacts	Consultation and cooperation with the nearest sensitive receivers will assist in minimising uncertainty, misconceptions and adverse reactions to noise. The following community relation measures will be implemented: • regular communication will be maintained with the residents affected by construction noise. The construction program and progress will be communicated on a regular basis, particularly when noise generating activities are planned. Communication with the local community will be maintained throughout the construction period • a community liaison phone number and details of permanent site contact will be provided so that noise complaints can be received and addressed in a timely manner. • upon receipt of a noise complaint, monitoring will be undertaken and reported as soon as possible. If exceedances are detected, the situation will be reviewed to identify means to attempt to reduce the impact to acceptable levels.	Pre-construction Construction

6.7 Land use and property

6.7.1 Existing environment

Land use

The proposal site is located in the Bomen Business Park (industrial area) about seven kilometres north-east of the Wagga Wagga CBD. Although the proposed solar farm development areas are zoned IN1 General Industrial, these areas are currently being used for agricultural purposes including cropping.

Services and infrastructure in and around the proposal site include roads, a rail line, electricity transmission lines, water services and gas pipelines. Easements on the proposal site include (see Figure 1.2):

- an existing Essential Energy 66 kilovolt (kV) subtransmission line and a new 132 kV subtransmission line, which is currently being built to replace the 66 kV subtransmission line. The subtransmission lines traverse the northern solar farm development area and connect to the TransGrid Wagga North Substation
- two parallel buried 450 mm high pressure gas pipelines traversing the southern and northern solar farm development areas
- an AAPT fibre optic telecommunications cable that runs parallel to the existing gas pipelines

- a 132 kV transmission line in the vicinity of the TransGrid Wagga North Substation
- various transmission lines and water services that traverse the proposed transmission line corridor options.

Land surrounding the site is used for industrial, agricultural and residential purposes.

An Enirgi administration building is located on the western side of the proposed transmission line alignment in Lot 3 DP 594679 (see Figure 1.2). This facility is typically used by up to eight Enirgi employees.

Industrial facilities on the western side of the proposal site include (see Figure 1.2):

- Riverina Oils and Bio Energy (ROBE) industrial facility (oilseed crushing and refining) at the Byrnes Road/Trahairs Road intersection, west of the proposed northern solar farm development area
- former Riverina Wool Combing facility and effluent ponds north and south of Trahairs Road, west of the proposal site
- Enirgi power storage recycling facility west of the proposed transmission line in Lot 3 DP 594679.

The proposal site does not contain any residences. The nearest residences are homesteads associated with rural properties, as described in section 1.2.2 and shown in Figure 1.2.

The proposal site is not used for mining or quarrying. A mineral, coal and petroleum titles search through the NSW Planning and Environment MinView application confirmed that no current titles or applications apply to the site or any of the areas immediate adjacent to the proposal site (see MinView maps in Appendix I).

Land and soil capability

Land within NSW is commonly classified according to its capability to remain stable under particular land uses. Table 6.25 provides an overview of these classifications (Cunningham *et al* 1988).

Table 6.25: Land and soil capability

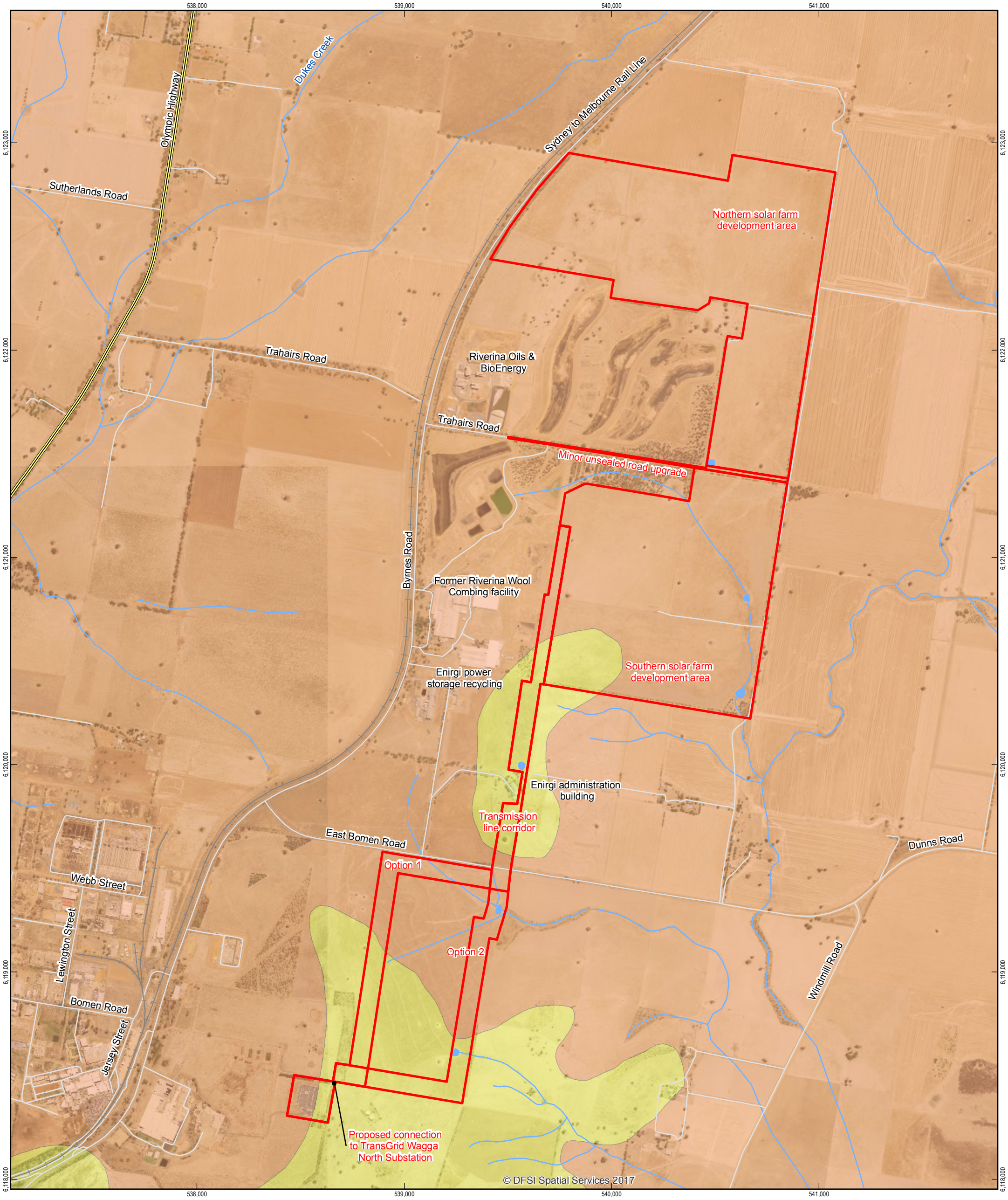
Broad category	Class	Description
Land capable of being regularly cultivated (Slope < 10%)	Class 1	No special soil conservation works or practices necessary
	Class 2	Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation.
	Class 3	Structural soil conservation works such as diversion banks, graded banks and waterways, together with soil conservation practices as in Class 2.
Land not capable of being regularly cultivated but suitable for grazing with occasional cultivation (Slope 10% - 25%)	Class 4	Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or reestablishment of permanent pastures.
	Class 5	Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class 4.
Land not capable of being cultivated but suitable for grazing (Slope > 25%)	Class 6	Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. This class may require some structural works.

Broad category	Class	Description
Other lands	Class 7	Land best protected by green timber
	Class 8	Cliffs, lakes or swamps and other land incapable of sustaining agricultural or pastoral production.

Table 6.26 outlines the land capability classifications that apply to the proposed solar farm development areas. The transmission line corridor is not included in this table, as the new transmission line would not result in a change in land use, and agricultural land would not be lost. Figure 6.21 shows the land capability classification for the entire proposal site. The majority of the solar farm development areas (96 per cent) is assigned class 3, which is considered to be land capable of being regularly cultivated.

Table 6.26: Land capability of the solar farm development areas

Land and soil capability class	Area (ha)	Percentage of site area
3	220.1	96%
5	9.2	4%
Total	**229.3**	**100%**



LEGEND

- Proposal site
- Land and soil capability class
  - 3
  - 5
  - Dam
- Highway
- Road
- Rail line
- Drainage line/stream

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number	23-16243
Revision	0
Date	09 Apr 2018

Land capability of the proposal site

Figure 6.21

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Data source: NSW Government (LPI): Hydrolines, rail lines and roads - 2012 and aerial photograph - 2017; NSW Government (OEH): Land and soil capability classes - 2013. Created by:afoddy

6.7.2 Potential impacts

Construction and decommissioning

Utilities

Design and construction of the proposal would minimise impacts to existing utilities in the proposal site. Liaison with the service providers would continue during detailed design and construction, particularly in relation to the current work to replace the subtransmission line traversing the proposal site.

Amenity and access

Potential short term amenity and access impacts may occur during construction. These may include increased noise and vibration (see section 6.6), increased vehicle movements on local roads associated with materials delivery (see section 6.8), dust (see section 6.13) and temporary visual impacts associated with construction activities (see section 6.4).

Operation

Loss of agricultural production

While the solar farm development areas of the proposal site are classed as land that is capable of being regularly cultivated, it has been identified by Council planners as being better purposed for non-agricultural uses. This led to the rezoning of these areas from RU1 Primary Production to IN1 General Industrial in 2010.

During the operational stage of the proposal, it is intended that some agricultural value in the form of sheep grazing will be retained. This practice is used at solar farms to control vegetation below the photovoltaic arrays. As described in section 6.12, the economic impact of the proposal on the landowner would be offset.

Land purchase and subdivision

Renew Estate has a call option with the landowner to purchase the following land on which the proposed solar farm is to be located:

- Lot 11 DP1130519 (part)
- Lot 2 DP590756 (part)
- Lot 174 DP751405 (part)
- Lot 108 DP751405 (part)
- Lot 110 DP751405
- Lot 109 DP751405.

Subdivision of the first four lots listed above is proposed as part of this application, to allow the purchase of the required land for the proposal site.

Easement acquisition

Details of easement acquisition are provided in Table 3.1 in section 3.2.5. The indicative areas provided in Table 3.1 may change once boundaries are finalised during detailed design.

Proposed potential easement acquisition has been minimised where possible. Easement acquisition would not result in any unreasonable land use impacts. Current land use in the proposed easement would be able to continue after construction of the transmission line. With

the exception of a small area (0.2 hectares) of an existing tree planting, which may be removed, existing land uses would be able to continue within the proposed transmission line easement.

Rural land use conflict

Table 6.28 lists the potential sources of land use conflict from the proposal, assesses the risk based on the matrix in Table 6.27, and suggests management strategies to reduce possible conflicts. The list is adapted from the Department of Primary Industries (DPI) 'Living and Working in Rural Areas handbook' (DPI 2007). Items which are not considered to be applicable to the site have been removed from Table 6.28.

The assessment assumes the following:

- agricultural properties surrounding the proposal site will continue to be actively used for agricultural purposes in the future
- future farming purposes will be similar to current operations with no expected reduction in productivity or employment on the adjoining properties as a result of the proposal.

Table 6.27: Rural land use matrix

		Likelihood		
		Very likely	Likely	Unlikely
Consequence	Major consequences and impacts likely	High	High	Medium
	Modest or periodic consequences and impacts likely	High	Medium	Low
	Minimal consequences and impact likely	Medium	Low	Low

Source: Living and Working in Rural Areas: A handbook for managing land use conflict issues on the NSW North Coast (DPI 2007)

Table 6.28: Rural land use conflict risk assessment

Issue	Risk	Issue management
Agricultural aerial spraying	Low	The proposed infrastructure would be of similar heights to existing infrastructure on surrounding land, or lower, and would not cause a hazard for aircraft operating in the local area. Glare from the infrastructure would be low and would be unlikely to affect aircraft in a way that would create a safety risk (see section 6.4.3).
Catchment management/ drainage	Low	Runoff from the proposal site drains to the east. The proposal would have minimal impact on natural resource management on surrounding agricultural properties. The design (eg stormwater) will need to meet guidelines for discharges into waterways.
Dust	Low	While construction is expected to generate low levels of dust, once construction is complete dust generation would be limited to vehicles accessing the site for maintenance purposes. In this respect, it is expected that dust generation would be similar to that occurring on adjacent agricultural land. Landscaping to be located on site would potentially reduce dust moving beyond the site boundary.
Residences	Low	The closest residence is 465 metres south of the proposed southern development area of the site and as such there is little risk of land use conflict. The existing landscape plantings and future plantings to fill in gaps along the property boundary would reduce the potential risk of conflict.

Issue	Risk	Issue management
Fencing/ stray livestock	Low	Fences with adjoining agricultural land would be maintained in a condition to minimise the possibility of livestock straying onto the site from adjoining properties. The maintenance of shared boundary fencing is the responsibility of all land owners.
Fire	Low	A bushfire management plan would be prepared for the site (refer to section 6.5.4).
Lights	Low	Construction of the proposal would predominantly occur during standard construction hours, with limited work during night-time hours. Limited lighting would be required in the central work area (see Figure 1.2). During operation some lighting may be required on site, however this would be limited to the control building and substation, or occasional maintenance works, and would generally only be used when personnel are on site. This lighting is unlikely to impact on adjacent land uses (see section 6.4.3).
Noise	Low	As outlined in section 6.6.4, during construction, noise levels may exceed the noise management level, however impacts would be temporary. Operation of the proposal is predicted to comply with noise criteria and is unlikely to adversely impact on adjacent land use.
Pesticides	Low	Pesticide use within the proposal site would be limited to that required for weed control, and any products are likely to be similar to those used by surrounding landholders.
Roads	Low	There would be an increase in traffic numbers, particularly during construction, however increased traffic volumes are not expected to have any increased impact on local roads. Traffic impacts are addressed further in section 6.8.
Theft/ vandalism	Low	The boundary fencing and security video monitoring are expected to reduce the risk posed by theft/vandalism at the site and any indirect impacts to adjacent holdings.
Visual amenity	Low	The proposed northern solar farm development area site is adjacent to Byrnes Road and is partially screened by existing tree plantings along the road. Views of the proposal site are also partially screened by existing plantings along other site boundaries. A landscape plan would be developed to minimise visual impacts where they arise following construction. The existing landscape plantings and future plantings to fill in gaps along the property boundary would reduce the visual impacts. The proposed solar farm development is consistent with the IN1 General Industrial land zoning and is unlikely to cause visual impacts any greater than what is expected for land in this zone. The visual impact assessment in section 6.4 has concluded that the proposal is unlikely to cause a significant visual impact.
Weeds and pests	Low	Weed and pest control, including for priority weeds and pests, would be subject to ongoing routine monitoring and management.

Biosecurity impacts

The productivity and profitability of agricultural production depends in part on the management of pests and diseases, including the prevention of incursion of pests and diseases onto properties.

Farms generally have an on-farm biosecurity plan based on industry guidelines. The guidelines include risk assessments and control options to minimise impacts.

The major biosecurity risks from the proposal relate to the movement of people, vehicles and machinery, with the risks occurring at both construction and operation phases. Biosecurity risks relate to impacts within the proposal site and on neighbouring farms. The mitigation measures

which would be implemented to minimise biosecurity risks during the construction, operation and decommissioning phases are outlined in Table 6.29.

Industrial land use conflict

The proposed solar farm development is consistent with the IN1 General Industrial land zoning and is unlikely to cause conflict with any of the surrounding industrial facilities. These facilities may benefit from the proposal as a source of electricity. Consultation has occurred with the owners and operators of these facilities as described in chapter 4, and would continue during detailed design and construction.

Benefit for the Bomen Business Park

The proposal would benefit the local community by providing electricity generation infrastructure to support the growth and longevity of the Bomen Business Park (see section 2.1.4).

6.7.3 Safeguards and mitigation measures

Safeguards and mitigation measures provided in Table 6.29 would be implemented to minimise potential impacts on land use and rural lands.

Table 6.29: Land use mitigation measures

Impact	Environmental safeguards	Timing
Impacts to utilities	Renew Estate will consult with relevant service providers to confirm measures to be implemented to minimise impacts to existing utilities in the proposal site.	Detailed design Construction
Biosecurity general	Establish a vehicle high pressure wash down facility well away from livestock and crops to clean vehicles, boots and equipment which need to enter the property.	Construction Decommissioning
Biosecurity risk - people	Limit worker contact with livestock, crops or plant materials as much as possible and eliminate any unnecessary contact altogether.	Construction Operation Decommissioning
	Keep a visitor register.	Construction Decommissioning
Biosecurity risk - vehicles	Clearly sign and lock restricted access areas.	Construction Operation Decommissioning
	Ensure construction vehicles are clean and are parked in a designated area away from livestock or crops.	Construction Decommissioning
	Ensure construction vehicles remain on designated tracks.	
Biosecurity risk - equipment	Clean machinery and equipment from the top down and dismantle where practicable to gain access to internal spaces.	Construction Decommissioning
Impacts to land capability	Grazing within the site to be considered to minimise impacts of loss of land and also to manage groundcover vegetation within the proposal site.	Operation
	Rehabilitation of the site following decommissioning works will be carried out to ensure that the land can be used for agricultural purposes (cropping and grazing).	Post-decommissioning

6.8 Traffic, transport and access

A specialist traffic impact assessment was prepared to assess the potential impacts of the proposal and is provided in Appendix G.

6.8.1 Existing environment

Byrnes Road

Byrnes Road provides an alternative north-south route to the Olympic Highway (A41), between Wagga Wagga and Junee. Byrnes Road has the following road characteristics:

- it is a two lane two way carriageway
- it has a sealed carriageway, about seven metres wide with half metre sealed shoulders on each side of the road
- it has centre line road marking
- the signposted speed limit is 100 km/h.

At its intersection with Trahairs Road, Byrnes Road provides a rural auxillary left turn lane and right turn lane.

The Roads and Maritime Restricted Access Vehicle Map identifies Byrnes Road as being approved to accommodate vehicles up to the size of a 26 metre B-Double.

Figure 6.22: Byrnes Road looking south towards Trahairs Road

Trahairs Road (east of Byrnes Road)

Trahairs Road is a local road located about three kilometres north of Bomen. The section east of Byrnes Road provides access to the ROBE facility and other properties.

The 400 metre section of Trahairs Road east of Byrnes Road has the following road characteristics:

- it is a two lane two way carriageway.
- it has sealed carriageway approximately nine metres in width.
- no road marking is provided.

West of the 400 metre sealed section of Trahairs Road, it is unsealed with a width of about five metres.

Trahairs Road intersects Byrnes Road at a priority controlled (give way) intersection.

Figure 6.23: Sealed section of Trahairs Road looking towards Byrnes Road

Figure 6.24: Unsealed section of Trahairs Road

Crashes

Crash data for a five year period (from 2012 to 2016) was collected on Byrnes Road using data from the Transport for NSW Centre for Road Safety website. A total of 21 crashes have been recorded during this period, including:

- the majority of crashes (nine) were caused by vehicles leaving the carriageway on a bend
- four crashes involved vehicles driving off the road and four involved collisions between vehicles at intersections
- nine crashes caused injury, two of which were serious
- six crashes occurred at the intersection of Byrnes Road / Oura Road (south of Bomen), with the majority of these resulting in injuries.

The locations of the crashes recorded along Byrnes Road are shown in Figure 6.25.

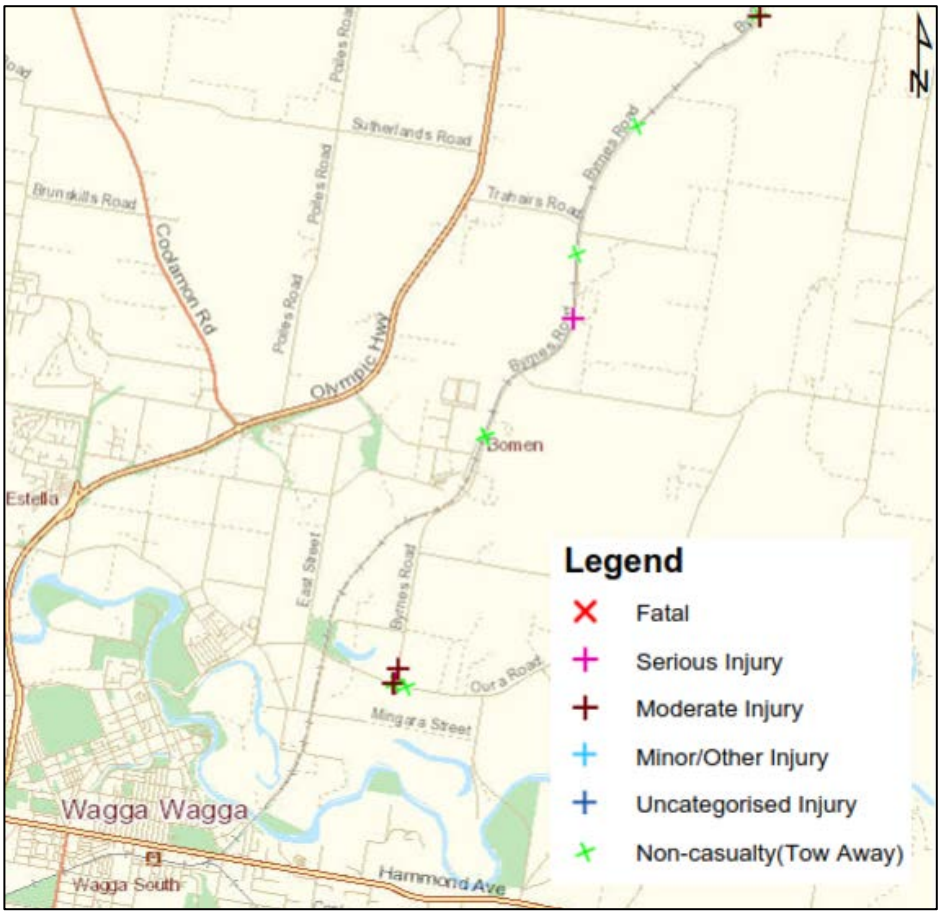

Figure 6.25: Crash location map

Active transport and public transport

There are no formal pedestrian or bicycle facilities provided in the vicinity of the proposal site, which reflects the rural location of the site.

In addition, there are no public bus services operating along Byrnes Road near the site.

Byrnes Road traffic volumes

Council traffic count data collected between 14 April 2015 and 21 April 2015 indicates the following:

- morning and evening peak periods of road network activity occur between 8:00 am – 9:00 am and 4:00 pm – 5:00 pm respectively
- during morning periods the vehicle activity on Byrnes Road is approximately 356 (bidirectional) vehicles per hour
- during afternoon periods the vehicle activity on Byrnes Road is approximately 472 (bidirectional) vehicles per hour
- during the morning peak, heavy vehicles constitute about 18 per cent of the traffic volumes
- during the afternoon peak, heavy vehicles constitute about 12 per cent of the traffic volumes.

Current network operation

The Roads and Maritime 'Guide to Traffic Generating Developments' (RTA 2002) specifies that for rural roads with a speed limit of 100 km/h, a single travel lane in each direction, level terrain

and 15 per cent heavy vehicles, have a mid-capacity (to a Level of Service D) of 1,410 vehicles (bi-directional traffic).

The measured traffic volumes for Byrnes Road indicate that it is operating well within the acceptable limits of its mid-block capacity.

6.8.2 Potential impacts

Construction and decommissioning

Traffic volumes

Details of construction traffic include:

- the construction period is expected to be nine to 12 months, commencing in the third quarter of 2018
- during peak construction it is expected that there would be up to 200 construction personnel on site, with about 170 inbound movements in the morning peak period and 170 outbound movements in the evening peak period, with some personnel carpooling
- during peak construction, there would be up to about 30 heavy vehicle movements per day, including both inbound and outbound movements.

The majority of the traffic impacts of the proposal would occur during construction. The highest peak hour traffic generation for the proposal under the peak construction scenario has been assumed to be 180 vehicle movements in total, which would consist of the following:

- morning peak hour:
  - five inbound heavy vehicle movements
  - five outbound heavy vehicle movements
  - 170 inbound worker movements (light vehicles).
- evening peak hour:
  - five inbound heavy vehicle movements
  - five outbound heavy vehicle movements
  - 170 outbound worker movements (light vehicles).

The majority of deliveries during construction would be by semi-trailer.

Similar volumes of construction vehicles would be required for decommissioning.

Trip distribution

It is anticipated that the majority of the construction labour force would reside in Wagga Wagga and would therefore travel northbound on Byrnes Road in the morning peak period and southbound in the evening peak period.

Heavy vehicle access routes during construction are not currently known. However, it is expected that the majority of heavy vehicles will enter/exit the proposal site to/from the Sturt Highway to the south and possibly the Olympic Highway to the east.

Existing auxiliary lanes are provided on Byrnes Road to accommodate vehicles turning into Trahairs Road.

Site access

Site access for the operational and construction traffic volumes would be via Trahairs Road.

GHD has reviewed the Trahairs Road access with respect to the expected construction vehicle activity and has made the following conclusions / recommendations:

- for the purpose of providing access for construction vehicles accessing the site, a single unsealed lane width of four metres for the length of Trahairs Road would provide sufficient access for semi-trailers, with no requirement for vegetation removal
- minor grading work along the unsealed section of Trahairs Road work to a width of four metres is required to make the unsealed section of the road suitable for use during construction
- to ensure that inbound and outbound vehicles do not need to traverse the single lane unsealed road simultaneously, a radio protocol would be implemented for vehicles to give way to oncoming vehicles already on the road. Appropriate warning signage detailing the radio protocol would also be erected at either end of the unsealed section of road
- a condition assessment of Trahairs Road should be conducted before and after construction.

During consultation with Council, it was agreed that the above would be likely to meet Council requirements (see chapter 4).

Construction traffic impacts

Byrnes Road is currently operating well within its functional mid-block capacity, with bi-directional traffic flows of up to 472 vehicles per hour and a capacity of approximately 1,410 vehicles per hour.

At its intersection with Trahairs Road, Byrnes Road provides a rural auxillary left turn lane (AUL) and right turn lane (AUR) to allow through vehicles to pass vehicles turning into Trahairs Road.

A minor upgrade of Trahairs Road would be carried out as described above to make it suitable for use by heavy vehicles during construction.

It is anticipated that Byrnes Road and Trahairs Road can accommodate the construction vehicle activity associated with the proposal and that the construction traffic volumes would have a negligible impact on road safety.

Operation

Traffic volumes

Details of operational traffic include:

- the solar farm would be staffed between 7:00 am – 5:00 pm, seven days per week
- the solar farm would have up to about ten staff members during the defect liability period (two years)
- subsequent to the defect liability period about five staff members would be employed at the solar farm
- it is anticipated that staff movements would be inbound in morning peak periods and outbound in evening peak periods
- there would be occasional heavy vehicle movements to the site, associated with the delivery of spare parts, waste removal and civil maintenance
- during the defect liability period the proposal is expected to generate up to light vehicle peak hour movements per day, with 10 inbound movements in the morning peak and 10 outbound movements in the evening peak

- after the defect liability period, the proposal is expected to generate up to 10 light vehicle peak hour movements per day including five inbound movements in the morning peak and five outbound movements in the evening peak.

Operational traffic impacts

Upon completion of the construction phase, the solar farm is expected to generate up to 20 light vehicle peak hour movements per day. This additional traffic would constitute about three per cent of the existing peak hour traffic volumes on Byrnes Road. This small variation in traffic movement within the road network would be unlikely to have an adverse impact on the road system and/or intersection operation, and would be within the typical daily fluctuations in traffic.

It is therefore anticipated that the road network would perform as per the existing conditions.

It is also anticipated that the operational traffic volumes would have a negligible impact on road safety.

6.8.3 Safeguards and mitigation measures

Safeguards and mitigation measures provided in Table 6.30 would be implemented to minimise potential impacts on land use and rural lands.

Table 6.30: Traffic mitigation measures

Impact	Environmental safeguards	Timing
Traffic impacts during construction	A detailed construction traffic management plan will be prepared and approved by Council before construction. The plan will include appropriate traffic control plans and will include detail in relation to: • traffic control measures in works areas • appropriate entry/exit points for the proposed compound areas • advising motorists of the change in traffic conditions associated with the work.	Pre-construction
	Appropriate exclusion barriers, signage and site supervision are to be employed at all times to ensure that the works area is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.	Construction Decommissioning
	All traffic control devices are to be in accordance with AS 1742.3-2009 – 'Manual of uniform traffic control Devices: Traffic control for works on roads' and the Roads and Maritime Services 'Traffic control at worksites manual'.	Construction Decommissioning
	A condition assessment of Trahairs Road will be conducted before and after construction.	Construction Decommissioning

6.9 Hydrology, groundwater and water quality

6.9.1 Existing environment

Hydrology

The proposal site is located within the Murrumbidgee River catchment, with the Murrumbidgee River located about 2.8 kilometres south of the proposal site.

The upper reaches of three ephemeral drainage lines are located in the central and southern parts of the proposal site and flow from west to east (see Figure 1.2). The drainage line running through the southern solar farm development area appears to start east of Byrnes Road, passing through decommissioned effluent ponds at the former Riverina Wool Combing facility. NSW Government spatial data indicates that the drainage lines converge about 2.1 kilometres east of the proposal site before flowing into Wheel of Fortune Creek, which then flows to the Murrumbidgee River.

Six farm dams are located in the proposal site, with four dams on, or near the drainage lines (see Figure 1.2). One of the dams captures runoff from the Enirgi administration building site.

The proposal site is not located on land mapped by Council as flood prone and would be unlikely to flood due to its elevation, landform and lack of permanent watercourses.

Water quality

The water quality of drainage lines, creeks and dams in the area is affected primarily by agricultural runoff. Agricultural runoff may contain farm chemicals and fertilisers that degrade water quality. Agricultural runoff may also contain manure from stock, which can increase:

- biochemical oxygen demand
- levels of nutrients such as nitrogen
- levels of bacteria such as faecal coliforms.

Groundwater

A search of the Department of Primary Industries Water groundwater monitoring data (DPI 2018) was carried out on 11 December 2017. Three bores were identified within 508 metres of the proposal site with recorded standing water levels. None of these bores are located on the proposal site. Other registered bores in the vicinity of the proposal site did not have any recorded standing water levels.

Table 6.31 provides an overview of the bores in the vicinity of the proposal site with recorded standing water levels. The standing water levels recorded for some of these bores were at relatively shallow depths, although these measurements may have been influenced by unique factors such as proximity to water storage ponds. The lack of recorded standing water levels for other bores in the vicinity of the proposal site may be due to the depth to groundwater being below the depth of bore construction. The standing water level for bore GW415965 (11 metres) may be most indicative of depth to groundwater across most of the proposal site.

Table 6.31: Groundwater bores near the proposal site with recorded standing water levels

Borehole	Use of bore	Location in relation to site	Depth to standing water at time of establishment
GW415964	Monitoring bore	In south-eastern corner of southern development area	3 metres
GW415965	Monitoring bore	On eastern boundary of southern development area	11 metres
GW400116	Monitoring bore	286 metres west of the southern development area	4 metres
GW400118	Monitoring bore	400 metres west of the southern development area	2 metres
GW400119	Monitoring bore	508 metres west of the southern development area	1.2 metres

Groundwater data collected in and around the Riverina Wool Combing effluent ponds (ENSR|Aecom 2008) from 1997 to 2007, when they were operational, show that depth to groundwater in this area was typically greater than one metre. The measurements were recorded during a period of drought and may have been influenced by the dry conditions at that time. However, as the effluent ponds have since been decommissioned and no longer receive liquid effluent, it is likely that current groundwater levels are lower than those measured during 1997 to 2007.

Most registered groundwater bores in the vicinity of the proposal site have been established for groundwater monitoring (DPI 2018). Groundwater bores registered for other uses (stock and domestic) are listed in Table 6.32.

Table 6.32: Groundwater bores registered for stock and domestic use in the vicinity of the proposal

Borehole	Use of bore	Location in relation to site
GW024160	Stock, domestic	577 metres south of the southern development area
GW010925	Stock, domestic	469 metres west of the northern development area

There are 14 registered groundwater monitoring bores in the proposal site (DPI 2018). These are shown in Figure 6.26.

539,000 540,000 541,000

6,123,000 6,122,000 6,121,000

GW400120
GW400121
GW400092
Northern solar farm development area
GW403041
GW400123
GW400122
GW403040
GW403038
GW400093
Trahairs Road
Trahairs Road
GW400114
Byrnes Road
Southern solar farm development area
GW415966
GW415965
GW415964
GW415968

LEGEND

- Groundwater monitoring bore
- Drainage line/stream
- Road
- Proposal site

Paper Size A3

0 100 200 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Registered groundwater monitoring bores in the solar farm development areas

Job Number 23-16243
Revision 0
Date 28 Mar 2018

Figure 6.26

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig6-20 Registered groundwater monitoring sites.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia T 61 2 6923 7400 F 61 2 6971 9565 E wgamail@ghd.com W www.ghd.com

Data source: NSW Government: Hydrolines and roads - 2012, aerial photograph - 2017 and groundwater monitoring bores - 2010. Created by:afoddy

6.9.2 Potential impacts

Construction and decommissioning

Flooding

The proposal site is not located on land mapped as flood prone and would be unlikely to flood due to its elevation, landform and lack of permanent watercourses. The construction and decommissioning stages of the proposal are unlikely to cause any flooding impacts at the site.

Water use

The proposal would require water throughout the construction period and potentially the decommissioning phase, primarily for dust suppression. It is estimated that about two megalitres of water would be required during the construction and decommissioning periods. This would potentially be sourced from a Council water filling station or a similar alternative location and no water would be sourced from the site (including from groundwater). As such, the proposal would be unlikely to affect any licensed water users in the vicinity of the proposal.

Water quality

The disturbance of soils during construction has the potential to impact on water quality. Activities likely to disturb soils are described in section 6.11.2. The erosion of disturbed soils has the potential to impact on water quality in downstream areas through increased turbidity and could also cause sedimentation of drainage lines.

Erosion and sedimentation impacts would be managed in accordance with 'Managing Urban Stormwater: Soils and Construction' (Landcom 2004) to minimise impacts. The provision of sedimentation basins on site would be considered during detailed design and this could involve converting existing farm dams into basins for the duration of the construction period.

Spills and leaks from construction equipment could potentially impact on water quality in drainage lines. This impact would be managed by implementing safeguards and mitigation measures detailed in section 6.9.3.

Groundwater

As outlined in section 6.9.1, groundwater in the vicinity of the proposal is likely to be at depths of at least one metre. Depths of excavations for the solar farm development area are likely to be one metre or less, and are therefore unlikely to intercept groundwater. Excavations for the transmission line poles are likely to be up to three metres and therefore there is potential for some interception of groundwater. The proposal would not involve large excavations and would be unlikely to cause any impacts to groundwater in the vicinity of the proposal. As outlined in Section 5.3.3, an aquifer interference licence under the *Water Management Act 2000* would not be required as dewatering activities from excavations is considered to be less than three megalitres per year.

There is the potential for registered groundwater monitoring bores in and around the proposal site to be damaged during construction and operation activities.

Operation

Flooding

The proposal site is not located on land mapped as flood prone and would be unlikely to flood due to its elevation, landform and lack of permanent watercourses. The proposal is unlikely to cause any flooding impacts at the site.

Hydrology

The existing runoff characteristics of the proposal site will be maintained throughout the operation of the proposal. This will be achieved through maintaining groundcover beneath the solar arrays and through implementing design measures as necessary to mitigate any significant runoff impacts, such as the establishment of dams, vegetation, retention basins, infiltration trenches or swales.

While the proposal involves constructing solar arrays with impervious surfaces, these would not increase runoff from the proposal site, as they would allow rainwater to drain to the ground underneath the arrays and follow similar flow paths to those currently present on the site (see Figure 6.27). The ground surface would absorb runoff similarly to current conditions on site.

Figure 6.27: Rainfall flow path

A 2013 study into the impact of solar farms on hydrology confirmed that a solar farm of the type proposed would not have a significant impact on the surface water run-off rate, or volume (Cook and McCuen 2013). This study found that underlying groundcover was the primary determinant of run-off rate, whereby over bare ground (a smoother surface) the velocity and volume of run-off increases, whereas ground with good grass cover (a more rough surface) delays run-off and absorbs more water. Therefore, by retaining good grass cover across the proposal site, run-off water would be absorbed similarly to current conditions.

The 2013 study also looked at the angle of the solar panels and the influence this has on the velocity and volume of run-off. The study found that run-off volume decreased when panels were at a steep angle (70°) and increased when panels were closer to horizontal (30°), due to changes in water velocity, although the overall difference (~0.5%) was very slight.

Three existing dams in the proposed solar farm development area would potentially be decommissioned, which would involve filling the dams with material excavated from other parts of the proposal site. This would be confirmed during detailed design and would depend on factors such as the locations of the dams and the need for water sources for livestock.

Any decommissioning of dams on the proposal site would potentially increase runoff from the site, as this water would no longer be captured. This increase in flows off site is unlikely to adversely impact on adjacent properties, as flows are would be relatively small due to the small catchment area of the ephemeral drainage lines. If considered necessary, additional water storage would be constructed to maintain the existing runoff characteristics of the proposal site.

The proposal would increase the area of impermeable surfaces on site through construction of the control building, battery storage system, substation, and access tracks. This has the potential to increase runoff which in turn can increase erosion and sedimentation impacts. This impact is considered to be minimal because the impermeable surfaces would occupy a small area. Impermeable roof areas are likely to be used for stormwater capture, with water stored in

rainwater tanks and used for operational functions on site. The impact of this would be a reduction in runoff from these areas.

Detailed design would maintain the hydrology of natural drainage lines (or flow paths) on site. The proposal would not substantially increase or decrease the availability of water to other properties.

Water use

The proposal is expected to use up to 500 kilolitres of water per year to clean the solar arrays as part of maintenance activities. Rainfall is generally sufficient to clean the solar arrays, and therefore the volume of water required for cleaning is dependent on annual rainfall. A small volume of water would also be required for the control building. This would potentially be sourced from a Council water filling station or a similar alternative location and would be trucked to site.

Water quality

Water quality impacts during operation are considered to be minimal as the site would be stabilised following construction. Runoff from the site would continue to follow the existing drainage patterns to ephemeral drainage lines.

Access to the site by maintenance personnel would potentially result in spills and leaks from equipment or vehicles, however due the frequency of such works and the implementation of safeguards and mitigation measures impacts are considered to be minor.

Groundwater

Any minor excavations carried out during operation would be unlikely to intercept groundwater due to the likely depth to groundwater at the site (greater than one metre). The proposal would be unlikely to affect any nearby licensed groundwater users or basic landholder rights.

6.9.3 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.33 would be implemented to minimise potential hydrology or water quality impacts.

Table 6.33: Hydrology and water quality management measures

Impact	Environmental safeguards	Timing
General	An erosion and sediment control plan (ESCP) will be prepared as part of the CEMP. All erosion and sediment control measures shall be designed, implemented and maintained in accordance with relevant sections of 'Managing Urban Stormwater: Soil and Construction Volume 1' (Landcom 2004) ('the Blue Book) (particularly section 2.2) and 'Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services' (DECC 2008). The ESCP will include stockpiles, stormwater runoff, trees, site boundaries, site access and storage areas.	Construction
	The Department of Primary Industries – Water controlled activity guidelines will be considered as part of the detailed design of the proposal.	Detailed design

Impact	Environmental safeguards	Timing
Rehabilitation	Rehabilitation works are to commence as soon as practicable to stabilise the land surface after works are completed in any area.	Construction
Increased run-off	Groundcover vegetation would be maintained beneath the solar arrays during operation, to minimise potential for increased run-off.	Construction and operation
	A groundcover management plan would be developed that includes measures to manage any bare areas and erosion that develop beneath the solar arrays.	Operation
Contamination of surface water	All fuels, chemicals, and liquids will be stored at least 50 metres away from waterways and will be stored in an impervious bunded area within the compound site.	Construction
	The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas in the compound site.	Construction
	Vehicle wash downs and/or concrete truck washouts will be carried out within a designated bunded area on an impervious surface or carried out off-site.	Construction
	Machinery will be regularly checked to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills	Construction
Spills and leaks	A site specific emergency spill plan will be developed, and will include spill management measures in accordance relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Construction
	An emergency spill kit will be kept on site at all times. All staff will be made aware of the location of the spill kit and trained in its use.	Construction
Groundwater monitoring bores	Registered groundwater monitoring bores in and around the proposal site will be identified, located and protected during construction and operation as necessary. Any removal of groundwater monitoring bores will be carried out in consultation the DPI Office of Water.	Construction Operation

6.10 Electric and magnetic fields

6.10.1 Background

Electric and magnetic fields (EMF) are part of the natural environment. Electric fields are present in the atmosphere and static magnetic fields are created by the earth's core. EMF is also produced wherever electricity or electrical equipment is in use. Transmission lines, electrical wiring, household appliances and electrical equipment all produce power frequency EMF.

An electric field is the force that fills the space around every electric charge, including any powered electrical appliance or conductor (eg transmission line). Electric fields are measured in volts per metre (V/m) or kilovolts per metre (kV/m). They occur both naturally and as a result of power generation, and are produced every time voltage runs through a wire. The higher the voltage the stronger the electric field. Electric fields are strongest closest to the wires and their level reduces quickly with distance. Most materials act as a shield or barrier to electric fields.

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 hertz. This frequency falls within the Extremely Low Frequency range of 0 to 300 hertz.

In addressing the question of adverse health effects, electricity authorities in NSW rely on expert advice on EMF from competent health authorities in Australia and from around the world. This includes the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), which is the Federal Government agency responsible for providing health assessments and recommendations to the Government on matters relating to EMF.

ARPANSA has adopted the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limiting exposure to EMF, published in 2010. The ICNIRP Guidelines express limits in terms of 'Reference Levels' and 'Basic Restrictions' under general public and occupational exposure conditions (see Table 6.34).

The Basic Restriction values are expressed as the internal electric fields which can be induced in the body without adverse health outcomes, these must be met. As the Basic Restriction values apply within body tissue, it is difficult and impractical to measure them. For that reason, Reference Levels, which are simpler to measure, are provided as an alternative means of showing compliance with the Basic Restrictions. If desktop study and/or direct field measurements show that the EMF is below the Reference Levels, the EMF is well within the Basic Restrictions. The reference levels may be exceeded if it can be demonstrated that the basic restrictions are still met.

Table 6.34: EMF reference levels under general public and occupational exposure conditions

Reference levels	Electric field strength (kilovolts per metre – kV/m)	Magnetic field (microteslas - µT)
General Public Reference Levels	5	200
Occupational Reference Levels	10	1,000

6.10.2 Potential impacts

Construction and decommissioning

There would be limited exposure to EMF during construction and decommissioning with the only sources of EMF being the existing subtransmission line which runs through the site and the

North Wagga substation at the southern end of the proposed transmission line. The magnetic field exposure of the existing subtransmission line is likely to be well under the limits outlined in Table 6.34 for occupational and public exposure.

Workers would be unlikely to be working in close vicinity to the subtransmission line for an extended period of time because the solar arrays would not be within the subtransmission line easement.

Workers would be in close vicinity to the North Wagga substation for a short period of time during works to connect the transmission line to the substation. These works are unlikely to present a health risk to workers, who would follow standard health and safety guidelines for length of time exposed to EMF.

Operation

Overview

During operation the following sources of EMF would be present on the proposal site:

- proposed on-site substation
- existing TransGrid Wagga North Substation
- existing subtransmission line
- solar arrays including associated cabling
- proposed transmission line.

Solar farm

The main source of EMF would be the new on-site substation. The layout of the substation and the selection of equipment which would be undertaken during detailed design would be in line with the design of similar substations throughout Australia. The principles of prudent avoidance would be implemented, and careful positioning and selection of equipment is likely to result in exposure levels at the boundary of the substation being similar to existing background levels. Fencing around the substation (and wider site) would ensure that members of the public would be at negligible risk of exposure from the substation. Access to the substation would only be available to suitably trained workers.

While the rest of the electrical equipment to be located on site would generate magnetic fields, due to its substantial distance to the nearest sensitive receivers, it is likely to comply with limits for both public and occupational exposure. Exposure levels are likely to be close to background levels at the property boundary. Security fencing to be erected around the site would prevent access to the site by members of the public, limiting public exposure.

Transmission lines

Magnetic fields in the immediate vicinity of high voltage transmission lines (132 kV to 500 kV) are typically (TransGrid 2018):

- 1-20 microteslas directly under the transmission line
- 0.5-20 microteslas directly above an underground transmission line
- 0.2-5 microteslas at the edge of the easement (typically 22.5 to 35 metres from the centre line).

These magnetic fields are low in relation to the interim guidelines on limits of exposure (see Table 6.34).

Overhead sections of the transmission line would have an easement width of 30 to 45 metres. The easement width for any underground sections of the transmission line would likely be seven to 11 metres. Houses, buildings and other substantial constructions would be prohibited within the proposed easement. The transmission line is unlikely to present an EMF risk to the general public or workers.

Exposure levels for the existing subtransmission line on site are unlikely to be altered by the proposal.

6.10.3 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.35 would be implemented to minimise potential EMF impacts.

Table 6.35: EMF mitigation measures

Impact	Environmental safeguards	Timing
EMF	Design and selection of all electrical equipment is to minimise EMF levels and comply with the ICNIRP exposure levels.	Construction
	Monitoring of electromagnetic levels would be undertaken during the commissioning of the substation to confirm exposure levels. Should levels be above the ICNIRP exposure levels the potential need for further mitigation would be considered.	Commissioning

6.11 Soils and geology

6.11.1 Existing environment

Topography

The terrain of the study area is slightly undulating. Elevation across the site varies from 200 metres above sea level in the south-east to 240 metres in the north-west. The proposal site is located in the Junee Hills and Slopes Mitchell Landscape, which comprises rolling hills, low ranges and undulating plains. The general elevation of the landscape is 300 to 450 metres above sea level, with local relief typically 60 metres (Mitchell 2002).

Geology

The Junee Hills and Slopes Mitchell Landscape has a geology of Silurian-Devonian massive granite and granodiorite (Mitchell 2002).

The proposal site is located in the Wantabadgery Granite geologic unit, which comprises S-type, mafic, unfractionated granite (NSW Department of Mineral Resources 2002).

Desktop soils assessment

The Junee Hills and Slopes Mitchell Landscape contains coarse siliceous sands amongst rock outcrop and tors, and thin gritty red and yellow texture-contrast soils on slopes with harsh blocky subsoil (Mitchell 2002).

Two NSW soil landscapes occur in the proposal site and are shown in Figure 6.28 and described in Table 6.36.

Table 6.36: Soil landscapes in the proposal site

Soil landscape	Description
East Bomen (aeolian landscape)	Landscape – undulating rises of Silurian Wantabadgery Granodiorite. Local relief 15-40 m, slope gradients 3-10%. Broad crests and ridges, long waning slopes, and shallow drainage depressions. Almost completely cleared tall woodland. Soils—shallow to moderately deep (40–150 cm) Eutrophic Red Dermosols on crests and ridges; deep (80-200 cm) Eutrophic Brown Dermosols on slopes; and moderately deep (80-150 cm) Eutrophic Brown Dermosols in drainage lines. Limitations – moderate erosion hazard, moderately acid and locally shallow soil.
Glenmornon (vestigial landscape)	Landscape – ridges and crests of granite low hills. Local relief 30-100 m; slope gradients >15% (some >30%). Rock outcrop common. Extensively cleared tall woodland and open-forest. Soils – shallow to moderately deep (40-100 cm) Mesotrophic Red Kandosols. Limitations – steep slopes, common rock outcrop, high erosion hazard, strong acidity, low fertility (locally shallow and stony) soil.

Mapping and descriptions © State of NSW and Office of Environment and Heritage (OEH) 2013.

Four soil profiles were obtained from the OEH's eSpade soil and land information database on 11 January 2018 for the northern part of the proposal site (see locations in Appendix I). These indicate that soils in this area have the following characteristics:

- slight to moderate erosion potential
- surface condition is hard set
- profile is imperfectly to well drained
- no salinity is evident
- neutral acidity
- topsoils consist of loam, sandy clay loam, loamy sand and light clay
- subsoils consist of light clay, sandy clay and medium clay.

Drillers logs for two registered groundwater bores in the vicinity of the southern development area (DPI 2018) record the soils as having:

- topsoil – sandy clay of low plasticity with fine to coarse sand
- subsoil (to 7 m) – clay of high plasticity with fine to medium sand.

No potential acid sulfate soils have been mapped for the proposal site.

Contamination

A search of the EPA's contaminated land record was carried out on 11 January 2018 for the Wagga Wagga LGA. No contaminated sites were identified in close proximity to the proposal site.

A search of the EPA's 'List of NSW Contaminated Sites Notified to EPA as of 22 December 2017' identified one site at Bomen about 1.2 kilometres west of the proposal site. No contaminated sites were identified in close proximity to the proposal site.

The Planning Certificate for the proposed solar farm development areas (ie the site excluding the transmission line corridors), issued in June 2017 under Section 149(2) of the EP&A Act, identifies that in relation to the *Contaminated Land Management Act 1997* (CLM Act), the proposal site is not:

- significantly contaminated land within the meaning of the CLM Act
- subject to a management order within the meaning of the CLM Act
- subject of an approved voluntary management proposal within the meaning of the CLM Act
- subject to an ongoing maintenance order within the meaning of the CLM Act.

No obvious physical evidence of contamination was observed during inspections of the proposal site. Communication with the land owner indicated that the proposal site does not contain any decommissioned livestock dips.

The decommissioned Riverina Wool Combing effluent ponds are located upslope, and on the western side of, the proposal site. While the Riverina Wool Combing plant was operating, treated effluent from the ponds was used to irrigate land in the northern solar farm development area, and possibly the southern solar farm development area. The irrigation with effluent was carried out under Environment Protection Licence 3914. The Riverina Wool Combing plant ceased operating in December 2009.

McMahon Earth Science completed a contamination assessment of the decommissioned effluent ponds in 2014 (see Appendix H). The effluent ponds contain sludge contaminated with lanolin residues. Testing and analysis of the sludge (including pesticides, heavy metals and hydrocarbons) in each pond demonstrated that the levels of contamination at the site were below threshold levels for commercial/industrial land use and that environmental risks were manageable.

Given these results, it is considered unlikely that any substantial migration of contaminants could have occurred from the effluent ponds to the proposal site. It is also unlikely that historical irrigation of the proposal site with treated effluent from the effluent ponds could have caused elevated levels of contaminants in the proposal site. Levels of any contaminants in the proposal site would be likely to be below threshold levels for commercial/industrial land use.

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6,123,000 6,122,000 6,121,000 6,120,000 6,119,000 6,118,000

Olympic Highway
Dukes Creek
Sydney to Melbourne Rail Line
Sutherlands Road
Northern solar farm development area
Trahairs Road
Riverina Oils & BioEnergy
Trahairs Road
Minor unsealed road upgrade
Byrnes Road
Former Riverina Wool Combing facility
Enirgi power storage recycling
Southern solar farm development area
Enirgi administration building
Transmission line corridor
East Bomen Road
Option 1
Option 2
Webb Street
Lewington Street
Bomen Road
Jersey Street
Dunns Road
Windmill Road
Proposed connection to TransGrid Wagga North Substation

LEGEND

- Proposal site
- Soil landscape
  - Currawarna
  - East Bomen
  - Glenmornon
  - Kurrajong Plain
- Highway
- Road
- Rail line
- Drainage line/stream
- Dam

Paper Size A3

0 200 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Renew Estate
Bomen 120 MW solar farm EIS

Job Number	23-16243
Revision	0
Date	09 Apr 2018

Soil landscapes in the proposal site

Figure 6.28

N:\AU\Wagga Wagga\Projects\23\16243\GIS\Maps\Deliverables\EIS\BomenSolarFarmEIS_Fig6-22 Soil landscapes.mxd

Suite 3, Level 1, 161-169 Baylis Street Wagga Wagga NSW 2650 Australia **T** 61 2 6923 7400 **F** 61 2 6971 9565 **E** wgamail@ghd.com **W** www.ghd.com

Data source: NSW Government (LPI): Hydrolines, rail lines and roads - 2012 and aerial photograph - 2017; NSW Government (OEH): Land and soil capability classes - 2013. Created by:afoddy

6.11.2 Potential impacts

Construction and decommissioning

Soil erosion

The proposal would disturb soils through minor earthworks for the following activities:

- minor grading of the unsealed section of Trahairs Road to a width of four metres
- levelling the ground for structures such as the control building, battery storage area and substation, as well as for the construction compound and laydown areas
- limited grading for installation of tracking systems
- construction of internal access tracks
- excavating cable trenches to a depth of up to one metre – the trenches would be backfilled to match the adjacent land surface
- excavating pole footing holes for construction of overhead sections of the transmission line up to three metres deep
- levelling small areas where there are changes in the land slope that exceed 10 per cent.

Minor disturbance to soils would also occur where trees are removed.

The disturbance of soils has the potential to result in the following impacts:

- mixing of the soil horizons which could impede vegetation growth on site
- erosion and sedimentation which could cause a loss of topsoil in parts of the site.

Soil erosion risk is low for the following reasons:

- soil disturbance would be low (features of the proposal where minor earthworks are required would largely be constructed on the existing landform)
- in areas where trees are removed the topsoil would be stockpiled and reinstated
- a geotechnical study is currently being completed which includes an analysis of potential issues regarding slope stability and erosion at the proposal site. An erosion and sediment control plan would be prepared as part of the CEMP that includes measures to manage any potential soil erosion issues identified through the study. The erosion and sediment control plan would remain in place during any required rehabilitation following construction.
- additional erosion and sediment controls would be implemented as specified in section 6.11.3.

Minor disturbance of soils would occur during decommissioning when removing infrastructure.

Soil contamination

The proposal could result in the localised contamination of soils as a result of spills and leaks from equipment and machinery on site. These impacts are considered to be minimal with the implementation of safeguards and mitigation measures outlined in sections 6.9.3 and 6.11.3.

Operation

Soil erosion

Soil impacts during operation would be minimal and limited to maintenance activities. These activities are not considered to require any substantial soil disturbance on a regular basis.

Rainfall runoff from solar panels is unlikely to cause soil erosion during operation. Cook and McCuen's (2013) study of the impact of solar farms on hydrology found that increased kinetic energy of water flowing off the panels may increase erosion in areas at their base, however this potential impact would be effectively mitigated by the maintained groundcover vegetation and ongoing maintenance if needed. In addition, the panels would constantly change orientation, with runoff being distributed in the area around each panel, and not drained permanently to a single place on the ground. Measures to manage any bare areas and erosion that develop beneath the solar arrays would be included in a groundcover management plan for implementation during operation of the proposal.

Soil contamination

There is potential for localised contamination of soils due to maintenance activities or spills, however these impacts would be minimised through the implementation of mitigation measures.

6.11.3 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.37 would be implemented to minimise potential soil impacts. The measures in Table 6.37 are those proposed in addition to the measures in section Table 6.33.

Table 6.37: Soil mitigation measures

Impact	Environmental safeguards	Timing
Soil impacts	The erosion and sediment control plan developed as part of the CEMP will include measures to manage any potential soil erosion issues identified by a geotechnical study in relation to the characteristics of soils at the site.	Pre-construction
Contamination	The CEMP will contain an unexpected finds protocol for land contamination that directs workers to cease work and implement pre-determined procedures before further works proceed, including reporting of the potential find to the Council as the applicable pollution control authority.	Pre-construction
Soil impacts	Erosion and sediment control measures would be in place during the entire construction period and during any required rehabilitation.	Construction
	Activities with a risk of soil erosion such as earthworks will not be undertaken immediately before or during high rainfall or wind events.	Construction
	Where possible, groundcover on site would be retained particularly in the areas of the solar arrays where disturbance would be limited to the installation of the poles for the mounting structure.	Construction
	Any disturbed areas (with no existing groundcover) would be stabilised promptly and progressively during and following the end of construction.	Construction
	Groundcover vegetation would be established and maintained beneath the solar arrays as much as possible before and during construction, to minimise areas exposed to erosion.	Construction

Impact	Environmental safeguards	Timing
	A groundcover management plan would be developed that includes measures to manage any bare areas and erosion that develop beneath the solar arrays.	Operation

6.12 Socio-economic

6.12.1 Existing environment

Wagga Wagga

Wagga Wagga is the largest regional city in NSW. The city provides essential services, such as medical and community facilities, shopping and schools. The city also has manufacturing, research and many other professional services and commercial operations.

2016 Census data

The 2016 Census (ABS 2017) provides the following core demographic data about the Wagga Wagga LGA:

- at the time of the 2016 Census there were 64,085 people in the Wagga Wagga LGA
- the number of residences was 26,096, with an average household size of 2.5
- the median age was 35
- the median weekly household income was $1,354.

The top employment industries for the Wagga Wagga LGA (ABS 2017) are provided in Table 6.38.

Table 6.38: Top employment industries for the Wagga Wagga LGA

Industry	Number employed	Percentage of people employed
Professionals	5,877	19.7
Technicians and Trades	4,667	15.6
Community and Personal Service	3,868	13.0
Clerical and Administrative	3,657	12.3

The main employment sectors in the Wagga Wagga LGA (ABS 2017) included:

- Defence 4.6%
- hospitals (except psychiatric hospitals) 4.5%
- higher education 3.1%
- other social assistance services 2.4%
- secondary education 2.4%.

Land use

Land uses in the study area are identified in section 6.7.1. In general, land use in the study area is typically characterised by industrial development and agricultural land uses.

6.12.2 Potential impacts

Construction and decommissioning

The proposal is expected to employ a maximum of about 200 construction personnel during the peak construction period. This work force would largely be sourced from the Wagga Wagga region. This increase in employment would benefit the region for the nine to 12-month construction period. If workers from outside the region are required they may temporarily relocate to the area and this would stimulate the local economy through accommodation and retail expenditure.

An increase in population could also result in increased demand for local services. However, as the workforce would be relatively small, and would largely be sourced from the local region, the demand would be unlikely to strain local services.

Operation

Reduction in greenhouse gas emissions

The proposal would contribute to a reduction in the dependence on non-renewable power generation (such as coal), reducing the emission of greenhouse gases. The reduction in greenhouse gas emissions and therefore global warming may benefit the local area, which heavily relies on agriculture as a source of income. Modelled global warming scenarios predict that temperatures will increase in the Murray Murrumbidgee Region and spring rainfall will decrease (refer to section 6.13.1), potentially impacting on the region's current agricultural land uses, which are reliant on rainfall.

Long-term employment

The operational workforce would consist of about three to five full time positions, and up to five to 10 full time positions during the initial defect liability period of operation (estimated two years).

6.12.3 Safeguards and mitigation measures

Safeguards and mitigation measures provided in Table 6.39 would be implemented to minimise potential socio-economic impacts.

Table 6.39: Socio-economic mitigation measures

Impact	Environmental safeguards	Timing
Community consultation	A community and stakeholder consultation plan will be implemented to manage the concerns of stakeholders and any impacts on adjacent property owners. The plan will include (but not be limited to) the following: • protocols to keep the community and stakeholders updated about the progress of the project and its benefits • protocols to inform relevant stakeholders of potential impacts of construction activities such as changes to traffic conditions and night works • protocols to allow the community to identify any concerns or issues with the project, particularly during construction and decommissioning.	Construction Decommissioning

6.13 Air quality and climate change

6.13.1 Existing environment

Air quality

A search of the National Pollutant Inventory (DotEE 2018) identified that nine facilities in the local area (postcode 2650) emit 33 substances to the atmosphere. A number of these facilities are located in the Bomen area. Of these facilities, two are located immediately west of the proposal site:

- ROBE facility
- Enirgi power storage recycling facility.

The main substances emitted by each facility in 2015/16 are provided in Table 6.40.

Table 6.40: Main substances emitted to atmosphere from industrial facilities west of the proposal site

Five most statistically significant substances emitted	2015/16 emission quantity (kg)
Renewed Metal Technologies Pty Ltd (now Enirgi) – power storage recycling plant	
Carbon monoxide	250,000
Lead & compounds	57
Sulfur dioxide	37,000
Chromium (III) compounds	0.11
Mercury & compounds	1.7
Riverina Oils And Bio Energy Pty Ltd – oilseed crushing and refining plant	
n-Hexane	4,700
Total Volatile Organic Compounds	4,800
Sulfur dioxide	110
Chromium (III) compounds	0.14
Nickel & compounds	0.20

Other sources of air pollution in the vicinity of the proposal site would be typical of a rural environment and are likely to include:

- dust from vehicles travelling on unsealed roads
- emissions from vehicles on local roads
- dust from agricultural activities
- smoke from paddock stubble burn-off in agricultural areas during autumn.

The nearest sensitive receivers include:

- a residence about 465 metres south of the proposed southern development area and 785 metres east of the transmission line option 2 alignment
- a residence about 640 metres south of the proposed southern development area and 1.1 kilometres east of the transmission line option 2 alignment
- two residences about 980 metres east of the southern end of the the transmission line option 2 alignment
- a residence about 490 metres south of the southern end of the transmission line option 2 alignment

- the Enirgi administration building on the western side of the proposed transmission line alignment in Lot 3 DP 594679.

Climate

Climate data in the vicinity of the proposal was sourced from Wagga Wagga AMO (site number 072150) at the Wagga Wagga Airport.

The Wagga Wagga area receives an average annual rainfall of 573.7 millimetres. Rainfall is spread evenly throughout the year with a mean maximum of 56.9 millimetres in October (BoM 2018b).

The hottest month is January, with a mean maximum temperature of 31.7 degrees Celsius and a mean minimum temperature of 16.3 degrees Celsius. The coldest month is July, with a mean maximum temperature of 12.7 degrees Celsius and a mean minimum temperature of 2.9 degrees Celsius (BoM 2018b).

Solar exposure is the amount of solar energy that hits a horizontal surface. The annual average daily solar exposure at Wagga Wagga is 17.8 MJ/m^2, with the highest solar exposure occurring in January (27.7 MJ/m^2), and the lowest solar exposure occurring in June (7.6 MJ/m^2).

Climate change

Climate change refers to the warming temperatures and altered climate conditions associated with the concentration of greenhouse gases in the atmosphere.

In 2014, the NSW Office of Environment and Heritage published climate change projection snapshot reports for the NSW and ACT governments as part of the NSW and ACT Regional Climate Modelling (NARCliM) project. The study focused on projections for two future 20 year time periods: 2020-2039 as the near future and 2060-2079 as the far future. The snapshot included the analysis of over 100 climate variables, including temperature, rainfall and wind.

The projected climatic changes by 2039 (near future) for the Murray Murrumbidgee Region of NSW (OEH 2014) include the following:

- maximum temperatures are projected to increase by 0.4 to 1.0 degrees Celsius
- minimum temperatures are projected to increase by 0.4 to 0.8 degrees Celsius
- the number of hot days will increase and the number of cold nights will decrease
- rainfall is projected to decrease in spring and increase in summer and autumn
- the risk of fire is projected to increase during summer and spring.

6.13.2 Potential impacts

Construction and decommissioning

Air quality

The proposal has the potential to impact on air quality during construction by generating dust from excavation, vegetation clearance, construction vehicles driving over exposed soils or unsealed roads and wind blowing over stockpiles and exposed surfaces. Dust has the potential to impact on the amenity of those occupying nearby properties. Due to the distance to nearby properties, potential impacts are considered minor.

The proposal would require minimal earthworks and therefore the generation of dust from such activities is likely to be limited to the works required for minor levelling of the land, road work along Trahairs Road and installing the arrays and associated cable trenches.

The operation of construction plant and equipment would also result in additional exhaust emissions in the area.

Impacts due to the generation of dust and exhaust emissions would be short term (ie about nine to 12 months for construction) and minor due to the distance to nearby sensitive receivers and the small number of sensitive receivers. Safeguards and mitigation measures outlined in section 6.13.3 would be implemented to minimise impacts.

Potential impacts on air quality are considered to be less for the decommissioning phase, as activities such as vegetation clearing and earthworks would not be required or would be minor. The measures outlined in section 6.13.3 would be implemented to minimise any air quality impacts during the decommissioning phase.

Operation

Air quality

The proposal is unlikely to result in any substantial air quality impacts during operation. Maintenance activities at the site have the potential to result in the generation of dust due to movements over unsealed roads. These activities would occur infrequently and any air quality impacts would be minor and short term.

Climate change

The proposal would generate electricity from a renewable source, reducing dependence on coal and gas plants for the generation of power. This would contribute to reducing greenhouse gas emissions, which are a by-product of fossil fuelled power plants.

6.13.3 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.41 would be implemented to minimise potential air quality and climate change impacts.

Table 6.41 Air quality mitigation measures

Impact	Environmental safeguards	Timing
General air quality impacts	The CEMP will include measures to minimise impacts on air quality including: • a map identifying locations of sensitive receivers • identification of potential risks/impacts through dust generation activities • management measures to minimise risk including progressive stabilisation • a process for altering management measures as required • a process for reviewing and updating the plan before decommissioning works start.	Pre-construction
Dust emissions	Surveillance for visible dust generation will occur at all times.	Construction Decommissioning
	Works that disturb vegetation, soil or stockpiles will not be carried out during strong winds (over 40 km/h) when this may affect receivers (visibility on roads, dust and debris near residences).	Construction Decommissioning

Impact	Environmental safeguards	Timing
	Stockpiled materials will be covered, stabilised or stored in areas not subject to high wind.	Construction Decommissioning
	All trucks will be covered when transporting loose materials to and from the site.	Construction Decommissioning
	Work activities will be reprogrammed if the safeguards and management measures implemented do not adequately restrict dust generation.	Construction Decommissioning
	Maximum speed limits will be enforced for construction traffic within the site to limit dust generation.	Construction Decommissioning
	A water tanker or similar will be used to spray unpaved roads and exposed areas during construction where required.	Construction Decommissioning
Exhaust emissions	Construction machinery and equipment will be maintained in good working condition to limit impacts on air quality.	Construction Decommissioning
	Construction equipment, machinery and vehicles will be appropriately sized for the task.	Construction Decommissioning
	Machinery and equipment will be serviced regularly to ensure it is operating efficiently.	Construction Decommissioning
Impacts on sensitive receivers	A community and stakeholder consultation plan will be implemented to manage the concerns of stakeholders and any impacts on adjacent property owners. The plan will include protocols for informing adjacent property owners of the construction program and protocols to allow the community to identify any concerns or issues.	Construction Decommissioning
Climate change	The use of alternative fuels and power sources for construction machinery and equipment will be considered.	Construction Decommissioning
	Energy efficiency and related carbon emissions will be considered in the selection of vehicles and machinery.	Construction Decommissioning
	Local suppliers will be used to limit transport where practicable.	Construction Decommissioning

6.14 Non-Aboriginal heritage

6.14.1 Methodology

A search of the following heritage registers and databases was carried out on 18 December 2017 to identify any heritage items recorded in the study area, including the following:

- Australian Heritage Database (including the Commonwealth and National Heritage Lists)
- Australian Heritage Places Inventory
- NSW State Heritage Register
- Heritage Schedule 5 of the Wagga Wagga LEP.

6.14.2 Existing environment

History of European settlement

The Wagga Wagga area was first visited by Europeans when the party of explorers led by Charles Sturt travelled through the area in 1829, during their exploration of the Murrumbidgee and Murray Rivers. Settlement followed soon after. Historic settlement in the study area is closely related to the pastoral and agriculture activity that has characterised the region's economy.

The following information has been summarised from the Wagga Wagga City Council Urban Heritage Study (Freeman 2002).

Initial European settlement of the Riverina region and Wagga Wagga area began in the 1830s as pastoral landholders from Sydney began to expand south, first into Goulburn area and by 1836 into the Wagga Wagga area.

During this initial pastoral settlement, major routes between Sydney, Melbourne and Adelaide were established. By the 1840s these routes had become well defined tracks or roads. The route used by the early explorer Sir Thomas Mitchell during his 1836 journey eventually became the Port Phillip Road. This was the main overland route from Sydney to Melbourne and passed through Wagga Wagga.

By the late 1860s, the New South Wales government became aware of the increasing settlement and agricultural production in the Riverina region. The Wagga Wagga area was incorporated into a municipality in 1870 as the population had reached more than 1,200.

Heritage sites

Numerous sites of non-Aboriginal heritage are listed on databases for the Wagga Wagga area. The following non-Aboriginal heritage sites are recorded within two kilometres of the proposal site. All these sites are listed under 'Schedule 5 Environmental heritage' of the Wagga Wagga LEP. Bomen Railway Station is also listed under the State Heritage Register.

- "Bomen Railway Station" (I8/5001442) about 750 metres to the west
- "Bomen Stationmaster's Residence" (I9) about 750 metres to the west
- "Hopevale" (I26) about two kilometres to the west
- "Brucedale Hall and Tennis Courts" (I23) about 1.8 kilometres to the north-west
- "Holy Family Chapel" (I35) about 1.8 kilometres to the northwest
- "Brucedale Public School (former)" (I24) about 1.8 kilometres to the northwest
- "Kurrajong Woolshed and Shearer's Quarters" (I54) located about 1.6 kilometres to the east
- "Hareenyha Slab Shed" (I55) about 1.6 kilometres to the east.

No historic heritage items were observed in the proposal site during the Aboriginal heritage survey.

6.14.3 Potential impacts

Construction and decommissioning

It is unlikely that the proposal would cause any impacts to items of non-Aboriginal heritage, as none are recorded within or adjacent to the proposal site.

In the event any unknown heritage items are identified during the construction or decommissioning phases, safeguards and mitigation measures outlined in section 6.14.4 would be implemented to minimise any impacts.

Operation

The proposal would be unlikely to cause impacts to any non-Aboriginal heritage items during operation as no known items are located on the proposal site.

6.14.4 Safeguards and mitigation measures

Safeguards and mitigation measures provided in Table 6.42 would be implemented to minimise potential non-Aboriginal heritage impacts.

Table 6.42: Non-Aboriginal heritage mitigation measures

Impact	Environmental safeguards	Timing
Unexpected finds	In the event that a site or artefact (as defined by the *Heritage Act 1977*) is identified during construction works, works will cease at the location. The find will be immediately reported to the regulator (OEH Heritage Division) in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator.	Construction Decommissioning

6.15 Waste management

6.15.1 Policy background

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.

6.15.2 Existing environment

The existing site is used for cropping and grazing purposes and does not generate any waste that requires specific management measures. No substantial wastes were observed during site inspections. The only wastes likely to be generated by the site are domestic waste from farm workers and any waste from maintenance of the property (eg redundant equipment or offcuts of fencing wire).

6.15.3 Potential impacts

Construction

Waste would be generated at the proposal site during construction. Where possible, waste would be removed on a daily basis, or as soon as reasonably practical, to maintain the site in a tidy and litter free condition. The proposal has the potential to generate the following wastes:

- surplus materials used during site establishment such as safety fencing and barriers which may include plastics and metal. The volume of waste is expected to be minimal as it is likely that prefabricated structures would be used
- general construction waste such as excess concrete, timber, paper, plastic, metal and packaging materials
- vegetation waste from the clearance of vegetation on site. This is considered to be minimal and generally limited to the removal of isolated paddock trees and potentially planted trees along internal fences
- domestic waste including food scraps, aluminium cans, glass bottles, plastic and paper containers, and putrescible waste generated by site construction personnel
- surplus spoil from earthworks required on site. Any excess spoil is likely to be reused elsewhere on site
- waste from onsite amenities. This waste would be collected by the supplier of any such systems in line with general practices
- wastewater generated from the construction compounds.

All waste would be transported and disposed of in accordance with the 'Waste Classification Guidelines' (EPA 2014) and the *Protection of the Environment Operations Act 1997*. Following construction, a search of the site would ensure that no waste has been left behind.

Operation

During operation, the generation of wastes would be limited to maintenance activities and would include redundant equipment and general waste from maintenance workers. All waste during maintenance activities would be removed from site by appropriately licensed contractors.

Decommissioning

It the proposal is decommissioned (and not upgraded) at the end of its operational life, the entire facility would be removed from site with only some below ground infrastructure to remain. All aspects of the proposal, where possible would be recycled or reused. Any items which cannot be recycled or reused would be disposed of at an appropriately licensed facility.

6.15.4 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.43 would be implemented to minimise potential waste management impacts.

Table 6.43: Waste management mitigation measures

Impact	Environmental safeguards	Timing
General	A waste management plan will be developed for the proposal and will form part of the CEMP. It will include but not be limited to the following:	Construction Operation Decommissioning

Impact	Environmental safeguards	Timing
	• identifying opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy • quantifying and classifying all waste streams • providing for recycling management onsite • providing toilet facilities for on-site workers and management of sewage • 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).	
Wastewater management	Septic tanks will be installed and operated in accordance with Council's requirements.	Construction Operation

6.16 Cumulative impacts

6.16.1 Existing environment

The following information sources were reviewed to identify any other projects likely to contribute to cumulative impacts:

- the major projects register for the Wagga Wagga LGA (reviewed on 12 January 2018)
- Council website
- Roads and Maritime website
- general knowledge of projects in the vicinity of the proposal site.

The following relevant projects in Table 6.44 were identified.

Table 6.44: Other current relevant projects in the Wagga Wagga LGA

Project	Location	Status
Essential Energy Construction of new subtransmission line	On the proposal site	Construction in progress – poles constructed
Renewed Metals Technology – Bomen (Enirgi) Expansion of Battery Resource Recovery Facility	240 metres west of the proposal site	Major project, SEARs issued, EIS in progress
Potential waste management facility at the site of the decommissioned Riverina Wool Combing effluent ponds	Adjacent to the proposal site to the west	Early planning stages
Teys Australia Wagga Wagga Relocation of Retail Ready Meat Products Facility	About 4 km west of the proposal site	Major project, SEARs issued
Gregadoo Solar Development of a 45 MW solar farm and associated infrastructure at Gregadoo	About 16 km south of the proposal site	Major project, SEARs issued

Project	Location	Status
Terrain Solar Wagga Wagga Solar Farm	Immediately east of the transmission line option 2 corridor	Development Application, being assessed by the Southern Joint Regional Planning Panel

The search of the major projects register identified a number of renewable energy electricity generation facilities (wind and solar) currently being considered across the state.

6.16.2 Potential impacts

The proposal may have cumulative impacts during construction with any of the projects listed in Table 6.44, that are near the proposal site and which are constructed at the same time as the proposal.

Cumulative impacts with other projects could result in relation to the environmental factors listed in Table 6.45.

Table 6.45: Potential cumulative environmental impacts

Environmental factor	Potential cumulative impacts
Construction traffic	Construction vehicles used for the proposal may use local roads to access the proposal site at the same time as construction vehicles are used for other projects in the Bomen area. This would contribute to increased local traffic. The expected timing of these developments (pending their approval) is not currently known. However, it is anticipated that the primary traffic impacts of these projects will occur during their construction phases rather than their operational phases, and will be short term in nature. A number of the developments are located a substantial distance from the proposal site. Taking into account the spare capacity of Byrnes Road, and the provision of turning lanes at the intersection with Trahairs Road, it is assessed that the proposal and developments detailed in Table 6.44 would have minor cumulative impacts on the road network.
Air quality	Dust and exhaust fumes from construction activities for projects in the Bomen area may contribute to an overall temporary decrease in air quality in the local area. With the implementation of safeguards and management measures, it is expected the potential air quality impacts during construction would be low and short-term.
Landscape and visual	Cumulative landscape and visual impacts may result from construction of the proposal and the proposed waste management facility. These visual impacts are likely to be consistent with the industrial zoning of the area. Cumulative landscape and visual impacts may also occur in relation to the proposed Wagga Wagga Solar Farm immediately east of the transmission line option 2 corridor. This development would be likely to have the greatest impact for residences in viewpoints 1 and 2 (see section 6.4). Due to the likely low visual impacts of the proposal, and the implementation of screening measures for affected residences, it is unlikely that the proposal would have a significant cumulative visual impact with the proposed Wagga Wagga Solar Farm. Existing remnant vegetation and tree plantings, and proposed additional plantings would aid in minimising visual impacts to surrounding sensitive receivers and local road users.

Environmental factor	Potential cumulative impacts
Biodiversity	The proposal and other projects could result in cumulative impacts relating to removal of paddock trees and planted trees in the Bomen area. These cumulative impacts are unlikely to be substantial, as vegetation removal for this proposal would be within the Wagga Wagga Biodiversity Certification Area and would result in a low loss of habitat and low impacts on biodiversity.
Soil erosion and sedimentation	The proposal could have cumulative impacts in relation to soil erosion and sedimentation with the proposed waste management facility, if construction of both projects occurs concurrently. Provided the necessary safeguards are implemented, it is unlikely that there would be a significant cumulative impact in relation to erosion and sedimentation.
Reduction in greenhouse gas emissions	The proposal and other renewable energy generation projects in the Wagga Wagga area and NSW would have a positive cumulative impact through collectively reducing greenhouse gas emissions in NSW.

6.16.3 Safeguards and mitigation measures

Safeguards and management measures provided in Table 6.46 would be implemented to minimise potential waste management impacts.

Table 6.46: Cumulative impact mitigation measures

Impact	Environmental safeguards	Timing
Cumulative traffic impacts	The construction traffic management plan will consider other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic.	Construction

7. Environmental management

7.1 Environmental management plans

This EIS identifies safeguards and mitigation measures to minimise adverse environmental impacts which could potentially arise as a result of the proposal. These are outlined throughout chapter 6. These management measures would be incorporated into the detailed design and applied during construction, operation and decommissioning of the proposal.

All safeguards and mitigation measures outlined in this document would be managed by implementing a project environmental management plan. The project environmental management plan would manage the impacts of all stages of the proposal and would include the following specific plans:

- construction environmental management plan (CEMP) to address the impacts of the construction phase
- operational environmental management plan (OEMP) to address the impacts of the operational phase
- decommissioning environmental management plan (DEMP) to address the impacts of the decommissioning phase. It is however noted that this plan would be similar to the CEMP as many of the measures to be implemented during this phase are similar to those in the CEMP.

Each of the above plans would be prepared before the commencement of each of the stages and would include but would not be limited to the following:

- roles of specific staff
- reporting requirements
- monitoring requirements
- environmental targets and objectives
- auditing and review timetables
- emergency response requirements
- details of training and inductions required
- complaint response procedures
- adaptive management mechanisms to encourage continuous improvement.

The above plans would also contain sub-plans for specific issues such as a flora and fauna management plan and an erosion and sediment control plan.

7.2 Summary of safeguards and mitigation measures

Environmental safeguards and mitigation measures outlined in this document would be incorporated during construction, operation and decommissioning of the proposal. These safeguards would minimise any potential adverse impacts arising from the proposal on the surrounding environment; including human health and safety. The safeguards and management measures are summarised in Table 7.1.

Table 7.1: Summary of safeguards and mitigation measures

Issue	Impact	Measure	Timing
Aboriginal heritage	Impacts on Aboriginal heritage items	An Aboriginal Cultural Heritage Management Plan would be developed for the proposal. The plan is to be developed in consultation with RAPs, and to the safisfaction of OEH and DP&E. The plan would contain procedures for consultation and involvement of the RAPs in the management of Aboriginal cultural heritage values. The plan would include details of all the below mitigation measures.	Pre-construction
		An archaeological salvage program should be undertaken for the Project prior to the commencement of any ground disturbance works within the proposal site. This would include the following: • surface collection of all impacted open artefact sites • program of archaeological test excavation and potentially open area excavation along the selected transmission line corridor where it is positioned within areas of identified high Aboriginal archaeological sensitivity. A detailed research design to be developed for the components of the salvage program.	Pre-construction
		An Aboriginal cultural heritage awareness training package should be developed for use throughout the life of the Project. This package should be developed in consultation with RAPs and completed prior to the commencement any ground disturbance works within the proposal site. A register of all persons having completed the training package should be maintained throughout the life of the Project. Aboriginal cultural awareness training should be mandatory for all staff and contractors whose roles may reasonably bring them into contact with Aboriginal sites and/or involve consultation with local Aboriginal community members. Training should also be offered on a voluntary basis to all other mine staff and contractors.	Construction
	Salvaged items	All Aboriginal objects salvaged as part of the excavation program should be curated in an appropriate manner, as determined through consultation with RAPs, OEH and DP&I during preparation of the ACHMP. Temporary off-site storage of salvaged objects should be allowed for the purposes of analysis and recording.	Pre-construction

Issue	Impact	Measure	Timing
		Aboriginal Site Impact Recording (ASIR) forms for all salvaged sites should be submitted to OEH at the completion of the salvage program.	Pre-construction
	Protection of items not within impact area	All Aboriginal sites not impacted by the Project but within the proposal site should be conserved in-situ. The potential scarred tree site should be protected via permanent stock-proof fencing and appropriate associated signage. Site fencing is to be erected after consultation with a qualified archaeologist and RAP representatives.	Construction
		All relevant staff and contractors are to be made aware of the nature and locations of all sites as well as Renew Estate's legal obligations with respect to them. Protected sites will need to be identified on all relevant site plans. Details for the care of protected sites should be incorporated into the ACHMP.	Construction
	Identification of potential human remains	In the event that potential human skeletal remains are identified within the study area at any point during the life of the Project, the following standard procedure should be followed. 1. All work in the vicinity of the remains should cease immediately; 2. The location should be cordoned off and the NSW Police notified. 3. If the Police suspect the remains are Aboriginal, they will contact the Office of Environment and Heritage and arrange for a forensic anthropologist or archaeological expert to examine the site. Subsequent management actions will be dependent on the findings of the inspection undertaken under Point 3. • If the remains are identified as modern and human, the area will become a crime scene under the jurisdiction of the NSW Police; • If the remains are identified as pre-contact or historic Aboriginal, OEH and all RAPs are to be formally notified in writing. Where impacts to exposed Aboriginal skeletal remains cannot be avoided an appropriate management mitigation strategy will be developed in consultation with OEH and RAPs; • If the remains are identified as historic non-Aboriginal, the site is to be secured and the NSW Heritage Division contacted; and If the remains are identified as non-human, work can recommence immediately.	Construction

Issue	Impact	Measure	Timing
	Identification of previous unknown item	AHIMS sites cards will be completed and submitted to OEH for all newly recorded sites within the study area at the completion of the assessment. In the event that a previously unidentified Aboriginal site is discovered within the study area at any point during the operational life of the Project, an AHIMS site card for that site should be submitted to OEH as promptly as possible. Timing protocols for the submission of AHIMS site cards should be included in the ACHMP for the Project.	Construction
Biodiversity	Loss of native vegetation and fauna habitat	A flora and fauna management plan will be prepared as part of the CEMP to minimise the ecological impacts of the proposal, which will include: • plans for the construction site and adjoining area showing native vegetation, flora and fauna habitat and threatened ecological communities • plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (including the hollow-bearing tree near the control building and areas of vegetation identified for conservation under the *Wagga Wagga Development Control Plan 2010*) • a landscaping plan showing areas for planting of locally native vegetation to replace vegetation removed by the proposal.	Pre-construction
		Pre-clearing surveys will be undertaken to identify exclusion zones and specific habitat features to be retained (including the hollow-bearing tree next to the southern boundary of the northern solar farm development area and trees identified for protection).	Construction
		Temporary exclusion fencing will be erected to prevent encroachment and clearing of remnant vegetation and protected areas beyond the construction footprint.	Construction
		Staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained.	Construction
		Where practicable, vegetation removal will occur between January and August, outside the main fauna breeding season, to avoid potential breeding disturbance to fauna.	Construction
		If tree removal is required during the breeding season, an ecologist will investigate if any of the hollows are being used for breeding by threatened species such as the Superb Parrot during pre-	Construction

Issue	Impact	Measure	Timing
		clearing surveys. Controls to prevent breeding disruption will be implemented as necessary.	
	Spread of weeds	Priority weed control measures will be implemented as part of the CEMP to prevent their spread in the study area.	Pre-construction
		Declared priority weeds will be managed according to requirements of the NSW *Biosecurity Act 2015*.	Construction Operation
		Soil material and stripped groundcover vegetation with the potential to contain Silverleaf Nightshade will not be removed from the proposal site.	Construction Operation
		Soil disturbance will be avoided as much as possible to minimise the potential for spreading weeds.	Construction Operation
	Disturbance of aquatic habitat	Disturbance of aquatic habitat in dams will be minimised if possible.	Construction
	Loss of hollows	Felled limbs with hollows will be placed in woodland or plantings along the boundary of the development area. The woody debris retained will be spread in a fashion that replicates the natural occurrence of woody debris in the environment and will not be stacked.	Construction
	Impacts to fauna	Fauna handling during vegetation removal will be undertaken by a qualified ecologist or Wildlife Information, Rescue and Education Service (WIRES) representative.	Construction
	Water quality, chemical and fuel impacts on flora and fauna	Any herbicides used for weed control will be applied to the manufacturer's specifications and as outlined in the manufacturer's Material Safety Data Sheet.	Construction
	Pathogen spread and establishment	Vehicle wash down facilities will be provided should evidence of pathogens or fungus such as Phytophthora or Chytrid be found.	Construction
Landscape and visual	Visual impacts of solar farm	A landscape plan (see draft in Figure 3.16) will be further developed to outline the location and type of plantings to assist in minimising impacts on views of the proposal site from nearby properties. The landscape plan will be prepared in consultation with all impacted nearby property owners. The plan will outline the species to be used on site and will use species from native vegetation communities found in the local area. All selected species will be determined in consultation with Riverina Local Land Services, the Rural Fire Service and property owners (where required).	Detailed design
		A review of the landscaping plan will be carried out within two months of operation commencing. This will include	Operation

Issue	Impact	Measure	Timing
		consultation with nearby landowners to discuss requests for further screening.	
	Visual impacts of structures (including glare)	The materials and colour of on-site infrastructure will, where practical, be non-reflective and be of a colour that will blend with the landscape.	Detailed design
		Security fencing posts and wire will be non-reflective.	Detailed design
	Visual impacts during construction	All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and shall be removed from the site following the completion of construction.	Construction Post-construction
		Work sites shall be kept tidy at all times.	Construction Post-construction
Hazards and risk	Vehicle interactions	Prepare a construction traffic management plan including standard traffic rules and signage	Pre-construction
		Implement site speed limits	Construction
		Provide designated pedestrian areas	Operation
		Ensure driver competency	Decommissioning
	Natural hazards and external fire (adjacent to site)	A bushfire management plan will be prepared in consultation with the Rural Fire Service. This plan will include but not limited to the following: • management of activities with a risk of fire ignition • management of fuel loads on site • storage and maintenance of firefighting equipment including siting and provision of adequate water supplies (see section 3.2.11) • the below requirements of 'Planning for Bush Fire Protection 2006' (RFS 2006): – identifying asset protection zones (see section 3.2.11) – providing adequate egress/access to the site (see section 3.2.11) – emergency evacuation measures • operational procedures relating to mitigation and suppression of bush fire relevant to the operation of a solar farm	Pre-construction
		Design buildings and structures to appropriate codes and standards	Pre-construction
		Manage fuel for vehicles and machinery on site to appropriate standards	Construction Operation Decommissioning
		Provide fire protection systems	
	Loss of containment and contact with chemicals, including dangerous goods	Store chemicals in line with appropriate standards	Construction Operation Decommissioning

Issue	Impact	Measure	Timing
		Implement a regular inspection and maintenance regime for chemical storage areas	
		Implement standard handling procedures	
		Provide a Safe Work Method Statement detailing methods for handling chemicals	
		Provide spill kits to be used in the event of an incident involving release of chemicals	
		Implement standard transfer and handling procedures	
		Provide a Safe Work Method Statement detailing methods for handling chemicals	
		Provide personal protective equipment (PPE) to all staff	
	Fall from heights	Implement working at heights procedures	Construction Operation Decommissioning
		Ensure all staff working at heights have completed the necessary training	
		Use fall prevention equipment	
	Contact with electricity	Implement isolation procedures	Construction Operation Decommissioning
		Install fit for purpose electrical systems	Construction
		Follow underground utility identification protocols, including Dial Before You Dig	Construction Decommissioning
	Mechanical or chemical damage of lithium-ion battery assemblies	Ensure batteries are Quality Assured	Construction Operation
		Install bollards/protective barriers around key battery areas	Construction
		Batteries will be stored as per suppliers specifications	Construction Operation
		The battery system will be containerised and bunded	Construction
		Implement a regular inspection and maintenance regime for the battery assemblies	Operation
	Overheating of lithium batteries	Provide ventilation systems in cabinets	Construction
		Batteries will be stored as per suppliers specifications	Construction Operation
		Provide insulation around batteries.	Construction Operation
Noise and vibration	Construction noise	A noise management plan will be prepared and implemented as part of the CEMP.	Pre-construction Construction
		All engine covers will be kept closed while equipment is operating.	Construction
		As far as possible, heights from which materials are dropped, into or out of trucks, will be minimised.	Construction
		Machines found to produce excessive noise compared to industry best practice will be removed from the site or stood down until repairs or modifications can be made.	Construction
		To reduce the annoyance associated with reversing alarms, broadband reversing	Construction

Issue	Impact	Measure	Timing
		alarms (audible movement alarms) will be used for all site equipment. Satisfactory compliance with occupational health and safety requirements will need to be achieved and a safety risk assessment may need to be undertaken to determine that safety is not compromised. Refer to Appendix C of the ICNG (2009) for more information.	
		Piling works and works to construct the transmission line will not occur during evening/night periods.	Construction
		Apart from works involving installing trackers and modules, all works in evening/night periods will be limited to the central work area (see Figure 1.2).	Construction
		Works involving installing trackers and modules during evening/night periods will not occur in the area between the southern boundary of the solar farm and 250 metres north of the southern boundary. This provides a 700 metre buffer from the residential receiver at R8 and will reduce the noise level to within the noise management level of 35 dBA.	Construction
		During night-works, quiet forklifts (electric – sound power level <100 dBA) will be used for construction activities around the solar array areas.	Construction
		All site workers will be briefed on the potential for noise impacts on local residents and the requirement to implement practical and reasonable measures to minimise noise impacts during the course of their activities. This will include: • avoiding the use of loud radios • avoiding shouting and slamming doors • where practical, machines would be operated at low speed or power and switched off when not being used rather than left idling for prolonged periods • keeping truck drivers informed of designated vehicle routes, parking locations and delivery hours • minimising reversing • avoiding dropping materials from height and avoiding metal to metal contact on material • keeping engine covers closed while equipment is operating.	Construction
		Once the selection of equipment has been finalised, a review will be carried out to ensure that the noise levels do not exceed the assumed levels in the noise assessment in Appendix F.	Construction

Issue	Impact	Measure	Timing
	Community impacts	Consultation and cooperation with the nearest sensitive receivers will assist in minimising uncertainty, misconceptions and adverse reactions to noise. The following community relation measures will be implemented: • regular communication will be maintained with the residents affected by construction noise. The construction program and progress will be communicated on a regular basis, particularly when noise generating activities are planned. Communication with the local community will be maintained throughout the construction period • a community liaison phone number and details of permanent site contact will be provided so that noise complaints can be received and addressed in a timely manner. • upon receipt of a noise complaint, monitoring will be undertaken and reported as soon as possible. If exceedances are detected, the situation will be reviewed to identify means to attempt to reduce the impact to acceptable levels.	Pre- construction Construction
Land use	Impacts to utilities	Renew Estate will consult with relevant service providers to confirm measures to be implemented to minimise impacts to existing utilities in the proposal site.	Detailed design Construction
	Biosecurity general	Establish a vehicle high pressure wash down facility well away from livestock and crops to clean vehicles, boots and equipment which need to enter the property.	Construction Decommissioning
	Biosecurity risk - people	Limit worker contact with livestock, crops or plant materials as much as possible and eliminate any unnecessary contact altogether.	Construction Operation Decommissioning
		Keep a visitor register.	Construction Decommissioning
	Biosecurity risk - vehicles	Clearly sign and lock restricted access areas.	Construction Operation Decommissioning
		Ensure construction vehicles are clean and are parked in a designated area away from livestock or crops.	Construction Decommissioning
		Ensure construction vehicles remain on designated tracks.	
	Biosecurity risk - equipment	Clean machinery and equipment from the top down and dismantle where practicable to gain access to internal spaces.	Construction Decommissioning
		Grazing within the site to be considered to minimise impacts of loss of land and also	Operation

Issue	Impact	Measure	Timing
	Impacts to land capability	to manage groundcover vegetation within the proposal site.	
		Rehabilitation of the site following decommissioning works will be carried out to ensure that the land can be used for agricultural purposes (cropping and grazing).	Post-decommissioning
Traffic, transport and access	Traffic impacts during construction	A detailed construction traffic management plan will be prepared and approved by Council before construction. The plan will include appropriate traffic control plans and will include detail in relation to: • traffic control measures in works areas • appropriate entry/exit points for the proposed compound areas • advising motorists of the change in traffic conditions associated with the work.	Pre-construction
		Appropriate exclusion barriers, signage and site supervision are to be employed at all times to ensure that the works area is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.	Construction Decommissioning
		All traffic control devices are to be in accordance with AS 1742.3-2009 – 'Manual of uniform traffic control Devices: Traffic control for works on roads' and the Roads and Maritime Services 'Traffic control at worksites manual'.	Construction Decommissioning
		A condition assessment of Trahairs Road will be conducted before and after construction.	Construction Decommissioning
Hydrology and water quality	General	An erosion and sediment control plan (ESCP) will be prepared as part of the CEMP. All erosion and sediment control measures shall be designed, implemented and maintained in accordance with relevant sections of 'Managing Urban Stormwater: Soil and Construction Volume 1' (Landcom 2004) ('the Blue Book) (particularly section 2.2) and 'Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services' (DECC 2008). The ESCP will include stockpiles, stormwater runoff, trees, site boundaries, site access and storage areas.	Construction
		The Department of Primary Industries – Water controlled activity guidelines will be considered as part of the detailed design of the proposal.	Detailed design
	Rehabilitation	Rehabilitation works are to commence as soon as practicable to stabilise the land surface after works are completed in any area.	Construction

Issue	Impact	Measure	Timing
	Increased run-off	Groundcover vegetation would be maintained beneath the solar arrays during operation, to minimise potential for increased run-off.	Construction and operation
		A groundcover management plan would be developed that includes measures to manage any bare areas and erosion that develop beneath the solar arrays.	Operation
	Contamination of surface water	All fuels, chemicals, and liquids will be stored at least 50 metres away from waterways and will be stored in an impervious bunded area within the compound site.	Construction
		The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas in the compound site.	Construction
		Vehicle wash downs and/or concrete truck washouts will be carried out within a designated bunded area on an impervious surface or carried out off-site.	Construction
		Machinery will be regularly checked to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills	Construction
	Spills and leaks	A site specific emergency spill plan will be developed, and will include spill management measures in accordance relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Construction
		An emergency spill kit will be kept on site at all times. All staff will be made aware of the location of the spill kit and trained in its use.	Construction
	Groundwater monitoring bores	Registered groundwater monitoring bores in and around the proposal site will be identified, located and protected during construction and operation as necessary. Any removal of groundwater monitoring bores will be carried out in consultation the DPI Office of Water.	Construction Operation
Electric and magnetic fields	EMF	Design and selection of all electrical equipment is to minimise EMF levels and comply with the ICNIRP exposure levels.	Construction
		Monitoring of electromagnetic levels would be undertaken during the commissioning of the substation to confirm exposure levels. Should levels be above the ICNIRP exposure levels the potential need for further mitigation would be considered.	Commissioning

Issue	Impact	Measure	Timing
Soils and geology	Soil impacts	The erosion and sediment control plan developed as part of the CEMP will include measures to manage any potential soil erosion issues identified by a geotechnical study in relation to the characteristics of soils at the site.	Pre-construction
	Contamination	The CEMP will contain an unexpected finds protocol for land contamination that directs workers to cease work and implement pre-determined procedures before further works proceed, including reporting of the potential find to the Council as the applicable pollution control authority.	Pre-construction
	Soil impacts	Erosion and sediment control measures would be in place during the entire construction period and during any required rehabilitation.	Construction
		Activities with a risk of soil erosion such as earthworks will not be undertaken immediately before or during high rainfall or wind events.	Construction
		Where possible, groundcover on site would be retained particularly in the areas of the solar arrays where disturbance would be limited to the installation of the poles for the mounting structure.	Construction
		Any disturbed areas (with no existing groundcover) would be stabilised promptly and progressively during and following the end of construction.	Construction
		Groundcover vegetation would be established and maintained beneath the solar arrays as much as possible before and during construction, to minimise areas exposed to erosion.	Construction
		A groundcover management plan would be developed that includes measures to manage any bare areas and erosion that develop beneath the solar arrays.	Operation
Socio-economic	Community consultation	A community and stakeholder consultation plan will be implemented to manage the concerns of stakeholders and any impacts on adjacent property owners. The plan will include (but not be limited to) the following: • protocols to keep the community and stakeholders updated about the progress of the project and its benefits • protocols to inform relevant stakeholders of potential impacts of construction activities such as changes to traffic conditions and night works protocols to allow the community to identify any concerns or issues with the project, particularly during construction and decommissioning.	Construction Decommissioning

Issue	Impact	Measure	Timing
Air quality	General air quality impacts	The CEMP will include measures to minimise impacts on air quality including: • a map identifying locations of sensitive receivers • identification of potential risks/impacts through dust generation activities • management measures to minimise risk including progressive stabilisation • a process for altering management measures as required a process for reviewing and updating the plan before decommissioning works start.	Pre-construction
	Dust emissions	Surveillance for visible dust generation will occur at all times.	Construction Decommissioning
		Works that disturb vegetation, soil or stockpiles will not be carried out during strong winds (over 40 km/h) when this may affect receivers (visibility on roads, dust and debris near residences).	Construction Decommissioning
		Stockpiled materials will be covered, stabilised or stored in areas not subject to high wind.	Construction Decommissioning
		All trucks will be covered when transporting loose materials to and from the site.	Construction Decommissioning
		Work activities will be reprogrammed if the safeguards and management measures implemented do not adequately restrict dust generation.	Construction Decommissioning
		Maximum speed limits will be enforced for construction traffic within the site to limit dust generation.	Construction Decommissioning
		A water tanker or similar will be used to spray unpaved roads and exposed areas during construction where required.	Construction Decommissioning
	Exhaust emissions	Construction machinery and equipment will be maintained in good working condition to limit impacts on air quality.	Construction Decommissioning
		Construction equipment, machinery and vehicles will be appropriately sized for the task.	Construction Decommissioning
		Machinery and equipment will be serviced regularly to ensure it is operating efficiently.	Construction Decommissioning
	Impacts on sensitive receivers	A community and stakeholder consultation plan will be implemented to manage the concerns of stakeholders and any impacts on adjacent property owners. The plan will include protocols for informing adjacent property owners of the construction program and protocols to allow the community to identify any concerns or issues.	Construction Decommissioning

Issue	Impact	Measure	Timing
	Climate change	The use of alternative fuels and power sources for construction machinery and equipment will be considered.	Construction Decommissioning
		Energy efficiency and related carbon emissions will be considered in the selection of vehicles and machinery.	Construction Decommissioning
		Local suppliers will be used to limit transport where practicable.	Construction Decommissioning
Non-Aboriginal heritage	Unexpected finds	In the event that a site or artefact (as defined by the *Heritage Act 1977*) is identified during construction works, works will cease at the location. The find will be immediately reported to the regulator (OEH Heritage Division) in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator.	Construction Decommissioning
Waste management	General	A waste management plan will be developed for the proposal and will form part of the CEMP. It will include but not be limited to the following: • identifying opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy • quantifying and classifying all waste streams • providing for recycling management onsite • providing toilet facilities for on-site workers and management of sewage • 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).	Construction Operation Decommissioning
	Wastewater management	Septic tanks will be installed and operated in accordance with Council's requirements.	Construction Operation
Cumulative impacts	Cumulative traffic impacts	The construction traffic management plan will consider other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic.	Construction

8. Conclusion

The proposal is considered to be justified, as described in chapter 2.

This EIS has been prepared to assess the potential environmental impacts of Renew Estate's proposal to construct, operate and decommission a solar farm about seven kilometres north-east of the Wagga Wagga CBD on the eastern side of Byrnes Road. The proposal requires development consent from the Minister for Planning under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This EIS has been prepared to address the SEARs and support the development application.

The proposal involves constructing, operating and eventually decommissioning a 120 megawatt (MWdc) solar farm. The proposal consists of about 400,000 photovoltaic solar modules and ancillary infrastructure including but not limited to internal electrical infrastructure, a transmission line, control building, minor upgrade of the unsealed section of Trahairs Road, new internal all-weather access tracks, a car park, fencing and landscaping. The proposal also includes subdivision of four lots to allow the purchase of the required land for the proposal site. The site layout and technology to be used would be determined during detailed design once a contractor has been appointed by Renew Estate.

The proposed solar arrays and associated components are expected to operate for about 30 years. At the end of its operational life, the solar farm would be decommissioned. Decommissioning would involve removing all above ground infrastructure and rehabilitating the site to allow it to be used for other purposes.

This EIS has assessed the potential impacts and concludes that the proposal is unlikely to result in any significant environmental impacts provided the recommended safeguards and mitigation measures are implemented. The proposal site has been modified by previous land uses, which have cleared most remnant vegetation from the site. The proposal has been designed to minimise the need to clear native vegetation. The proposal would contribute to NSW and Commonwealth government commitments to increase the proportion of electricity that is generated by renewable energy technologies.

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10. Glossary and abbreviations

Term / Acronym	Description
ABS	Australian Bureau of Statistics
ac, AC	Alternating current – voltage switches polarity or electric current switches direction back and forth
AHIMS	Aboriginal Heritage Information Management System
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BC Act	NSW *Biodiversity Conservation Act 2016*
Biota	The flora and fauna of a region
CEMP	Construction environmental management plan
Construction environmental management plan	A site or proposal specific plan developed to ensure that appropriate environmental management practices are followed during the construction and/or operation of a proposal.
Cumulative impact	An impact created by accumulation or successive additions of individual impacts, which may not themselves be substantial.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies
dbh	Diameter at breast height
dc, DC	Direct current – electric current flows in a constant direction
DECC	Department of Environment and Climate Change, now OEH (see below)
DECCW	NSW Department of Environment, Climate Change and Water, now OEH (see below)
Decibel [dB]	The units that sound is measured in.
'Do nothing' option	This assumes that the proposed construction and operation of the Bomen Solar Farm does not go ahead.
DoP	NSW Department of Planning, now Department of Planning and Environment
DotEE	Australian Department of the Environment and Energy
Earthworks	All operations involved in loosening, removing, depositing, shaping and compacting soil or rock
DPI	NSW Department of Primary Industries
Ecologically sustainable development	Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
EIS	Environmental Impact Statement
Environment	The environment incorporates physical, biological, heritage, cultural, economic and social aspects.
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
FM Act	*Fisheries Management Act 1994*
GHD	GHD Pty Ltd
GW	Gigawatt
GWh	Gigawatt hours
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
kL	Kilolitre

Term / Acronym	Description
km/h	Kilometres per hour
kV	Kilovolt
kW	Kilowatt
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
LALC	Local Aboriginal Land Council
Land use	The type of development existing or permitted in an area whether it be industrial, commercial, residential, recreational or a combination of some or all of these different uses.
LEP	Local Environmental Plan
LGA	Local government area
Likely	Taken to be a real chance or possibility.
Locality	The area within a 10 kilometre radius of the proposal.
Lot	A part (consisting of one or more pieces) of any land (except a road, a reserve, or common property) shown on a plan, which can be disposed of separately and includes a unit or accessory unit on a registered plan of strata subdivision and a lot or accessory lot on a registered cluster plan.
mm	Millimetre
ML	Megalitre
MV	Megavolt
MVA	Megavolt ampere
MW	Megawatt
NEM	National Electricity Market
NHMRC	National Health and Medical Research Council
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*
Proposal	The proposed construction, operation and decommissioning of the Bomen Solar Farm.
Proposal site	The area required for the construction of the proposal, including construction activities and construction vehicle access. It includes the construction footprint, site compound, stockpile sites, temporary sediment basins and any areas that would be disturbed.
PV	Photovoltaic
Rating background level	The overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).
Receiver	Any person, as well as a residence, business or facility, with the potential to be affected by an environmental impact (eg noise or air quality).
Road reserve	A road reserve is a legally described area within which facilities such as roads, footpaths, and associated features may be constructed for public travel. It is the total area between boundaries shown on a cadastral plan.
ROBE	Riverina Oils and Bio Energy
RTA	NSW Roads and Traffic Authority. The RTA now forms part of Roads and Maritime Services.
SCADA	Supervisory control and data acquisition
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy

Term / Acronym	Description
Study area	The area identified for assessing the potential impacts of the proposal relating to a specific discipline. Generally the investigation area is defined as the area of impact and any additional areas that are likely to be affected by the proposal, either directly or indirectly.
Threatened species	A species specified in Schedule 1 of the BC Act, or listed under the EPBC Act.
Unlikely	Taken to be an unlikely or remote possibility of occurring.
µm	Micrometre
µT	Microtesla
V	Volt
V/m	Volts per metre
Wagga Wagga LEP	*Wagga Wagga Local Environment Plan 2010*

11. Information about this report

11.1 Scope and limitations

This report has been prepared by GHD for Renew Estate Pty Ltd and may only be used and relied on by Renew Estate Pty Ltd for the purpose agreed between GHD and the Renew Estate Pty Ltd as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Renew Estate Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 11.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Renew Estate Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

11.2 Assumptions

The services undertaken by GHD in connection with preparing this EIS:

- assume that the construction footprint of the proposal will be as presented in this report
- assume that all safeguards and mitigation measures will be implemented as detailed in this report.

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