ENVIRONMENTAL IMPACT STATEMENT

YARREN HUT SOLAR FARM

AUGUST 2020

Project Number: 19-754

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Certification

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

EIS prepared by: NGH Pty Ltd

Applicant: BayWa r.e. Projects Australia Pty Ltd

Proposed development:

The Yarren Hut Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce up to 28 Megawatts (MW) of alternating current (AC) electricity. Associated infrastructure includes a substation, staff amenities, internal access tracks and fencing.

Land to be developed:

Lot 21 DP 704061

Certification:

I certify that I have prepared the contents of this Environmental Impact Statement in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulations 2000.* To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the project and that information is neither false nor misleading.

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Signature:	
Date:	03 August 2020

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TABLES

FIGURES

TERMS AND DEFINITIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AC	Alternating current
ACHAR	Aboriginal Cultural Heritage Assessment Report
ADG Code	Australian Dangerous Goods Code
adt	Average daily traffic
AEMO	Australian Energy Market Operator
AEP	Annual exceedance probability
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AoS	Assessments of Significance
APZ	Asset protection zone
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BAM	Biodiversity Assessment Methodology
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
BCC	Biobanking Credit Calculator
BCD	Biodiversity and Conservation Division (formerly OEH)
BDAR	Biodiversity Development Assessment Report
BoM	Australian Bureau of Meteorology
BOS	Biodiversity Offsets Scheme
Bogan LEP	Bogan Local Environmental Plan 2011
BLM	Bureau of Land Management
BSAL	Biophysical Strategic Agricultural Land
CCTV	Closed Circuit Television
CEMP	Construction Environmental Management Plan
CET	Clean energy target
CHMP	Cultural Heritage Management Plan
CIP	Community Investment Program
CIV	Capital investment value
CO2	Carbon dioxide
Conveyancing Act	*Conveyancing Act 1919*
CSEP	Community and Stakeholder Engagement Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
DAWE	Department of Agriculture, Water and Environment (formerly DEE)
dB	Decibels
dB(A)	A measure of A-weighted *(c.f.)* sound levels.
DCP	Development Control Plan
DECC	Department of Climate Change (now BCD)

DECCW	Department of Climate Change and Water (now BCD)
DEE	Department of Environmental Energy (now DAWE)
DOEE	Department of the Environment and Energy (Commonwealth)
DPE	Department of Planning and Environment (now DPIE)
DPIE	Department of Planning, Industry and Environment (DPIE)
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPIs	Environmental Planning Instruments
EPL	Environment Protection Licence issued under the POEO Act *(c.f.)*
ESD	Ecologically sustainable development
ESCP	Erosion and Sediment Control Plan
FM Act	*Fisheries Management Act 1994*
FMERP	Fire Management and Emergency Response Plan
FTE	Full time equivalent
GA	Geoscience Australia
GDE	Groundwater dependant ecosystem
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	Hectares
Heritage Act	*Heritage Act 1977* (NSW)
HAZMAT	Hazardous Materials
Hz	Hertz
IAP2	International Association for Public Participation
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
kL	Kilolitres
km	Kilometres
kV	Kilovolts
L_{A90} (15 minutes)	The A-weighted sound pressure level that is exceeded for 90% of a 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.

L_{Aeq} (15 minutes)	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period that excludes other noise sources such as from industry, road, rail and the community.
LALC	Local Aboriginal Land Council
LCA	Lifecycle analysis
LCU	Landscape character unit
LEP	Local Environment Plan
LGA	Local government area
LMZ	Landscape management zone
LRET	Large-scale Renewable Energy Target
LSC	Land and Soil Capability scheme
LUCRA	Land Use Conflict Risk Assessment
m	Metres
mm	Millimetres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory renewable energy target
MVA	Megavolt-ampere
MW	Megawatt
MWh	Megawatt hours
NEM	National Electricity Market
NML	Noise management levels
NPI	*NSW Noise Policy for Industry*
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, now BCD
PCT	Plant Community Type
PHA	Preliminary hazard analysis
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PPAs	Power Purchase Agreements
PPRD	Primary Production and Rural Development
PMF	Probable maximum flood
PV	Photovoltaic
PVHI	Photovoltaic heat island
RAPs	Registered Aboriginal Parties
RDMP	Rehabilitation and Decommissioning Management Plan
REF	Review of Environmental Factors
RET	Renewable Energy Target
RBL	Rating background level - the level of background noise
RDA	Regional Development Australia
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
REAP	Renewable Energy Action Plan (NSW)

RFS	NSW Rural Fire Service
RNP	NSW *Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
SEARs	Secretary's Environmental Assessment Requirements
Sensitive receiver	A place or object that is sensitive to a particular environmental impact. e.g. school, place of worship, residence, heritage building/structure, pipeline (for vibration/blasting). These may be separately defined by government and industry policies and guidelines
SEPP	State Environmental Planning Policy (NSW)
Sound pressure level	The noise at a given distance from plant or equipment
SoE	Statement of Evidence
sp/spp	Species/multiple species
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State significant development
TfNSW	Transport for NSW
TIA	Traffic Impact Assessment
UFP	Unexpected Finds Protocol
µT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
Vpd	Vehicles per day
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WMP	Waste Management Plan
ZVI	Zone of visual influence
The proposal	The construction and operation of the proposed solar farm
The proponent	BayWa r.e. Projects Australia Pty Ltd
Subject land	All land within the affected lot boundaries. The subject land comprises Lot 21 DP 704061, approximately 1205 ha.
Development site	The area of land that is subject to the proposal. The development site is made up of 92 ha and includes the existing Essential Energy transmission line that runs within the eastern side of the subject land. The development site is the area surveyed for this assessment prior to identified constraints and exclusions.
Development footprint	The area of land that is directly impacted by the proposal including solar array design, perimeter fence, access roads, transmission line footprint and areas used to store construction materials. The development footprint is approximately 92 ha.

EXECUTIVE SUMMARY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *A stand-alone executive summary.*

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction and operation of a proposed 28 Megawatt (MW) alternating current (AC) photovoltaic (PV) solar farm at Nyngan, NSW. The 1205 hectare (ha) subject land is located on freehold rural land approximately 17 kilometres (km) northwest of Nyngan in the Bogan Shire Local Government Area. The development site is approximately 92 ha.

NGH Pty Ltd (NGH) has prepared the EIS on behalf of the proponent, BayWa r.e. Projects Australia Pty Ltd (BayWa r.e.). The EIS has been prepared in accordance with Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). It is considered State Significant Development (SSD). The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs) provided by NSW Department of Planning, Industry and Environment (DPIE) on 6 February 2020.

COMMUNITY FOCUS

Community engagement is an essential part of the EIS process, required by consent authorities to ensure neighbours and the wider community are adequately informed of proposed plans and have sufficient and timely opportunity to provide input into aspects of the project that have the potential to impact their amenity or contribute to their specific interests.

To date, community engagement for the proposed Yarren Hut Solar Farm (the 'proposal') has primarily sought to 'provide meaningful avenues for BayWa r.e. to involve community stakeholders in the development of key aspects of the project' and 'manage, minimise and mitigate any impacts to community stakeholders to the maximum extent possible'. Due to the scale of the proposal, small compared to other solar farms in the region, and its location away from residential receivers, BayWa r.e. has received no objections or concerns from members of the public over the proposal.

BayWa r.e.'s goal is to generate community acceptance and trust for the Yarren Hut Solar Farm – ensuring sustainable social and economic performance over the lifetime of the asset.

PROPOSAL DESCRIPTION

The proposed Yarren Hut Solar Farm would have a total export capacity of up to 28 MW (AC), and would include:

- Single-axis tracker (or fixed) photovoltaic solar panels mounted on steel frames (approximately 84,000 PV solar panels).
- Underground electrical conduits and cabling to connect the arrays and the inverters and transformers.
- Inverters, transformers and electrical conduits.
- Onsite substation / switching station.
- 66 kV electrical sub-transmission line to connect the proposal to the existing Essential Energy transmission line.
- Site office, site compound, vehicle parking areas, access tracks and perimeter fencing.
- Site access from Mitchell Highway.

The development site would be accessed from a private access track directly from Mitchell Highway approximately 17 km northwest of the Nyngan townsite. Mitchell Highway is an arterial road managed and maintained by Transport for NSW (TfNSW).

The proposal would require subdivision of land, as only part of this property will be leased for the life of the proposal. It would involve the subdivision of Lot 21 DP 704061 into three separate lots including the 92 ha leased area for the proposal and small lot for a substation / switching station and connection to the existing 66 kV Nyngan to Bourke sub-transmission line. The remainder of the land comprising Lot 21 DP 704061 would be retained by the landholder.

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

The proposal is expected to operate for 50 years. The construction phase of the proposal is planned to commence in the third quarter 2021 and would last approximately 10 months. During the operating period, infrastructure maintenance would occur as required to ensure the efficient operation of the plant. Upon decommissioning, all above-ground infrastructure would be removed, and the site returned to its existing land capability, in consultation with the landowner.

PROJECT NEED

Human activity is resulting in the release of large amounts of greenhouse gasses (GHGs) which trap the sun's heat in our atmosphere and upset the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the United Nations Paris Agreement on Climate Change (DEE 2019). Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE 2019). Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia (DEE 2019). Once constructed, the proposal would provide around 76,000 megawatt hours (MWh) per year of GHG emission-free electricity. This represents the annual power consumption of about 9,000 homes. Generation figures may change subject to final site design and technology selection. The proposal would save about 61,000 tonnes of GHG emissions per year.

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

PROJECT BENEFIT

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 40 employees for the 5-month peak of construction and one or two FTE operational staff for the life of the project. These workers would be sourced from Nyngan as the nearest townsite where practicable. Maintenance contracts for panel cleaning, fence repair, road grading, etc. would also be required and would likely be met by local contractors.
- Direct business volume benefits for local services, materials and contracting (e.g. accommodation, food and other retail).
- Increased economic security to rural economies through diversification of employment opportunities and income streams.

It is estimated that the solar farm would require around $1.1 million per year of operational spending to maintain. This would mostly be spent on wages, local contractors, and materials.

To minimise the environmental costs of achieving the above benefits, in the first instance the development site was chosen primarily because it has very few environmental constraints. The proposal would also be designed to:

- Preserve biodiversity features through minimising native vegetation removal.
- Minimise impacts on items of Aboriginal significance.
- Minimise impacts on soil and water resources by using pile driven panel mounts rather than extensive soil disturbance and excavation.
- Retain existing site topography.
- Minimise visual impacts form public viewpoints, incorporating vegetation screening.
- Retain agricultural grazing value through managed stock grazing during operation.
- Preserve future agricultural production values, being highly reversible at the end of the project's life.

SITE SUITABILITY

The proposal would help reduce Australia's GHG emissions and help meet future energy demands. It would contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. It would contribute to economic development in Nyngan and the surrounding region.

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

- Minimal impacts on biodiversity are expected due to historical disturbance and agricultural activities.
- There would be no land use conflicts due to zoning.
- Minimal visual impact on neighbours with no dwellings within 3 km of the development site (the closest dwelling is 5 km from the site).
- The proposal is not located on Strategic Agricultural Land and according to the *Land and Soil Capability Scheme* (OEH, 2012) is located on Class 4 agricultural land:
    - The proposal is not expected to adversely affect the biophysical nature of the land.
    - The proposal would positively affect soils by providing many of the benefits of long-term fallow, including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving soil biota.
    - The proposal would not result in the permanent removal of agricultural land.
    - The proposal would not result in rural fragmentation given it will not permanently alter the existing or surrounding environment.
    - Adjacent farming operations are compatible.
    - Strategic sheep grazing would be used within the development site. Grazing would be used to reduce vegetation biomass and put grazing pressure on weeds in and around the solar farm.
- Flood modelling has been undertaken for the development site and indicates that flood risk would not be exacerbated onsite or on adjoining properties.
- The development site is mapped as Vegetation Category 3 Bushfire Prone Land. Detailed management measures would be put in place in accordance with statutory requirements.
- Two mining exploration licences cover the development site. The proponent contacted the owners of the exploration licences and has received no correspondence from them about the proposal.
- The proposal is not located on Crown land with the freehold lot belonging to private landholders.

KEY ENVIRONMENTAL ASSESSMENT ISSUES

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

- Visual amenity and landscape character.
- Land use impacts.
- Socioeconomic and community.
- Noise impacts.
- Traffic, transport and road safety.
- Water use, quality and hydrology
- Biodiversity.
- Aboriginal heritage.

Visual amenity and landscape character

No residential dwellings are located within 5 km of the development site. Four Landscape Character Units (LCU) were identified:

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

The operational visual impact assessment was undertaken considering:

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

NGH completed a Visual Impact Assessment (VIA). This involved detailed assessment of the potential impacts on near neighbours with views of the development site. Representative viewpoints of public local roads were also assessed. Mitigation options were then explored resulting in vegetation screening on the eastern and northern border of the development site facing Mitchell Highway.

The potential for glare from the type of solar panels used is limited. Solar panels are designed to absorb sun light, not reflect it and have an antireflective coating, whilst galvanised framing oxidises and becomes dull over time reducing the likelihood of creating glare or reflectivity to motorists or aircraft.

The operational view of the solar farm may generate visual impact being in direct contrast with the surrounding agricultural views. However, adverse visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape. No residential dwellings would be impacted by the proposal.

Land use and resources

The current land use of the development site is for agriculture. The site is not mapped as being Biophysical Strategic Agricultural Land (BSAL).

The proposal is not located on Strategic Agricultural Land, including industry clusters and biophysical strategic agricultural land. The proposal is located on Soil Capability Class 4 land. The site has suitable soil type to sustain the level and type of infrastructure proposed and not considered Biophysical

Strategic Agricultural Land (BSAL) as detailed further in section 5.2.5 on land capability. The existing 100 MW Nyngan Solar Farm is located approximately 9 km south of the proposal

The Land and Soil Capability Scheme (OEH 2012) defines Class 4 land as having "moderate to severe limitations where pasture improvement relies on minimum tillage techniques. While productivity of Class 4 land may be seasonally high, the overall result tends to be low due to major environmental constraints.

The development site is zoned RU1 for primary production. The land surrounding the development site is also RU1. Surrounding agricultural land consists of cropping and grazing activities. Thorndale State Forest is six km south west of the site.

There are two mineral exploration titles over the development site. BayWa r.e. have contacted the owners on both exploration licences and has received no objection.

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

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

Socioeconomic and community

The Bogan Shire Community Strategic Plan 2027 (Bogan Shire, 2017) identifies the community's main priorities and aspirations for the future. It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with reference to supporting economic development.

Extensive community engagement has occurred to date including:

- Upfront discussions with the DPIE and Bogan Shire to introduce them to the proposal, as well as to determine project-specific considerations that need to be accounted for.
- Letters were sent to both owners of relevant exploration licences over the subject land informing them of the project on 11 December 2019 (Appendix D).
- Advertisement for Registered Aboriginal Parties (RAPs) to participate in Aboriginal heritage assessment of the development site, published 4 December 2019.
- Face-to-face meetings with direct neighbours have been deemed unnecessary at the scoping phase due to the absence of residential dwellings within a 5 km radius of the development site. The Nyngan community (including near neighbours) has however been informed about the proposal and the community engagement process via flyer distributed by Australia Post (Appendix A.1).
- Nyngan residents were invited to attend an open public meeting about the proposal on 2 December 2019. This meeting was advertised via the flyer and the Nyngan Observer, published 21 November 2019.
- Establishment of a website for the proposal (https://yarrenhutsolarfarm.com.au/application/) on which key project information can be found.
- Ongoing consultation opportunities in the form of phone calls, feedback forms, e-mails, and a post-assessment newsletter.

The ongoing community and stakeholder engagement for the proposal aims to ensure that there is effective, ongoing liaison with the community as the proposal progresses. Measures to reduce adverse impacts and promote positive impacts have been identified in the EIS and appropriate management plans committed to, pending project approval.

Positive impacts of the proposal include the generation of around 40 full time equivalent jobs during construction plus indirect supply chain jobs. In addition, it would employ approximately one or two full

time equivalent staff during the operation and maintenance phase (expected to be 50 years). The employment benefits for construction extend through the local supply chains to fuel supply, vehicle servicing, uniform suppliers, hotels/motels, bed and breakfasts, cafés, pubs, catering and cleaning companies, tradespersons, tool and equipment suppliers and many other businesses in and around Nyngan.

Generally, the development site selected has few socio-economic constraints. The most likely adverse impact would be an increase in traffic movements along Mitchell Highway during construction. This potential impact has been minimised and mitigated by committing to adopting shuttle buses to transport workers to and from the development site.

Noise impacts

Construction activities would occur at several locations across the development site simultaneously. Modelling was carried out using a worst case scenario (it does not take into consideration natural buffers within the landscape, such as screening, topography or existing background noise). Noise emissions were modelled for the following separate scenarios:

- Earthworks e.g. internal road construction and trenching for cabling.
- Piling of panel supports.
- Assembly of frames and fixing panels.

In the absence of any residential neighbours within 5 km of the development site, daytime construction noise levels were assessed around the perimeter of the development site for three noise scenarios. For all three scenarios, highly noise affected areas were limited to within 5 m of the development site boundary. Maximum noise management levels (NMLs) would be limited to 40 m from the development site boundary.

The predicted construction road traffic noise levels satisfy the NSW Road Noise Policy (RNP) criteria for assessed residences.

The results of the noise assessment demonstrate that construction noise levels satisfy relevant regulatory construction and operational noise levels as NMLs would not be exceeded at residential dwellings under any of the noise scenarios evaluated.

Traffic, transport and road safety

Vehicle movements generated by the proposal can be separated into cars, buses, utility vehicles, trucks, standard articulated trucks and oversized and/or over-mass vehicles. Vehicle access to the site during construction would generally be confined to the standard hours of construction. Exceptions would occur as staff arrive and leave the site, before and after shifts. Additionally, the delivery of large components may take place outside normal working hours for safety and logistical reasons.

One main entrance for the project is proposed, located at the north eastern corner of the development site, on an existing private access track, off Mitchell Highway. The substation entrance would also be located on the private access track. The turnoff on Mitchell Highway would be sealed and upgraded for 26 m B-Double semi-trailers.

Internal access tracks would remain unsealed but would be sheeted with gravel or crushed stone to maintain their condition during the construction phase.

Overall, the additional traffic associated with the construction and decommissioning of the solar farm would be a small component of the existing traffic loads on local and state roads. No substantive increased collision risk, damage to road infrastructure, noise or dust impacts, disruption to existing services or reduced level of service is expected to accompany construction or decommissioning.

During operation, vehicles would use the designated road network to access the site and travel within the site during the operational phase. A small number of light vehicles would be expected during normal

operation of the proposal. Activities undertaken during the operation phase would include travelling to the office building and carrying out land management or maintenance activities.

Overall, traffic impacts from the proposal are considered to be well within the capacity of the local road network and manageable.

Watercourses and hydrology

There are no watercourses within or near the development site, nor is it located within any floodplains. The closest river is the Bogan River that runs through the town of Nyngan, 17 km to the southeast. The closest point of the Bogan River to the development site is approximately 10 km east, the floodplain of which is contained within the eastern side of the Mitchell Highway.

Six man-made dams exist within the subject land of Lot 21 DP 704061. None of these dams would be impacted by the proposal. BayWa r.e. have designed the proposal to have the ability to retain all six dams within the subject land.

The development site is not located in an area identified as having groundwater vulnerability. There are no aquatic for terrestrial groundwater dependant ecosystems (GDE) within 5 km of the development site. There is a low potential for groundwater to be encountered during excavations and earthwork for the construction, given the pile driving technology to be utilised and the limited amount of excavation for footings and road upgrades.

The proposal would not directly affect the surface water quality. Indirectly, the proposed works would involve a range of activities that could disturb soils though impacts are considered low and can be appropriately managed.

The Australian Groundwater Explorer database (BoM 2020a) lists two bores within 1 km of the development site (GW802495 and GW802497). GW802495 is listed as abandoned. GW802497 is listed as removed.

The proposal area is not identified as flood prone land under the Bogan Local Environmental Plan (LEP) 2011. Flood modelling of the subject land was deemed unnecessary due to its flatness, as well as the designs measures to accommodate overland flow and avoid preventing natural flow or create ponding. No impact on any waterway's hydraulic function or potential to generate erosion would occur.

Water demand for the proposal would be relatively small, as construction of the solar farm is not water intensive. No surface or groundwater extraction of water is required. Water during construction could be sourced from several sources including standpipes operated by Bogan Shire Council. The anticipated amount of non-potable water required during construction is 3,500 kL. This water would be predominantly used for dust control on internal access tracks.

During operation, water for panel washing and other maintenance activities would similarly be sourced from the available standpipes. It is expected 60 kL of potable water would be required each year. Dust generation on internal access tracks is likely to be infrequent due to aggregate applied to the surface and infrequent use.

Biodiversity

A Biodiversity Development Assessment Report (BDAR) (NGH 2020b) was prepared to assess the potential impacts of the proposal on biodiversity. Cleared and highly modified agricultural land occupies about 99% of the development site. One Plant Community Type (PCT) was identified in the development site:

- PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion.

PCT 98, not a listed threatened ecological community (TEC) under either the *Biodiversity Conservation Act 2016* or *Environmental Protection and Biodiversity Conservation Act 1999*.

For biodiversity impacts that are unavoidable, the proposal would require the removal of:

- PCT 98 - Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion – 1 credit.

The removal of 3 paddock trees generated the following credits:

- PCT 98 – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion – 1 credit.

No threatened species have been identified as having the potential to be significantly impacted by the development.

No entities listed on the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets under this Act.

As well as meeting the above offset requirements, in accordance with the *Biodiversity Conservation Act 2016*, the proposal has:

- Avoided biodiversity impacts by selecting a solar farm site that does not contain native vegetation; native vegetation is required for the access only.
- Minimised direct and indirect impacts by committing to a raft of mitigation measures, including restricting the impact areas, managing weed ingress, noise, light and dust on adjacent habitat.

Aboriginal heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR; NGH 2020b) was conducted to assess Aboriginal cultural values associated with the proposal area and the cultural and scientific significance of any Aboriginal heritage sites recorded. The assessment was undertaken in consultation with Registered Aboriginal Parties (RAPs).

A search of the AHIMS database (OEH 2020a) was undertaken over an area of approximately 20 km x 20 km centred over the project area with a buffer of 200 m. There were 28 Aboriginal sites recorded within this search area and no declared Aboriginal Places. None of these registered sites would be impacted by the proposal.

The site surveys, undertaken by an archaeologist from NGH with representatives of the Aboriginal community, found visibility across the development site was excellent. Two hearths and one scarred tree were identified.

Based on the land use history and an appraisal of the results from the field survey, there is considered to be low potential for subsurface deposits or cultural material within the proposal area. Management safeguards would be implemented to ensure that areas of potential deposits are not impacted.

Direct impacts are likely considering that the development site has been repeatedly cropped and subject to wind and water erosion over many years. The two hearths and the scarred tree identified during the survey would not be impacted. Overall, impacts on Aboriginal cultural heritage have been assessed as low. An Unexpected Finds Protocol (UFP) would be prepared and followed should there be an additional discovery of Aboriginal objects during construction.

LOWER RISK ISSUES

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

Climate and air quality

The air quality in the study area is expected to be good and typical of rural settings in NSW with low population density and few industrial pollution sources. Existing sources of air pollution are expected to include vehicle emissions, dust from agricultural practices and smoke from seasonal stubble burning. During colder months, solid fuel heating may result in a localised reduction in air quality, particularly if temperature inversions operate overnight. During construction and decommissioning there could be an increase in dust generation and air emissions from earthwork activities and vehicles.

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

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

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

Historic heritage

A search of the NSW heritage Register on 25 November 2019 for the Bogan local government area (LGA) identified 0 Aboriginal places under the NPW Act, 11 items under the Heritage Act, listed by State and local government agencies, and no items on the Australian Heritage Database.

The closest listed heritage items are located in the Nyngan townsite, approximately 17 km southeast from the western boundary of the proposed development site.

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

Soil

A soil capability assessment was undertaken by Barnson Pty Ltd in April 2020, which found that soil across the site is suitable to support solar farm infrastructure. Site work for the soil quality assessment was undertaken on 26 March 2020 and involved the excavation of six auger holes across the development site. Samples of soil collected from the six auger holes were sent to an accredited laboratory for chemical analysis.

Neither surface soils and subsoils store high levels of salt and soil erosion potential is considered low once groundcover has been restored to the development site due to the development site's flat topography. There is a high potential for waterlogging on site following high rainfall. However, this can be ameliorated by vegetation cover which can utilise excess water. The growth of natural grass species present at the site should be encouraged to stabilise the surface soils and prevent soil erosion.

Existing limitations for ongoing agriculture use of the development site include erosion and waterlogging, while the physical and chemical properties of the soils indicate that the productive capacity is good so long as nutrients and soil conditioners are applied regularly. These same features create risks for the solar farm development. Maintaining perennial groundcover and carefully managing sheep stocking rates are essential for managing erosion and preventing changes to the microtopography of the site caused by hoof holes during waterlogging events.

Hazards

The proposal does not exceed the screening thresholds for potentially hazardous or offensive development, in accordance with SEPP 33 Hazardous and Offensive Development. A Preliminary Hazard Assessment is not required.

Bushfire hazards include remnant native vegetation along Mitchell Highway and on adjoining land parcels Lots 15 and 16 DP 751317. The subject land is mapped Vegetation Category 3 bushfire prone land (RFS, 2019). The design of the proposal incorporates significant bushfire mitigation measures including a clear 10 m asset protection zone (APZ). No tree cover exists within 270 m of the development site.

Specific construction and operational activities may cause or increase the risk of bushfire. Grazed grass cover over much of the development site is considered a low fuel zone. This together with further mitigation measures established through consultation with the local RFS, such as access to water stored onsite, means that it is unlikely that construction or operation of the solar farm would pose an uncontainable bushfire risk. The bushfire hazard associated with the activities listed above is considered highly manageable.

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

Resource use and waste generation

The resource management options of the proposal would be considered against the principles of avoidance of unnecessary resource consumption, resource recovery and disposal. These principles would act as a guide to achieve efficient use of resources and reduce costs and environmental harm.

Waste generated during construction would be subject to a strict recycling protocol involving segregation of materials e.g. packaging of panels. BayWa r.e. have also committed to using bio-degradable packaging, where practicable. During operation, waste materials would comprise limited amounts of fuels, lubricants and metals. Items that cannot be reused or recycled would be disposed of in accordance with the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act). The majority of the solar farm infrastructure is built from valuable recyclable materials including steel framing, copper wire, silicon, aluminium and glass.

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

Cumulative impacts

An adverse cumulative impact can occur when the proposal activities exacerbate the negative impacts on other infrastructure or activities occurring nearby. Cumulative impacts are more likely for larger scale developments, particularly where peak activities, such as construction, may overlap.

During construction and decommissioning, the greatest potential for cumulative impacts for the proposal is from the combined effects of the project's traffic and local economic impacts (pressure on local services and impact on agricultural operations), in combination with other large projects which may occur concurrently. No operational cumulative impacts are anticipated.

There are four other Major Projects listed on the Major Projects Register within the Bogan LGA including two other large-scale solar farms:

- The Nyngan Scandium mine project has been approved. This project is located approximately 20 km west of Nyngan, with access proposed via Gilgai Road and Barrier Highway. The development is expected to generate approximately 70 vehicle movements per day once constructed.
- Western Slopes Pipeline had been issues SEARs but has yet submitted an EIS. The proposed infrastructure involves the construction and operation of approximately 450 km of buried steel gas transmission pipeline between Narrabri Gas Project and the existing Moomba Sydney Pipeline.

- Nyngan Solar Farm has been constructed and is located approximately 10 km west of the Nyngan township. The development is expected to generate approximately six light vehicle movements per day.
- Bogan River Solar Farm was located 2 km south of Nyngan, between the junction of Tottenham Road and Mitchell Highway. The development application was withdrawn in December 2018.

Of the four Major Projects listed above, only the top two have some potential for cumulative impacts if construction programs are concurrent. The identified cumulative impacts are considered manageable with the implementation of management protocols and consultation with these entities.

MANAGEMENT OF IMPACTS

The proposal has been designed to minimise adverse environmental impacts, including:

- Selection of a site with low environmental constraints including no residential dwellings within 5 km and very little native vegetation.
- Respecting known Aboriginal heritage items.
- Incorporating screening to reduce visual impacts from Mitchell Highway.

A range of additional management and mitigation measures have been developed to further reduce any residual impact. These strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks and include the following key measures:

- Vegetation screening to limit views of the proposal from Mitchell Highway.
- Avoid land use conflicts thorough consultation with relevant stakeholders.
- Ongoing discussions with Bogan Shire Council to enter into a Voluntary Planning Agreement (VPA) and a commitment to source workers locally.
- Traffic management measures during construction.
- A suite of Environmental Management Plans to minimise adverse impacts on water, soil, biodiversity and Aboriginal heritage.
- Bushfire preparedness and risk minimisation measures incorporated into the proposal design including a 10 m asset protection zone (APZ) and a water storage tank, and a Fire Management and Environmental Response Plan (FMERP) to ensure quick and appropriate action in the event of fire events.
- A range of standard construction mitigation measures to minimise dust, soil erosion, and waste impacts.
- All stages of the development would be designed and operated in accordance with Australian Standards to minimise risks to the health and safety of the public, employees, and the environment.

CONCLUSION

Overall, the proposal would represent an important contribution to Australia's transition to a low emission energy generation economy and will provide substantial economic benefits to the local area. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its current agricultural capacity for continued agricultural or alternative land use.

A suite of carefully considered management measures has been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas.

The impacts and risks identified are deemed manageable with the effective implementation of the measures stipulated in this EIS. The impacts are considered justifiable and acceptable.

1 INTRODUCTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

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

In particular the EIS must include:

- *a full description of the development including:*
  - *details of construction, operation and decommissioning.*
  - *a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process).*
  - *a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.*

The EIS must also be accompanied by a report from a suitably qualified person providing:

- *a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived.*
- *certification that the information provided is accurate at the date of preparation.*

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed 28 MW AC Yarren Hut Solar Farm State Significant Development (SSD) 10415 (the 'proposal'). NGH Pty Ltd (NGH) has prepared this EIS on behalf of BayWa r.e. Projects Australia Pty Ltd (herein 'BayWa r.e.' or 'proponent').

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to support a Development Application (DA) to be lodged with NSW Department of Planning, Industry and Environment (DPIE).

The objective of this EIS is to fulfil the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and Section 4.15 of the EP&A Act. The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPIE on 6 February 2020 (Appendix A).

The EIS also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is noted that this is not a Bilateral Assessment under the EPBC Act and Controlled Activity approval is not being sought.

BayWa r.e has conscientiously provided transparent and factual information to enable members of the public to participate meaningfully in the engagement process. Community feedback provided has been considered and utilised by the project development team to shape and enhance the proposed design.

The proponent has engaged NGH to prepare the EIS. Other independent consultants were contracted to carry out specialist technical assessments as required. This EIS will be independently evaluated by the NSW Government, considering input from the community provided during the public exhibition period. The development assessment process places the onus on the proponent to provide the information required for the State Government to make an informed decision. The process provides for public transparency, accountability and participation in development approval decision-making.

1.2 PROJECT OVERVIEW

1.2.1 The proponent

BayWa r.e. was founded in 2009 and is a subsidiary company of the BayWa Group, which was founded in 1923 and is based in Munich, Germany and operates with an annual revenue of 16 billion Euros. The BayWa Group consists of companies specialising in trading, logistics and services in the following markets: agriculture, energy and construction materials.

The BayWa r.e Wind and Solar Project teams have been operating in Australia since early 2017. The Solar Projects team entered the Australian market through the acquisition and subsequent development of the Hughenden Solar Farm in Northern Queensland as well as the Karadoc and Yatpool Solar Farms in Victoria. The Wind Projects team was established through the acquisition of a local developer, Future Energy, and its project pipeline.

BayWa r.e is experienced in delivering Australian wind and solar projects and offer services such as asset and operations management across the Asia-Pacific region, as well as turnkey construction, internal financing and investment opportunities and Power Purchase Agreements (PPAs).

1.2.2 Development site location

The subject land is located within the Bogan Shire Local Government Area (LGA) and is legally identified with the following (Figure 1-1):

- Lot 21 DP 704061

The development site can be accessed from a private access track directly from the Mitchell Highway, approximately 17 km northwest of the Nyngan. The Mitchell Highway is an arterial road managed and maintained by Transport for NSW (TfNSW).

The Bogan Shire occupies an area of approximately 14,610 km^2 and has a population of 3012 (Bogan Shire Council 2017). Nyngan and the surrounding region support primary agriculture including sheep and cattle grazing and large-scale dryland cropping.

Aerial imagery identified no residential receivers situated within 3 km of the proposal. The closest dwelling is approximately 5 km north west of the development site. The Essential Energy Nyngan to Bourke transmission line traverses diagonally through the subject land.

Nyngan is the closest town to the proposal, approximately 17 km southeast of the subject land.

Nyngan town lies on the Main Western railway line and contains an airport. The Barrier Highway runs from Nyngan, through Broken Hill to South Australia. Nyngan is already home to one of Australia's largest solar farms generating approximately 100 MW.

The Bogan River is located approximately 10 km east of the proposal. The site is not located in the immediate vicinity of any water courses, nor is it located within any floodplains. The closest river is the Bogan River that runs through the town of Nyngan, 17 km to the south east. The closest point of the Bogan River to the project site is approximately 10 km east of the site, the floodplain of which is contained within the eastern side of the Mitchell Highway.

1.2.3 Key components of the proposed Yarren Hut Solar Farm

The proposed development would occupy approximately 92 ha of the 1205 ha lot (Figure 1-2). The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar fixed or tracking array generating around 28 MW AC of renewable energy. The power generated would be exported to the national electricity grid.

Key development and infrastructure components would include:

- Single-axis fixed or tracker photovoltaic solar panels mounted on steel frames (approximately 84,000 PV solar panels).
- Underground electrical conduits and cabling to connect the arrays and the inverters and transformers.
- Inverters, transformers and electrical conduits.
- Onsite substation / switching station.
- 66 kV electrical transmission line to connect the proposal to the existing Essential Energy transmission line.
- Site office, site compound, vehicle parking areas, access tracks and perimeter fencing.
- Site access from Mitchell Highway.

The proposed infrastructure map (Figure 1-3) illustrates the indicative layout, including a concept development footprint for the solar arrays. Detailed design would allow for avoidance of sensitive features on the site. A native vegetation buffer would be established to minimise visual impacts from public roads in specific locations. There are no residential dwellings within 5 km of the development site.

In total, the construction phase of the proposal is expected to take about 10 months, and the facility would be expected to operate for around 50 years. One or two fulltime equivalent operations and maintenance staff and service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All infrastructure would be removed, and the site returned to its existing agricultural land capability.

1.2.4 Capital investment

The proposal would have a capital investment of around $42 million.

1.2.5 Land ownership

The subject land is owned by a single title holder of Lot 21 DP 704061.

The use of the site is based on a lease agreement between the proponent and the landowner for the main solar farm site. The freehold title of the switching station land (~0.4 ha) will be transferred to Essential Energy and will be purchased from the landowner.

The proponent has signed an Option Deed with the owner of this property to lease the land for the purpose of a solar farm. Landowner consent for the development and subdivision is provided in Appendix B.

The proponent has been in consultation with TfNSW regarding upgrading the site access on Mitchell Highway. TfNSW have raised no objection and have acknowledged this consultation in their component of the SEARs.

1.2.6 Development history

An Informal Access Application under the *Government Information Public Access Act 2009* was submitted to Bogan Shire Council on 27 February 2020. It was determined that no Development Applications of relevance were recorded within the proposal area (Appendix C.1).

A search for State Significant Development on the Major Projects website (accessed 26 March 2020) of Bogan LGA did not indicate any Development Applications on the affected lot (subject land).

Bogan Shire Council has indicated that they would not object to consent being granted by the Minister for the proposed subdivision under the minimum lot size for the development site and a switching station.

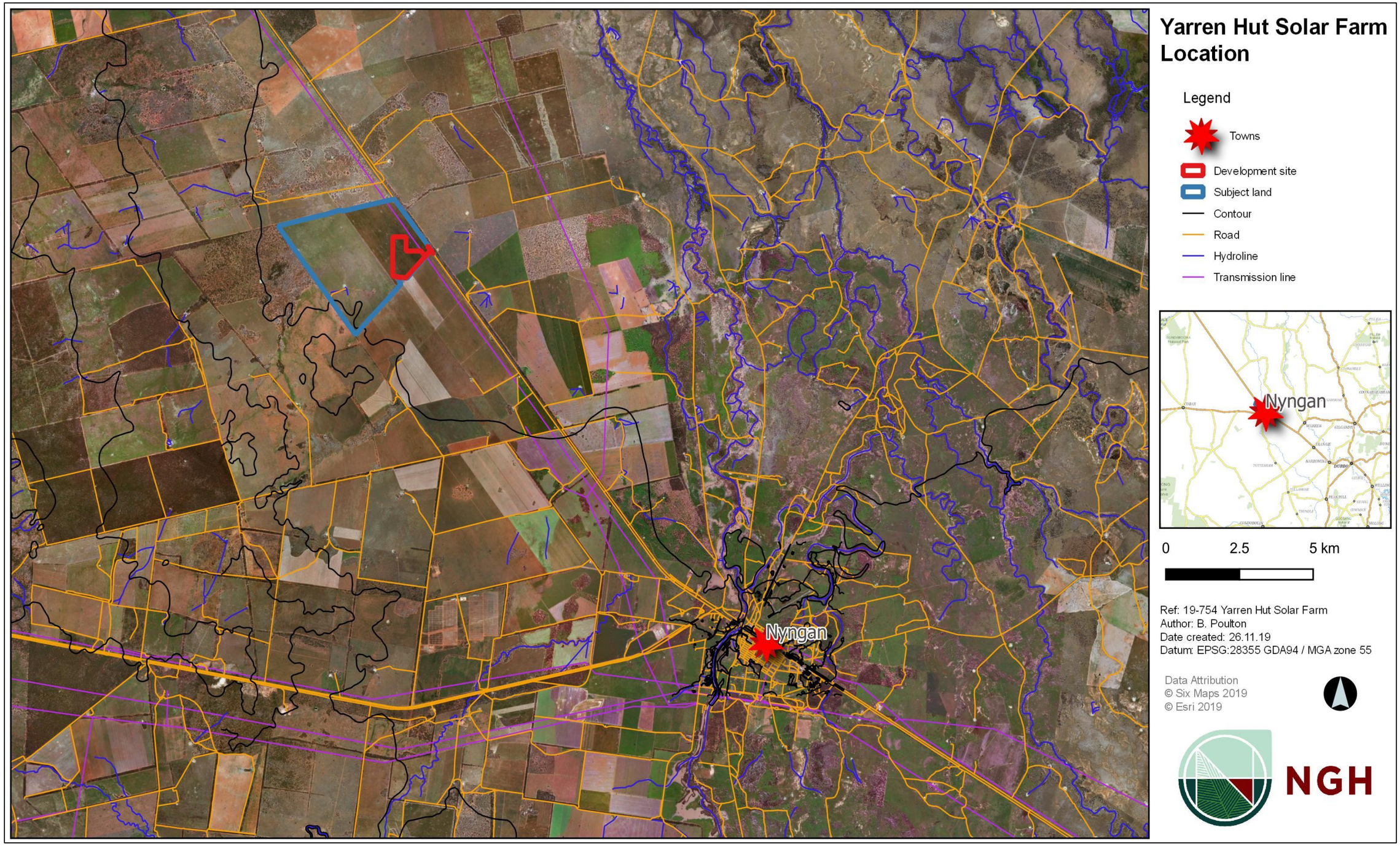

Figure 1-1 General location of the subject land

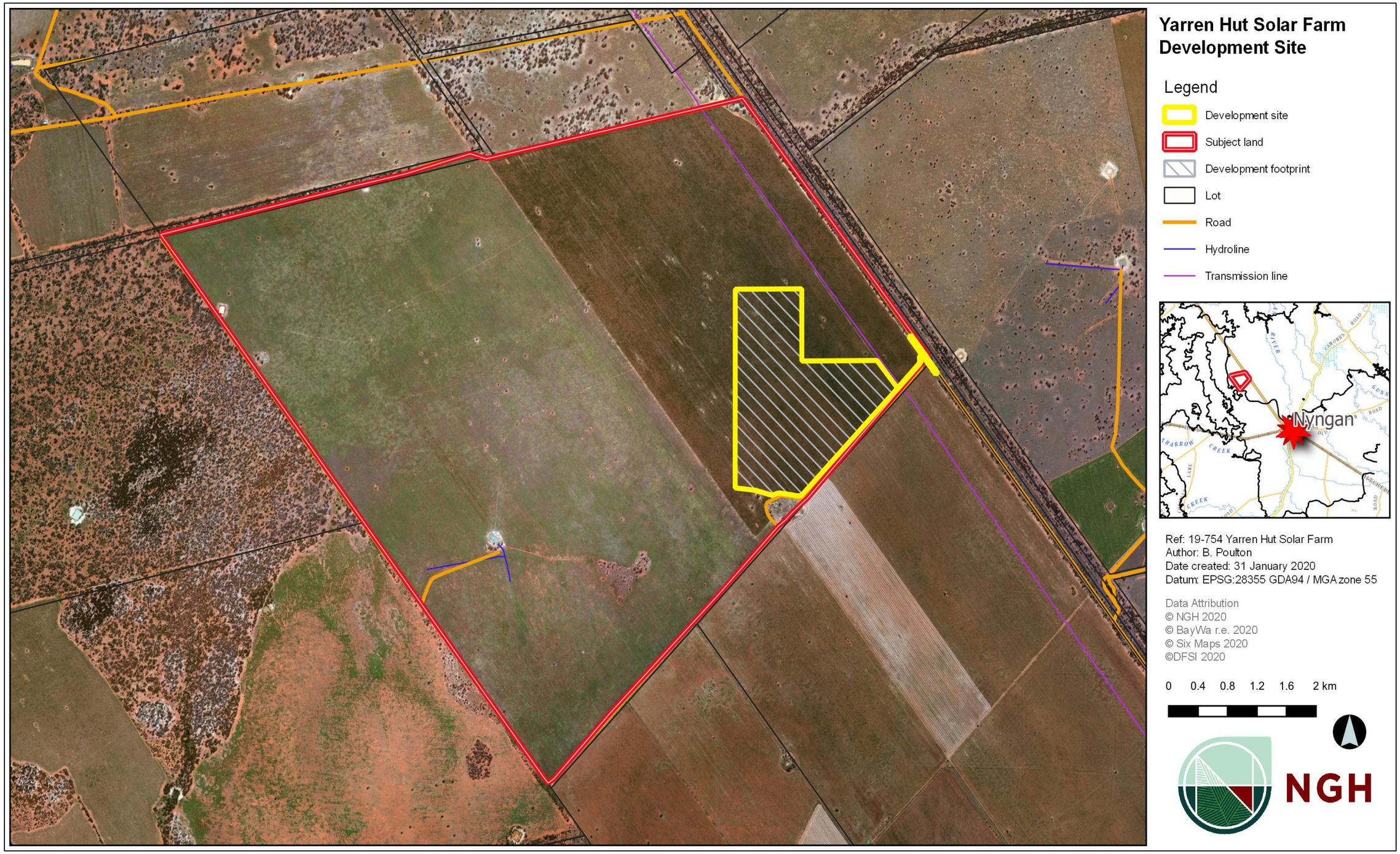

Figure 1-2 Development site within the subject land

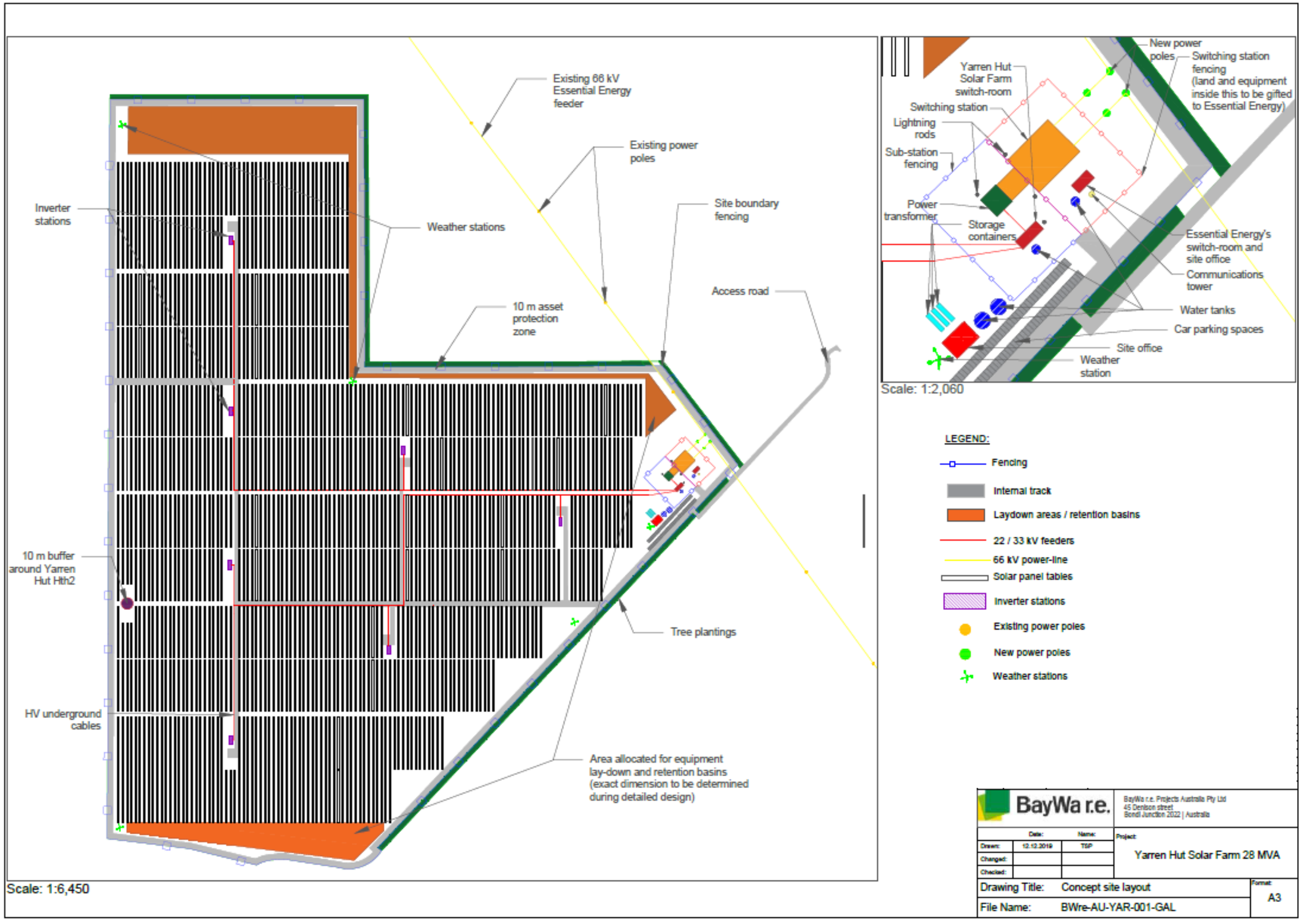

Figure 1-3 Proposed infrastructure

2 STRATEGIC JUSTIFICATION AND ALTERNATIVES CONSIDERED

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential).*
- *a detailed consideration of the capability of the project to the security and reliability of the electricity in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.*
- *a detailed evaluation of the merits of the project as a whole.*

2.1 STRATEGIC NEED

This section addresses the merits of the proposal and weighs the likely benefits against the potential impacts on the environment, local economy and community. In this case, the key benefits include renewable energy generation and local employment opportunities, particularly during the construction phase. Adverse impacts of the proposal would be minimal, largely due to appropriate site selection (few environmental constraints), which has mitigated impacts proactively.

2.1.1 Climate change

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and alter the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the United Nations Paris Agreement on Climate Change (DEE 2019). Federally, Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE 2019). Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia, representing 35 per cent of emissions (DEE 2019). The transition to low carbon renewable energy sources would be critical to enable Australia to meet its Paris commitments. In terms of renewable energy technologies, solar projects have the capacity to provide faster results in reducing greenhouse gas emissions than other options because of shorter potential construction and commissioning times (IPCC 2012). Rapidly improving technology in this sector is also seeing the improved performance of solar energy projects.

2.1.2 National renewable energy targets

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Australian Prime Minister signed Australia's instrument of ratification of the Kyoto Protocol in 2007, thereby committing Australia to reduce its collective GHG emissions.

There have been a number of government policies in place in Australia influencing the development of renewable energy. In 2001, the Commonwealth Government introduced the Mandatory Renewable Energy Target (MRET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The initial MRET was for Australian to provide 9500 gigawatt hours (GWh) of new renewable energy generation by 2010.

This target was revised and increased to 45,000 GWh from 2001 to 2020 in January 2011. The MRET was split into a Small-scale Renewable Energy Scheme and LRET components to ensure that adequate incentives were provided for large scale grid connected renewable energy. The LRET aims to create a financial incentive for the establishment and growth of renewable energy power stations, such as wind

and solar farms, or hydro-electric power stations through the creation of large-scale generation certificates.

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

2.1.3 Finkel Report

The 2017 Independent Review into the Future Security of the National Electricity Market (Finkel Report) is a report commissioned by the Australian Government in order to establish a framework for the development of the Australian energy sector. It recommends the use of a Clean Energy Target (CET) scheme to stimulate renewable energy production throughout the National Electricity Market (NEM) and would likely replace the present Federal MRET scheme due to expire in 2020. The report modelled the outcomes required to achieve the trajectory committed to by the Australian Government by 2030 and determined that renewable energy would constitute approximately 42% of the NEM.

2.1.4 NSW Renewable Energy Action Plan

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government, 2013). The Government's vision is for a secure, affordable and clean energy future for NSW.

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

The plan details 3 goals and 24 actions to efficiently grow renewable energy generation in NSW:

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

2.1.5 State and Federal Governments' support for renewable energy

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

2.1.6 Climate Change Fund Draft Strategic Plan 2017 to 2022

The *Climate Change Fund Draft Strategic Plan* (NSW Government, 2016) sets out priority investment areas and potential actions using $500 million of new funding from the $1.4 billion Climate Change Fund over the next five years. Investment in these areas would help NSW make the transition to net zero emissions by 2050 and adapt to a changing climate.

This Strategic Plan is an important first step to implementing the policy framework. The Strategic Plan organises potential actions into three priority investment areas that would form the basis of future action plans:

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

The advanced energy priority strategies focus on supporting the transition to a net-zero emissions economy by providing greater investment certainty for the private sector, accelerating new technology

to reduce future costs and helping the community and industry make informed decisions about a net-zero emissions future.

2.1.7 NSW 2021: A Plan to Make NSW Number One

NSW 2021: A Plan to Make NSW Number One was released in 2011, replacing the State Plan as the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation. Goal 22 of this plan seeks to protect our natural environment and includes a specific target to increase renewable energy.

A commitment is made to:

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

Specific initiatives under this target that directly support building solar power plants include the Solar Flagships Program, in partnership with the Australian Government, established in 2009 (now closed). Additionally, a strategic move towards renewable energy generation is supported through the establishment of a Joint Industry Government Taskforce to develop a Renewable Energy Action Plan for NSW, which would identify opportunities for investment in renewable energy sources.

2.1.8 Greenhouse gas emissions - lifecycle analysis and benefits of solar technology

Lifecycle analysis can be used to consider the emissions produced during the manufacture, construction, operation and decommissioning of, in this case, electricity generation technologies. When compared with existing conventional fossil fuel based electricity generation, solar PV technology generates far less lifecycle GHG emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al,* 2008; NREL, 2012).

Unlike fossil fuel systems, most of the GHG emissions for solar technology occur upstream of the lifecycle, with most of the emissions (50-80%) arising during the production of the module (Weisser. n.d.). Other lifecycle emissions relate to construction and decommissioning activities. During solar plant operation, the production of electricity with PV modules emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources.

Support activities, such as maintenance works, may however generate emissions but the amount would be regarded as negligible. End of life and associated transport activities do not result in meaningful cumulative GHG emissions (Weisser n.d).

Emissions from conventional energy generation based on fossil fuels can therefore be avoided by replacing conventional methods of fossil fuel energy generation with solar PV energy generation.

2.1.9 Electricity supply

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

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

2.2 PROPOSAL BENEFITS

2.2.1 Broad benefits

Broad benefits that would be associated with the operation of the Yarren Solar Farm proposal include:

- Reduce GHG emissions, assisting the transition towards cleaner electricity generation.
- Provision of a renewable energy supply that would contribute to the New South Wales Renewable Energy Action Plan (NSW Government 2013), which supports the national target of 20 percent renewable energy by 2020.
- The proposal would also contribute to the Commonwealth Government's objective to achieve an additional 33 GW from renewable sources by 2020 under the Renewable Energy Target (RET).
- The proposal would assist the Australian and NSW Governments to reach Australia's energy and carbon mitigation goals.
- Embed electricity generation supply into the Australian grid, closer to identified consumption centres.
- Combatting the effects of climate change by utilising a clean renewable energy source as an alternative to burning fossil fuels.

Specifically, the proposal would:

- Generate approximately 76,000 MWh of renewable electricity per year.
- Supply enough power each year to service approximately 9,000 households.
- Save around 61,000 tonnes of carbon dioxide (CO_2) per year, assuming generation would otherwise use coal with a carbon factor of 0.8 tonnes per MWh (, 2011).
- The proposal would displace 61,000 tonnes of CO_2 per annum is the equivalent of taking about 26,500 cars off the road each year, based on an average car in NSW travelling 14,000 km per year with CO_2 emissions of 162 g/km (or 2.3 tonnes of CO_2 emissions per car per year) (U.S. EPA 2020).
- Contribute to overall cheaper energy prices. As according to Deloitte, Australian households will pay $510 million more for power in 2020 without renewable growth through the RET and up to $1.4 billion more per year beyond 2020. Renewables increase competition in the wholesale energy market – and, as in any market, more competition means lower prices.

2.2.2 Electricity reliability and security benefits

The proposal would enhance electricity reliability and security.

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life. Nine coal-fired power stations have closed since 2011-2012, representing around 3,600 MW of installed capacity (AER, 2018).

Even with demand-management initiatives, the retirement of old power stations would require the development of new, reliable and low-emissions energy supply. Given the high levels of solar irradiance in NSW the declining cost of solar power over the last decade, the proposal is an important source of new power generation.

The transition to renewable energy sources based on variable wind and solar PV generators has implications for reliability and security; these sources lack usable inertia to support power system security (Finkel *et al.* 2016). The NEM grid is long and linear, with much less network meshing than many international systems. Geographic and technological diversity in the network can improve security and smooth out the impacts of variability (Finkel *et al.* 2016), this is highlighted in the proposal given the geographical location of the proposal and its immediate proximity to existing transmission line.

While grid-supplied electricity consumption is expected to remain stable (AEMO, 2018), the proposal would benefit network reliability and security by providing embedded electricity generation closer to local consumption centres, contributing to a more diverse mix of energy sources and potentially regulating inputs (including improving the security of supply).

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

The electricity network was designed to deal with a small number of very large power generating stations.

2.2.3 Downward pressure on electricity prices

Household electricity bills increased 61% between 2008-09 and 2012-13, due mainly to network expenditure (ABS 2019b). Australian households would pay $510 million more for power in 2020 without renewable growth through the RET and up to $1.4 billion more per year beyond 2020 (Roam Consulting 2014). Renewables increase diversity and competition in the wholesale energy market – and as in any market, more competition means lower prices.

Variable renewable energy generation such as PV solar operates with no fuel costs and can, with the right policy framework and technological development to manage variability, be used to reduce overall wholesale prices of electricity (Finkel *et al*. 2016).

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

2.2.4 Local benefits

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 40 employees at the peak of construction (five months) and one or two FTE operational staff for the life of the project.
- Diversifying employment opportunities beyond the productive agriculture sector. Limited grazing will be maintained onsite as well as a drought-proof income stream provided by the solar farm lease payments.
- The proposal would provide significant participation opportunities for businesses and workers in and around Nyngan.
- Direct business volume benefits for local services, materials, and contracting (e.g. accommodation, food and other retail).
- Assistance in meeting the future electricity demands of the Bogan LGA.
- An approximate annual operating budget of $1.1 million, which would include employment opportunities and engaging local contractors.
- Council rates and a VPA with the Bogan Shire Council.

Additionally, the proposal has very few environmental constraints and would address potential environmental impacts appropriately. It would be designed to:

- Preserve biodiversity features through minimising tree and vegetation community removal.
- Enhance biodiversity through planting of native vegetation.
- Preserve Aboriginal cultural heritage through maintaining important features.
- Minimise impacts to soil and water, through pile driven panel mounts rather than extensive soil disturbance and excavation.

- Minimise visual impacts to neighbours, incorporating vegetation screens, where required.
- Preserve agricultural production values, being highly reversible at the end of the proposal's life and utilising the area for sheep grazing on managed groundcover for the lifetime of the proposal. Weeds would be controlled under a Weed and Pest Management Plan.

2.3 PROPOSAL OBJECTIVES

The objectives of the proposal are to:

Community:

- Actively engage with the local community to ensure the proposal and its mitigation strategies align with local values.
- Provide local and regional employment opportunities and other social benefits during all stages of the proposal.

Environment:

- Provide a clean and renewable energy source to assist in reducing GHG emissions.
- Avoid and minimise environmental and cultural impacts where practicable through careful design and best practice environmental protection and impact mitigation.

Growth and development:

- Select and develop a site which is suitable for commercial scale solar electricity generation.
- Assist the NSW and Australian Governments to meet Australia's renewable energy, energy generation and carbon emission reduction goals.
- Provide electricity generation close to an identified consumption centre.
- Provide downward pressure on electricity costs, by providing more competition in the solar market, currently providing the least cost for new electricity generation.

2.4 ALTERNATIVES CONSIDERED

During the development of the proposal, a number of alternatives were considered. These include the 'do nothing option' (not developing the solar farm), alternative proposal area locations, and developing different renewable technologies.

2.4.1 The 'do nothing' option

The consequences of not proceeding with the proposal would be to forgo the identified benefits. This would result in the **loss** of:

- Opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- A renewable energy supply that would assist in reaching the LRET.
- Additional electricity generation and supply into the Australian grid.
- Social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.
- Opportunities for farmers to diversify their income leading to resilience to drought and unpredictable market prices.
- Sustainable demand for local goods and services.

The 'do nothing option' would avoid:

- Temporary noise, traffic and dust, visual impacts during construction.

- The loss of four paddock trees.
- The permanent loss of 0.4 ha of productive agricultural land (limited to the switching station).

The 'do nothing' option may avoid potential adverse impacts on the community and natural environment; however, the likelihood of significant negative impacts is extremely low. It is considered that the benefit of the proposed solar farm outweighs any adverse impact, whilst contributing to ecologically sustainable development. Given the benefits of the proposal, the 'do-nothing' option is not considered to be a preferred option.

2.4.2 Technology alternatives

Generation technology

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

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broadscale deployment at the site. Immediate grid access enables energy production without the need to construct additional transmission lines to connect to the network.

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

2.4.3 Alternative site locations

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

- Low environmental constraints (predominantly cleared cropping and grazing land).
- Low-rise terrain for cost-effective construction.
- High quality solar resource.
- No residential dwellings within 5 km of the development site.
- Suitable planning context.
- Acceptable flood risk.
- Artillery road access.
- Access to the distribution network.
- Sufficient levels of available capacity on the grid distribution system.

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

The design of the proposal is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the proposal have become available.

Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall.

The Essential Energy Nyngan to Bourke transmission line traverses diagonally through the subject land. Available grid capacity on the existing Essential Energy Nyngan to Bourke transmission line on site was instrumental in making Nyngan a suitable choice for a renewable energy development.

2.4.4 Scale of the proposal

The scale of the proposal has been influenced by:

- Transmission grid capacity.
- Property boundaries.
- The location of existing onsite dams, vegetation, and plant communities.
- Consideration of Aboriginal cultural heritage values.
- Demand for new renewable electricity generation to meet generation targets.
- Commercial investment and viability considerations.

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

2.4.5 Grid connection and capacity

Essential Energy have indicated in their Preliminary and Detailed Response that it may be possible to connect a ~28 MW AC output solar farm at the proposed location. Essential Energy have also issued the Network Modelling Study Pack which allows grid consultants to start the grid studies. These studies will determine compliance of the plant or remediation / upgrade works required to satisfy AEMO and Essential Energy's technical requirements.

2.5 SITE SUITABILITY AND JUSTIFICATION

The proposal would meet the proposal objectives, principally the development of a utility scale solar electricity power station, with built in consideration of community impacts and environmental constraints. It is justified in terms of reducing Australia's GHG emissions and meeting future energy demands. It would contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. Ultimately, it would contribute to economic development in Nyngan and the surrounding region.

Suitability details are described in Table 2-1 below.

Table 2-1 Site conditions and constraints (Guidelines (DPE, 2018))

Preferable site conditions	Site justification
Visibility and topography – sites with high visibility, such as those on prominent or high ground positions, or sites which are located in a valley with elevated nearby residences with views toward the site. This is particularly important in the context of significant scenic, historic or cultural landscapes.	The proposal does not have high visibility as no residential dwellings are located within 5 km of the proposed solar farm. The locality is relatively flat, and the site does not have prominent or high ground positions nor provide any nearby dwellings with elevated views looking towards the proposal
Biodiversity – areas of native vegetation or habitat of threatened species or ecological communities within and adjacent to the site, including native forests, rainforests, woodlands, wetlands, heathlands, shrublands, grasslands and geological features.	Based on the biodiversity and heritage assessments, as well as other investigations carried out for the EIS, the indicative footprint would minimise environmental impacts overall. Very little native vegetation is present within the study area and mainly comprises roadside vegetation along Mitchell Highway. The final design would avoid the majority of native vegetation, habitat of threatened species or ecological communities. Panel infrastructure would be installed over previously cropped land, currently devoid of understorey and vulnerable to erosion. The site is also unobtrusive, flat, and has low lying

Preferable site conditions	Site justification
	topography.
Residences – residential zones or urbanised areas.	The proposal is not within a residential zone or urbanised area. Consideration has been given to proximity to dwellings.
Agriculture – important agricultural lands, including Biophysical Strategic Agricultural Land (BSAL), irrigated cropping land, and land and soil capability classes 1, 2 and 3. Consideration should also be given to any significant fragmentation or displacement of existing agricultural industries and any cumulative impacts of multiple developments.	The proposal is not located on Strategic Agricultural Land, including industry clusters and biophysical strategic agricultural land. The proposal is located on Soil Capability Class 4 land. The site has suitable soil type to sustain the level and type of infrastructure proposed and not considered Biophysical Strategic Agricultural Land (BSAL) as detailed further in section 5.2.5 on land capability.
Natural hazards – areas subject to natural hazards such as flooding and land instability.	The scale and size of the proposal was influenced by the land area, geology, hydrology, adequate site access and road connections. The site is not located in the immediate vicinity of any watercourses, nor is it located within any floodplains. The development site is mapped Category 3 Vegetation Bushfire Prone land; however, the subject land is largely devoid of groundcover and tree cover is sparse.
Resources – prospective resource developments, including areas covered by exploration licences, and mining and petroleum production leases. Solar development applicants should seek advice from the Department of Planning, Division of Resources and Geoscience about the coverage of resources-related licences.	Preliminary search of the Minview database (DPI 2018) indicates that there are two current exploration licences (EL8631 and EL8730) over the subject land. A letter from GSNSW received on 27 November 2019, has confirmed the existence of these two exploration licences.
Crown Lands – if any part of the project or associated transmission or distribution infrastructure will cross Crown Lands, it may be subject to legislative requirements that restrict access to the land.	The development site comprises privately owned farmland, which would be leased for the life of the proposal. Planning portal mapping shows Crown Roads in close proximity to the western and northern corners of the subject land but these would not be intersected or utilised by the proposal. No travelling stock reserves are located within 5 km of the development site.

3 PROJECT DESCRIPTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must include:

- *a full description of the development, including:*
- *details of construction, operation and decommissioning.*
- *a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process).*
- *a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.*

3.1 PROPOSAL AREA DESCRIPTION

The subject land (affected lot) comprises about 1205 ha of freehold land, identified as Lot 21 DP 704061, with an existing Essential Energy 66 kV Nyngan to Bourke transmission line running diagonally through the subject lot. The Mitchell Highway runs along the north-eastern boundary of the subject land (Figure 1-2).

The development site comprises several large flat unirrigated paddocks that are largely cleared of native vegetation. The site has been subject to previous cultivation for pastures and grazing (which is the dominant land use in the area). No buildings are present within the development site.

The development site would occupy 92 ha of the 1205 ha subject land. The subject land is currently one lot that is proposed to be subdivided into three lots. Approximately 92 ha would be leased for the solar farm, with approximately 1113 ha retained by the landholder for agricultural purposes. A small area within the development site, approximately 0.4 ha would be subdivided to house the switching station. This area would become the freehold property of Essential Energy on commissioning of the proposal.

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

Figure 3-2 Large dam directly south of the development site

3.2 COMMUNITY DESCRIPTION

The proposal is located within the Bogan LGA, part of the Orana region of NSW.

Nyngan is the closest town to the proposal, approximately 17 km southeast of the subject land. According to the Bogan Shire, its population in 2019 was approximately 3076 persons (Bogan Shire 2018). Nyngan town lies on the Main Western railway line and contains an airport. The Barrier Highway runs from Nyngan, through Broken Hill to South Australia. Nyngan is already home to one of Australia's largest solar farms generating approximately 100 MW.

The Bogan LGA occupies an area of approximately 14,610 km^2 and has a population of 3012 (Bogan Shire Council 2017). Nyngan and the surrounding region support primary agriculture including sheep and cattle grazing and large-scale (non-irrigation) cropping. Public accommodation options in Nyngan includes two caravan parks, three motels, one hotel and free municipal camping areas. Two taverns, three licenced clubs and a selection of restaurants provide dining and recreation services for visitors and local residents.

The closest regional services are in Dubbo 170 km South East of the proposal.

Nyngan supports two schools, two churches, a supermarket, post office, service stations, restaurants, medical services and recreation facilities.

3.3 PROPOSED YARREN HUT SOLAR FARM

Key features of the proposal are summarised in Table 3-1. Component specifications are subject to detailed design and product selection:

Table 3-1 Key features of proposed Yarren Hut Solar Farm.

Proposal element	Description
Proposal	Yarren Hut Solar Farm.
Proponent	BayWa r.e. Projects Australia Pty Ltd
Capacity	28 MW (AC) Note: the approximate capacity is based on the proposed technology available at the time of the EIS but may change through the life of the solar farm, as advances in technology occur.
Subject land	1205 ha.
Development site	92 ha.
Development footprint	92 ha.
Site description	Lot 21 DP 704061. Freehold agricultural land zoned RU1 (Primary Production) under the Bogan Local Environmental Plan.
Local Government Area	Bogan Shire
Subdivision	Lot 21 DP 704061 would be subdivided into three lots, comprising 1113 ha, 92 ha and 0.4 ha respectively. Only 92 ha of this Lot 21 DP 704061 would be leased for the proposal. This new lot would contain solar arrays. The 0.4 ha lot would contain the Essential Energy switching station, which would become the freehold property of Essential Energy. The remaining portion would be retained by the landholder for farming activities.
Solar array	Approximately 84,000 solar panels mounted in arrays, with 5 m to 16 m row spacing. The 2 m x 1 m solar panels would be fixed or arranged in rows on single axis trackers with a maximum height not exceeding 4 m above the natural ground level. The PV mounting structure would comprise steel posts driven approximately 1.2-2.5 m into the ground using a pile driver.

Proposal element	Description
Modular inverters	The proposal would include approximately 7 or 8 modular inverter units across the site, each up to 4.5 m in height.
Substation	The substation would occupy approximately 1 ha with gravelled hardstand and security fencing. The Essential Energy owned switching station will occupy 0.4 ha of this sub-station land area. Overhead cabling would connect the switching station to the 66 kV transmission line. The maximum height of substation infrastructure including overhead cables would be 12 m.
Cabling	The majority of cabling across the development site would be below ground at approximate depths of at least 0.3 m – 1.5 m .
Internal access tracks	Internal access tracks would be topped with crushed stone or gravel to minimise dust. Internal access roads to the substation would be approximately 5 m to 10 m width (including shoulders and any required drainage), whilst general internal roads would be approximately 3.5 m to 5 m width.
Operations and maintenance buildings	Buildings would be constructed to provide a site office, control room, switch room and storage facilities for the solar farm.
Security fencing, lighting and CCTV	Continuous security lighting (infra-red) and CCTV cameras would be installed on posts up to 3.5 m high adjacent to the perimeter security fencing and around the operation and maintenance buildings. Security fencing installed around the site would indicatively be 2.4 m high.
Construction hours	Construction hours would generally be 7.00am to 6.00pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays, however, as the development site is located 5 km form the closest residential dwelling, BayWa r.e. may consider working outside of standard recommended construction hours. Bogan Shire Council would be consulted regarding construction hours pre-construction.
Construction timing	5 – 10 months commencing in the third quarter 2021.
Workforce	Construction – peak of around 40 workers Operation – one or two full time equivalent staff and service contractors.
Operation period	Up to 50 years.
Decommissioning	The site would be returned to its pre-works state. All infrastructure would be removed. The site would be rehabilitated in consultation with the landowner consistent with land use requirements.
Capital investment	Estimated $42 million.

3.4 PROPOSAL LAYOUT

The proposed layout has been developed iteratively in tandem with the environmental assessments and community consultation to ensure potential impacts are avoided and minimised where possible and that the proposal is one that is supportable.

A constraints analysis of the proposal site was undertaken to assist with designing the solar farm layout and planning the environmental assessment. Environmental constraints are factors which affect the 'developability' of a site, and include physical, ecological, social and planning aspects. Specific constraints at the site were allocated to three classes: high, medium and low. Environmental constraint classes are described in Table 3-2.

The layout of the proposed solar farm has been adapted to avoid high constraint areas as far as practicable and at least minimise impacts to moderate constraint areas (Figure 3-3). In terms of biodiversity values, Endangered Ecological Communities (EEC) vegetation and threatened flora and fauna habitat were avoided as far as practicable.

Table 3-2 Environmental constraints at Yarren Hut development site

High constraint
Nil.
Moderate constraint
Isolated paddock trees Three living isolated trees in cropland have habitat and connectivity value for native wildlife.
Use of agricultural land The Land and Soil Capability Assessment Scheme (OEH, 2012) identifies the development site as Class 4 agricultural land.
Isolated artefacts **One** hearth was identified within the development site.
Low constraint
Cleared, cultivated paddocks Approximately 92 ha with exotic understorey with low habitat value.
Remnant woodland vegetation Remnant woodland with native understorey. No EECs or hollow-bearing trees would be impacted.
Scarred trees One scarred tree of Aboriginal cultural significance was outside the development footprint, north of the access point along Mitchell Highway.

3.5 SUBDIVISION

The proposal would require subdivision of the subject land. The following configuration is proposed to create a three-lot subdivision (Figure 3-4):

- One lot would contain the solar farm compound and solar array and would comprise an area of approximately 92 ha.
- One lot of 0.4 ha within the compound area for the substation; these assets and lot would be transferred to Essential Energy.
- The balance of land, being approximately 1113 ha, would be retained by the landholder for agriculture land use.

The subject land will be leased from one private landowner. When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under s.7A *Conveyancing Act 1919* (NSW) (formerly s.327A *Local Government Act 1919* now repealed) is required when the total of the original term of the lease, together with any option for renewal, is more than five years.

A portion on the north east corner of Lot 21 DP 704061 (as shown in Figure 3-4) would be leased under an arrangement between the landholder and the proponent for a period for the life of the proposal. A small subdivision for the purpose of the switching station would also be required to allow Essential Energy to own the land on which their assets will be located.

Bogan Shire Council have confirmed that they do not in principle object to the proposed subdivision (Appendix C.1.1).

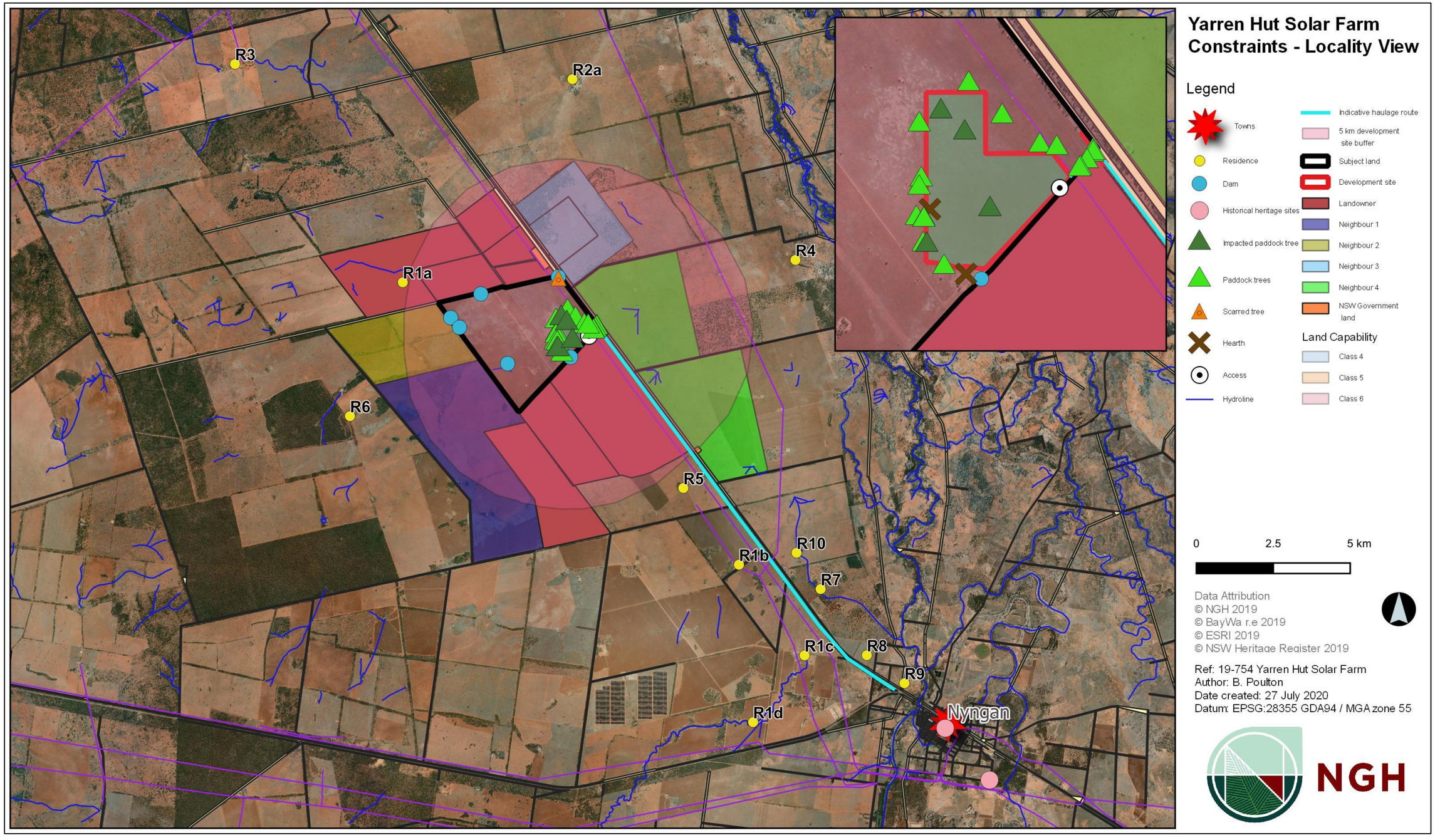

Figure 3-3 Environmental constraints

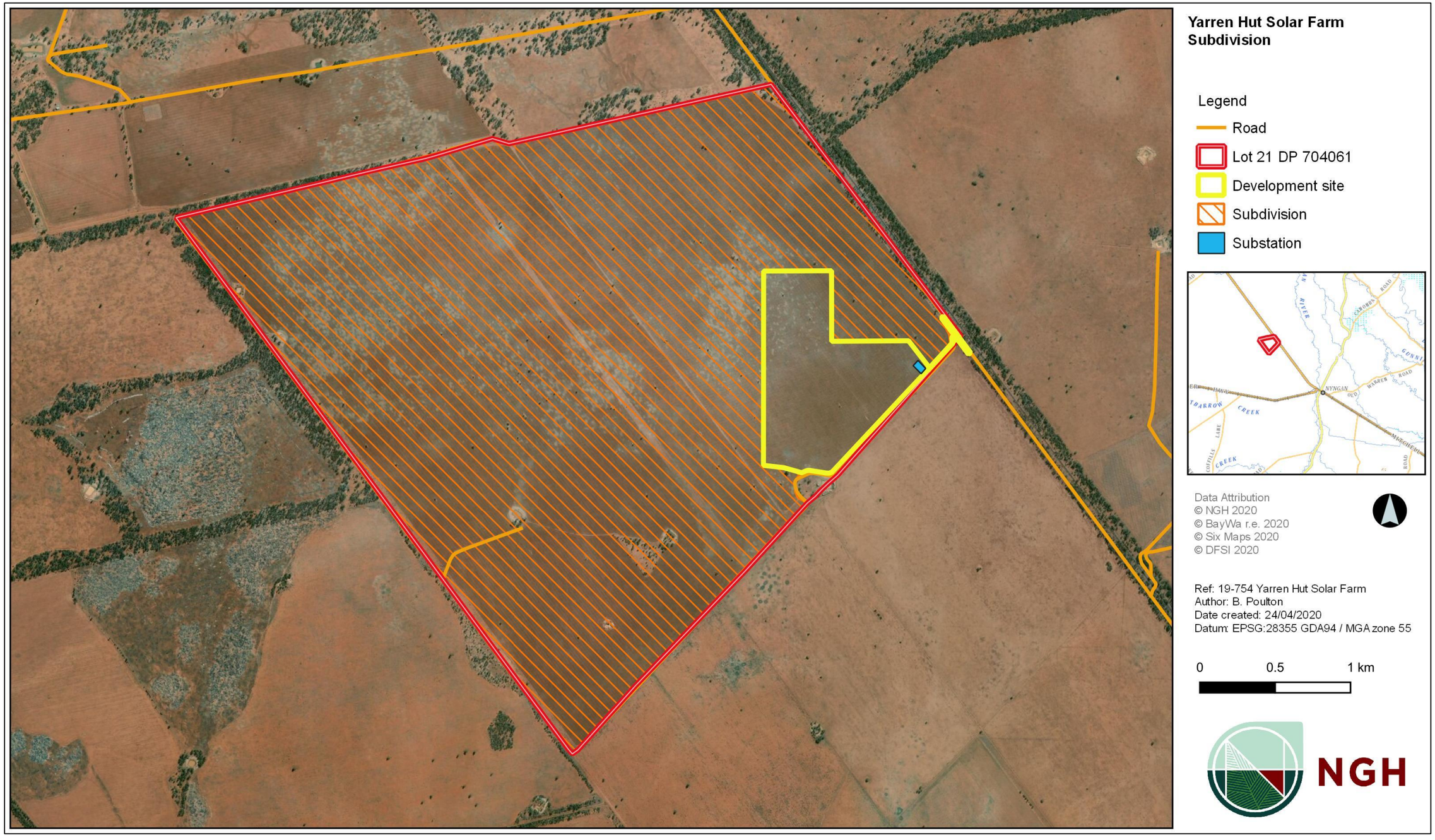

Figure 3-4 Proposed subdivision

3.6 PROPOSED INFRASTRUCTURE

The proposal involves the construction of a ground-mounted photovoltaic solar farm which would generate approximately 28 MW (AC) of renewable energy. The solar farm would connect (via the substation and transmission line) directly into the existing Essential Energy transmission line, which passes through the property.

The layout of the infrastructure components is shown on Figure 1-3 and the components are described in detail below. Indicative plans and drawings of infrastructure components are provided in C.2.6. The plans and specifications of the components are subject to detailed design and product selection which will occur pending project approval, when Engineering, Procurement and Construction contractors are appointed to the project.

3.6.1 Solar arrays

It is expected that the array would comprise approximately 84,000 single axis tracker or fixed PV solar panels mounted in rows on steel frames.

A tracker system would be selected for its high energy yield, lower installation cost and fewer moving parts compared to other systems.

If used, a single axis trackers would have a typical maximum height of 4 m, based on a 2 m vertical height panel and 1.5 m to 3 m high support posts. Row lengths would depend on the detailed design but could be up to 100 m. Spaces between rows (edges of panels) may vary between 5 m and 16 m.

Piles would be driven or screwed into the ground to support the solar array. The pile depth would be determined following detailed geotechnical site investigation; depths are typically 1.5 m to 2.5 m. Pile heights would vary according to topography and soil conditions.

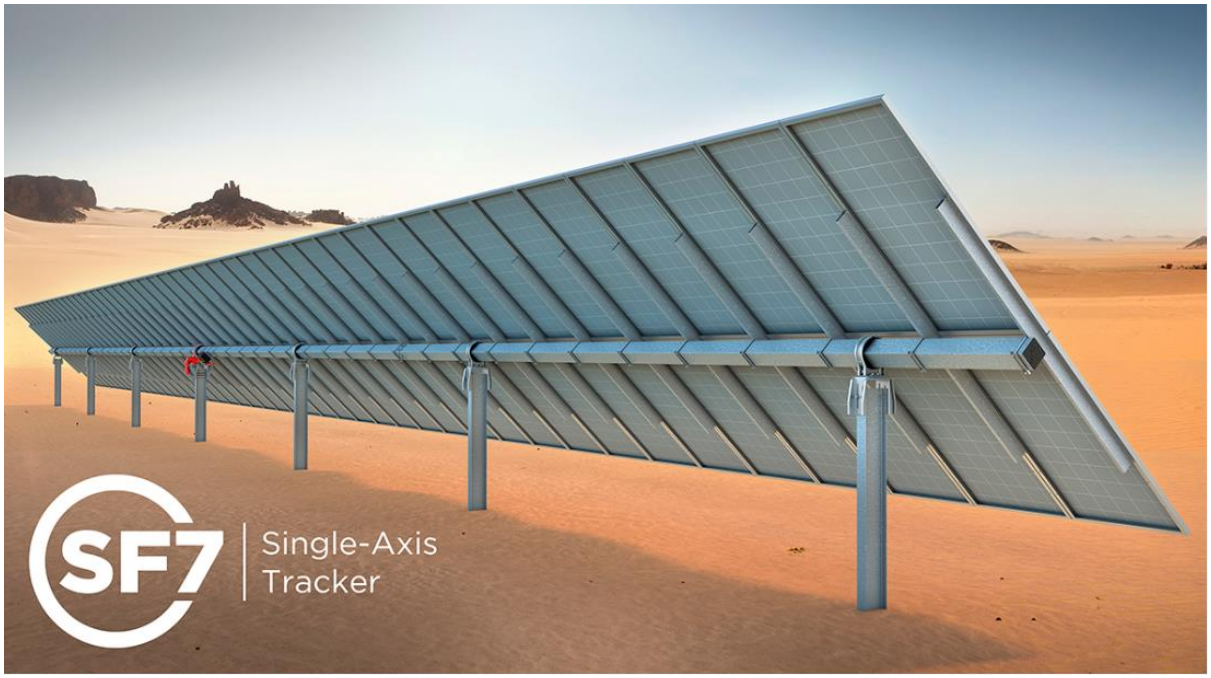

Figure 3-5 Example of single axis tracking system.

3.6.2 Inverter/transformers

Electricity generated by the panels would be in 1500 Vdc format from where it would flow to the 4 - 7 MW central inverter stations (7 - 8 across the site). C.2.6 provides diagrams of indicative inverter units and Figure 3-6 illustrates an example of the equipment within a solar array. The inverter units would be constructed on concrete footings approximately 100 mm above ground level.

At each central inverter site, the electrical current would be inverted to AC and then be transformed from 0.4 kV – 0.8 kV to 33 kV.

A ring main unit as part of the central inverter station would collect the 33 kV cables. From here the cables will be underground directly to the main 33 kV / 66 kV power transformer that forms part of the substation. Within the substation, the 33 kV power would be transformed up to 66 kV and exported to the wider sub-transmission network through a switching station owned by Essential Energy.

The proposal includes approximately 7 - 8 modular inverter units across the site (locations illustrated in Figure 3-3).

Power from the solar panels would generate direct current DC electricity that would be converted to AC via the inverter, with the voltages stepped up to 33 kV by the inverter station transformers.

The dimensions of these units would be approximately 3 m x 6.5 m with highs of approximately 4.5 m.

There would be one 66 kV power transformer located near the substation.

Figure 3-6 Indicative modular transformer

3.6.3 Overhead and underground cabling

Most cabling at the site would be buried. The only overhead cabling likely would be those at the sub-station and connection to the Essential Energy's sub-transmission powerline.

All underground cabling would be installed at a depth in accordance with the relevant Australian Standard.

Prior to excavating the cable trench, the topsoil would be stripped and stockpiled for use in rehabilitating the trench line. Depending on the quality of the excavated material, a loam mix may be used in the trench to create a cable bed. Once the cables are installed, another layer of loam mix may be placed above the cable prior to the trench being backfilled with excavated material, replacing the soil profile to assist revegetation of the disturbed areas. Cables would be protected in accordance with *Australian Standard (AS) 3000:2007 Electrical Installations*.

3.6.4 Transmission network connection

The solar farm would connect directly to the existing 66 kV overhead transmission line, which passes immediately northeast of the development site. The subdivision map (Figure 3-4) shows the location of the proposed substation, and connection point to the transmission network.

3.6.5 Substation

The substation will have a footprint of ~1 ha. Part of the substation i.e. the switching station with a footprint of ~0.4 ha will be owned by Essential Energy. The remaining substation assets including the power transformer will be owned by the proponent.

The switching station and over-head powerlines for connecting the switching station to the existing sub-transmission power-line will be assessed under a separate Review of Environmental Factors (REF) under Part 5 of the EP&A Act with Essential Energy as the determining authority. The switching station would be constructed to meet Essential Energy's Transmission and Zone Substation Design Guidelines (Essential Energy 2016). The remaining portion of the substation (to be owned by the proponent) is to be assessed under this EIS.

Design drawings for the proposed substation are provided in C.2.6. The substation power transformer would have an approximate height of 10 m.

The substation would be surrounded by a security fence. There would also be a fence within the substation separating the assets owned by Essential Energy and the proponent. Gravel hardstand would be placed under and around the substation compound to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards. The substation location is not impacted by flooding. The substation is expected to closely resemble the existing substation at Moree Solar Farm shown in Figure 3-7.

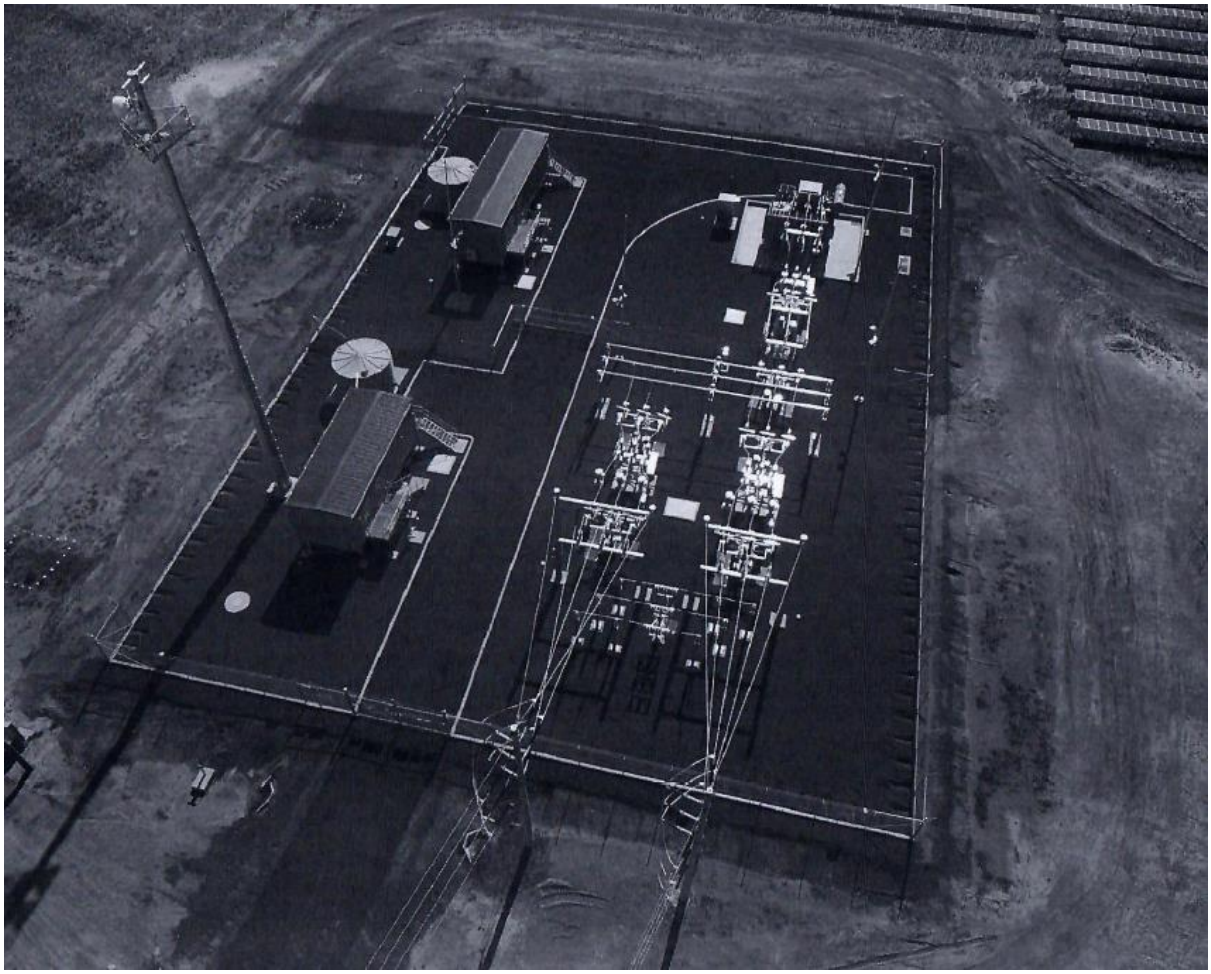

Figure 3-7 Indicative substation from Moree Solar Farm

3.6.6 Site access and internal tracks

The development site would be accessed from one entrance point on a private access track directly off Mitchell Highway approximately 17 km northwest of the Nyngan townsite. Substation access would be via the same private access track as the solar farm entrance. This access point would be used by both Essential Energy and the proponent. The location and form of the access road intersection would be developed to provide adequate sightlines for vehicles entering and exiting the access track on Mitchell Highway, in accordance with Austroads and TfNSW guidelines. An indicative design recommended by Amber is shown in Figure 3-8.

The main access and internal tracks would be constructed of engineered fill topped with crushed stone pavement. The internal roads would be approximately 3.5 m to 5 m width. The indicative locations of proposed internal tracks are shown on Figure 1-3 and Figure 3-3.

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

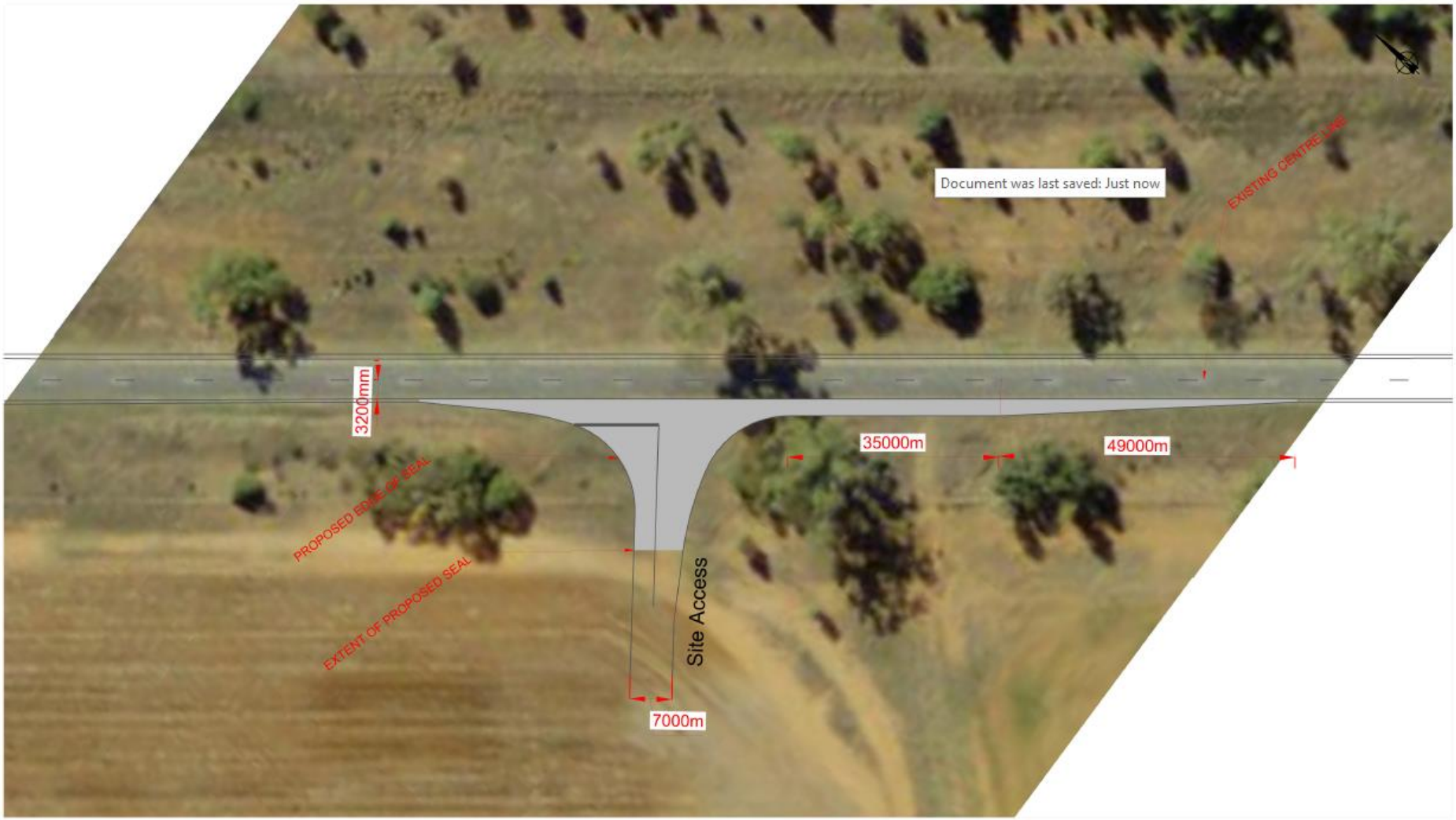

Figure 3-8 Access design recommended by Amber Organisation

3.6.7 Site office, switchroom, storage

The operation compound would comprise an administration office and reception would be located near the main access point at the north-eastern corner of the development site. Indicative designs for these buildings are provided in C.2.6. The office building and switchroom would contain essential fire safety equipment, including fire extinguishers and hose reels.

A single storey office building approximately 24.5 m x 12 m would be constructed for BayWa r.e. administration on concrete footings. The building would likely be clad in unobtrusive green/beige Colorbond sheeting. Guttering and a water tank would be installed to collect rainwater. The office building would contain an office and staff amenities (toilet, kitchen and storage). The switchroom would be a control room as shown in Figure 3-9.

Figure 3-9 Indicative switchroom

3.6.8 Security CCTV, lighting and fencing

CCTV

BayWa r.e. will procure a well-designed closed circuit television (CCTV) system that will deliver both high quality video surveillance as well as early detection of unauthorized entry to the solar farm associated compound area. Cameras will be installed alongside the perimeter monitoring the area between the fence line and the solar panels. If human movement is detected, a relay will be activated communicating to the 24-hour offsite security control room.

Along with this system, cameras and access controls will be installed at the office building and entry gate to protect against unauthorised access and provide video surveillance. All cameras that cover the perimeter are internet protocol (IP) rated and mounted on a 4 m high CCTV pole spaced between 200 m to 300 m apart and for every change of direction of fencing.

Lighting

Lighting across the development site would be reactive to prevent disrupting the rural nightscape largely devoid of light pollution and would be limited to the office building and other critical infrastructure. Lighting is expected to arise mainly from staff working in offices after nightfall, vehicles entering and leaving the proposal and external motion-sensing lighting provided for safety.

Lighting at the substation would be in accordance with Essential Energy's *Transmission and Zone Substation Design Guidelines*, which requires lights for:

- walking in open areas likely to be accessed.
- walking in closed or constrained areas (e.g. stairs).
- the substation security fence in areas unlikely to be accessed as a deterrent.

The switching station would be owned and operated by Essential Energy.

Fencing

The security fencing installed around the site would be approximately 2.4 m high, providing adequate access points for project maintenance, land management purposes and for emergency egress (C.2.6). An example of the security fencing installed is shown in Figure 3-10.

BayWa r.e. have committed that the top wire on their security fencing would be devoid of barbed wire to minimise harm to native fauna. Barbed wire would also be absent from internal stock fencing within the development site.

Security fencing would be installed surrounding and within the substation in accordance with Essential Energy's *Transmission and Zone Substation Design Guidelines*.

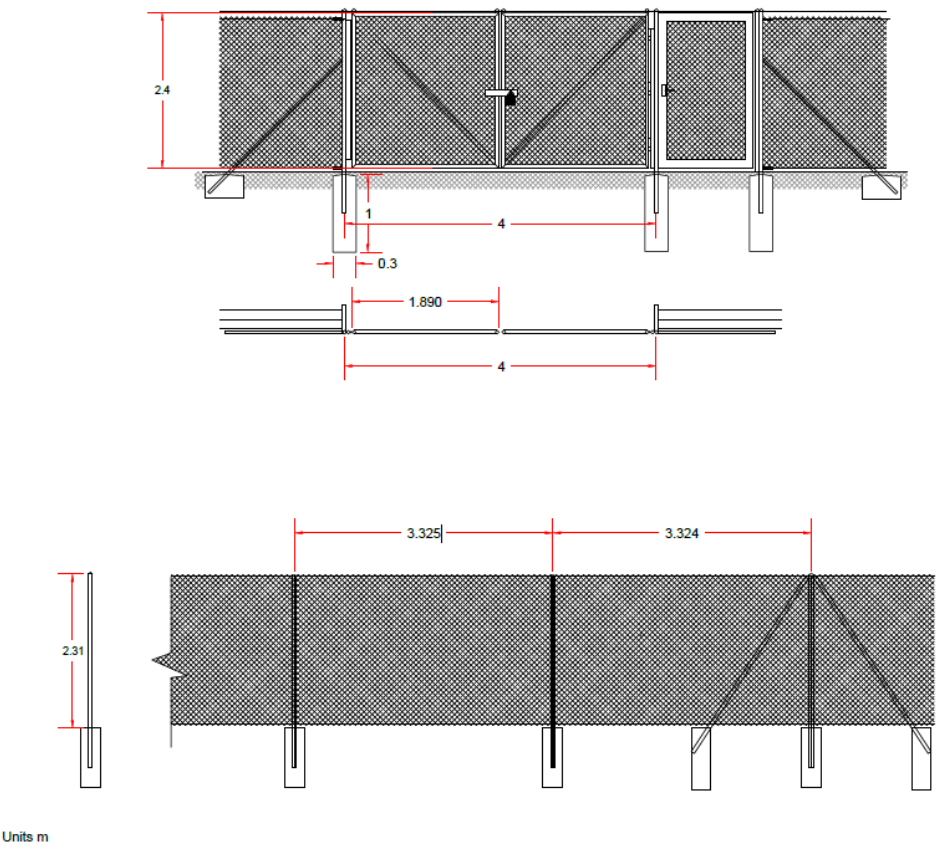

Figure 3-10 Indicative security fencing

3.6.9 Landscaping and revegetation

Landscaping and screen planting would be undertaken along sections of the perimeter of the site to 'break up' or 'soften' views of the infrastructure from Mitchell Highway and the private access track to the site. This would entail 5 m wide vegetation buffers of planted native species to break up views of the infrastructure. Native tree and shrub species suited to site conditions would be selected to enhance local biodiversity to achieve effective screening of the solar farm infrastructure. Proposed screening options, developed in consultation with adjoining landholders, are presented in the Indicative Landscape Plan shown in section 6.2.

The solar array would be mounted above ground and would enable groundcover species to persist during operation. Suitable perennial groundcover would be maintained beneath the panels and grazed to reduce biomass for bushfire management. Sheep grazing would also maximise efficient use of the land meaning that the development site would be used for livestock and energy generation, retaining a contribution to the local agricultural economy. Groundcover grass species would be selected which are tolerant of limited shading conditions and suitable for the soil type and climate at the proposal site.

The 10 m minimum bushfire protection setback from solar farm infrastructure would be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm, as well as remnant woodland vegetation, in accordance with Planning for Bushfire Protection guidelines (RFS, 2019). The setback area may include a 3.5 m - 5 m wide (plus shoulders and required drainage) perimeter access track.

Areas disturbed during the construction phase would be stabilised and revegetated with suitable perennial grass species immediately following construction.

3.6.10 Temporary construction facilities

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

- Material laydown areas.
- Temporary construction site office.
- Temporary car and bus parking areas for construction workers.
- Staff amenities (kitchen and toilet/s).
- Temporary security lighting and CCTV at construction compound.
- Containers for the use of subcontractors.
- Bunded area for refuelling.
- Storage area.
- Generator for construction compound power supply.
- Skips with wind shield and lid.

A hardstand area in the compound would consist of compacted stone to provide a clean, firm, level and free draining surface suitable for cabins and heavy traffic. Temporary staff amenities would be designed to accommodate the number of workers at the peak of the construction period (estimated at 40 workers).

3.7 CONSTRUCTION

3.7.1 Construction activities

The construction phase is expected to last approximately 10 months with a peak construction period of five months. The main construction activities would include:

- Site establishment and preparation for construction - fencing, ground preparation, construction of the internal track system, upgrade of existing access points/intersections, preliminary civil works and drainage.
- Installation of steel post and framing system for the solar panels.

- Installation of underground cabling (trenching) and installation of inverter stations.
- Installation of PV panels.
- Construction of office building and switchrooms.
- Construction of the substation and connections.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.
- Landscaping.

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently. Temporary construction facilities would be situated predominantly at the north eastern corner of the development site (Figure 1-3).

3.7.2 Site preparation and earthworks

Soils within the development envelope, which have been showing to have agricultural limitations, have been highly modified by decades of farming activities including regular cropping. Ground disturbance resulting from earthworks associated with the proposal would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of 1.5 m – 2.5 m.
- Construction of internal access tracks and access points and associated drainage.
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and O&M storage facilities.
- Cable trenches up to 1500 mm deep.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing and CCTV.

Topsoil under the footprint of the array area would remain in-situ during the construction of the solar farm. Topsoil salvaged from the construction of the access tracks and other works would be securely stored for use in site rehabilitation.

The development site is currently largely devoid of groundcover. Establishing native perennial groundcover prior to construction would reduce the risk of erosion and would also benefit local biodiversity. Where required, weed treatments would be undertaken prior to earthworks commencing to reduce the potential spread of these species within the development site

3.7.3 Materials and resources

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

Labour, machinery and equipment

It is anticipated that approximately 40 construction personnel would be required onsite during the peak construction period of five months. Construction supervisors and the construction labour force, made up of labourers and technicians, would be hired locally where possible.

It is anticipated that most workers would be local, and those who were not would use existing accommodation within Nyngan and the surrounding region. It is proposed that bus transfers will be provided (where practicable) to minimise traffic volumes and transit risks during construction.

Equipment used during construction would include:

- Earth-moving equipment for civil works (excavators, graders).
- Small piling or drilling rigs for installation of the posts of the solar arrays.
- Diesel generators.
- Trucks.
- Light vehicles.

- Large transit vehicles, including delivery and waste removal vehicles.
- Forklifts.
- Cable trencher or excavator.
- Cable laying equipment.
- Cranes including 50 T mobile crane.

Materials

Construction materials would be sourced as locally as possible. Dubbo is the nearest large town which is a possible source of the bulk of the aggregate material required for construction, followed by Nyngan, Bourke and Gilgandra.

Approximately 2,000 m^3 of gravel would be required to surface the access road and internal service track network, inverter areas and substation hardstand. Loam mix may be required for the bedding of underground cables, depending on electrical design and ground conditions. Concrete would be required for all infrastructure footings including inverters, the substation and CCTV footings, fencepost fittings and the site office.

Approximately 3,500 kL of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, onsite amenities and landscaping. The bulk of this water would be trucked in from a Bogan Shire standpipe in consultation with Council.

A small amount of potable (drinking) water would be used onsite during the construction period on an as needs basis and stored within temporary water tanks at the staff amenities area.

3.7.4 Transport and access

Haulage route

Where possible, goods and services for the solar farm would be sourced locally. Items such as solar panels, posts and racking systems which can't be sourced locally would likely come by road from Melbourne or Sydney. Construction traffic would access the site from the access point of Mitchell Highway. The final haulage route and movement number would be further detailed in the Traffic Management Plan that would be prepared by the appointed contractor as part of pre-mobilisation works.

Access from Mitchell Highway

Austroads (2017) *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings* specifies the turning treatment required at intersections. Based on traffic volumes and existing speeds along Mitchell Highway, a Basic Left Turn (BAL) treatment is required at the intersection of Mitchell Highway and the private access track. The configuration includes a lane extension and tapers on the approach from Nyngan on the Mitchell Highway. No further intersection treatment is required to accommodate the proposed increase in heavy vehicle movements. Figure 3-11 shows the proposed intersection based on a 30 m long A-Double vehicle and was created using a software called 'AutoTurn'.

Road condition surveys

Prior to construction, a pre-condition survey of the relevant sections of the existing road network would be undertaken, in consultation with TfNSW. During construction the sections of the road network utilised by the proposal would be monitored and maintained to ensure continued safe use by all road users. At the end of construction, a post-condition survey would be undertaken to ensure the road network is left in the consistent condition as at the start of construction.

Traffic movements

Construction activities would typically be undertaken during standard daytime construction hours. Any construction outside of the normal working hours would be undertaken with approval from relevant

authorities. Traffic movements for light and heavy vehicle during the construction period, with mitigation measures manage impacts on the local road network are provided in section 6.6.

Water for dust suppression will be obtained from a Council standpipe in Nyngan. Heavy vehicle movements associated with this have been accounted for within the Traffic Impact Assessment.

Figure 3-11 Swept path analysis turning left out of Mitchell Highway

3.7.5 Work hours

Construction activities would predominantly be undertaken during standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays). Any construction outside of these normal or agreed working hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g. to make work safe.

3.8 OPERATION

3.8.1 Operation activities

Operation activities would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays, as required.
- Routine visual inspections, general maintenance and cleaning operations of the substation, as required.
- Vegetation management, likely using sheep to control grass growth beneath the panels. Groundcover vegetation would be maintained over the site to minimise erosion, dust and weeds. Groundcover would be monitored and remediation (such as reseeding, soil protection or destocking) undertaken as required.
- Site security response (24 hr), if required.
- Site operational response (24 hr), if required.
- Replacement of equipment and infrastructure, as required.
- Maintenance of landscaping and screening plantings, as required.
- Pest plant and animal control, as required.

3.8.2 Materials and resources

During operation, potable water would be required for cleaning panels and watering livestock. Around 60 kL per year would be required for cleaning, sourced from standpipes and tankered to the site when required. Approximately 5 kL of water may be required per year for watering plants within the vegetation screening. However, watering is very rarely carried out or required due to the Nyngan region attracting more rain than other localised areas and if planting occurs in late winter/early spring. This coupled with good site preparation means the need for watering can be significantly reduced or eliminated altogether.

A steel or concrete tank would be installed at the site to store water for bushfire protection and other non-potable water uses, with a minimum of 20,000 L reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rainwater collected from tanks beside site buildings.

3.8.3 Personnel and work hours

The solar farm would be monitored and operated by one or two full time equivalent (FTE) employees.

The majority of plant maintenance including inverter station, transformer and HV switchgear, PV arrays, ground and vegetation and the trackers would be conducted by site staff on a rolling basis with activities scheduled consistently throughout the year.

3.8.4 Transport and access

Staff and service contractors would primarily use light vehicles (4WD) during the operation phase. Trucks would be infrequent.

Traffic associated with the operation and maintenance of the solar farm would also use the routes specified for the construction phase (refer section 3.7.4).

3.8.5 Refurbishment and upgrading

The solar farm operator may replace or upgrade solar panels or other infrastructure within the existing development footprint during the projected 50-year life of the solar farm. If any major upgrade works during the life of the solar farm would extend beyond the existing impact footprint or alter the nature or scale of environmental impacts, the proponent will consult DPIE regarding the need for further assessment or approval. The proponent would also consult DPIE regarding the need for further assessment and approval to continue the operation of the solar farm beyond the 50-year timeframe.

3.9 DECOMMISSIONING AND REHABILITATION

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

3.9.1 RDMP objectives

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

- Identifying the final land use following decommissioning of the proposal with the landowner.
- Providing a description of the decommissioning process and how it would be integrated with rehabilitation.
- Identifying a benchmark site that is used to determine realistic performance criteria.
- Including a timeline for rehabilitation activities.
- Outlining a program for monitoring rehabilitation success using appropriate indicators.

3.9.2 Timeline and methodology

Certain infrastructure, such as tracks, may be retained by mutual agreement with the landowner at the time of decommissioning, as they may be of value to ongoing agricultural activities. Other examples may include site fencing, vegetative buffers, operation and maintenance buildings.

Typically, the reclamation of the proposal proceeds in reverse order of installation. All above and below ground infrastructure would be removed. Key elements of decommissioning would include:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse wherever possible.
- All site amenities and equipment would be removed including buildings, inverter stations and materials recycled or reused wherever possible.
- Posts and cabling would be removed and recycled.
- Fencing would be removed including small concrete footings.
- Gravel pavement materials will be recovered and recycled as general fill in an appropriate location.
- Soil remediation treatments would be applied as required, for example, sodic soil would be treated as necessary with lime or gypsum. Areas subject to compaction will have the topsoil ripped to a depth suitable for seeding, if appropriate.
- Disturbed areas would be seeded, in consultation with the landowner.

The RDMP would reference:

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

Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase. Wherever possible and practicable, materials removed from the site would be either re-used or recycled (for example, some internal access is likely to be retained). A Decommissioning Traffic Management Plan would be captured as part of the RDMP.

3.10 INDICATIVE TIMELINE

An indicative timeline for the proposal is outlined in Table 3-3. It is expected that the solar farm would be commissioned at the end of the 5 - 10 month construction period.

Table 3-3 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	Q3 2021	5 - 10 months
Operation	Q1 / Q2 2022	50 years
Decommissioning	Q1 / Q2 2072	6 months

3.11 CAPITAL INVESTMENT

The proposal would have an estimated capital investment of approximately $42 million.

4 PLANNING CONTEXT

4.1 PERMISSIBILITY

The proposed development is defined as electricity generating works and is permissible with consent under clause 34(1) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP). Consent may be granted under Part 4 of the EP&A Act.

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) declares the proposal to be SSD as it is development for electricity generating works with a capital cost of greater than $30 million (clause 20, Schedule 1).

Section 4.12 (formerly section 78A) of the EP&A Act requires a development application for SSD to be accompanied by an EIS prepared in accordance with the EP&A Regulation. This EIS has been prepared in accordance with Part 4 of EP&A Act and Schedule 2 of the EP&A Regulation.

4.2 NSW LEGISLATION

4.2.1 Environmental Planning and Assessment Act 1979

Objects

Development in NSW is subject to the requirements of the EP&A Act and the EP&A Regulation. Environmental planning instruments prepared under the Act set the framework for development approval in NSW.

The proposal would be assessed under Part 4 of the EP&A Act. The objects of the EP&A Act are:

> *(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.*
>
> *(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.*
>
> *(c) to promote the orderly and economic use and development of land.*
>
> *(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.*
>
> *(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).*
>
> *(g) to promote good design and amenity of the built environment.*
>
> *(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.*
>
> *(j) to provide increased opportunity for community participation in environmental planning and assessment.*

The objects of the EP&A Act have been considered throughout this environmental assessment and natural resources and competing land uses have been considered. The proposal aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The proposal has been located and designed so that it would avoid native vegetation as much as possible and minimise the use of natural and artificial resources while considering the social and economic

welfare of the local community. For these reasons it is considered that the proposal is consistent with the objects of the EP&A Act.

Matters for consideration

Section 4.40 (formerly section 89H) of the EP&A Act provides that section 4.15 (formerly section 79C) applies to the determination of DAs for SSD. Under section 4.15 of the EP&A Act, the consent authority is required to consider several matters when determining a DA under Part 4. These matters are listed in Table 4-1 and assessed in terms of their relevance to the proposal.

Table 4-1 Matters of consideration under the EP&A Act.

Provision	Relevance to the proposal
Any environmental planning instrument	Relevant Environmental Planning Instruments (EPIs) are discussed in section 4.2.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority	There are no draft instruments relevant to the proposal.
Any development control plan (DCP)	The Bogan Shire Council Development Control Plan 2012 details local controls on industrial and commercial developments such as design, setbacks, parking and access, and landscaping controls. However, under clause 11 of the SRD SEPP provides that DCPs do not apply to SSD.
Any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	BayWa-r.e. has entered into discussion with Bogan Shire Council regarding a voluntary planning agreement (
The regulations (to the extent that they prescribe matters for consideration)	Clause 92 of the EP&A Regulation requires consideration of: • The Government Coastal Policy, for development applications in certain local government areas. • The provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters are relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates	Repealed and no longer applicable.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in sections 6.4 and 6.9 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have been avoided or minimized through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development	The suitability of the site for the development is assessed in section 2.5. Characteristics that make it suitable for development of a solar farm are identified and justified.

Provision	Relevance to the proposal
Any submissions made in accordance with the EP&A Act or the regulations	Feedback and direction from the public during the preparation of the EIS to maximise opportunities for public engagement has been undertaken, as set out in section 5.3. Public submissions would be sought and responded to as part of the EIS determination process. The proponent would consider and respond to any submissions made in relation to the proposal in a Submissions Report or Preferred Project Report following the public exhibition period.
The public interest	A number of public benefits are relevant to the proposal as discussed in section 2.2. Specifically, these relate to: • Reducing fossil fuel emissions that contribute to climate change. • Meeting State and Australian Government policies to increase renewable energy supply. • Providing local employment and regional development opportunities.

4.2.2 Environmental Planning and Assessment Regulation 2000

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

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

4.2.3 Bogan Local Environmental Plan 2011

The development area is located within Bogan LGA and is subject to the provisions of the Bogan LEP.

(2) The particular aims of this Plan are:

(a) to protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources,

(b) to encourage a range of development, including housing, employment, recreation and community facilities, to meet the needs of existing and future residents of Bogan,

(c) to promote the efficient and equitable provision of public services, infrastructure and amenities.

It is considered that the proposal is compatible with the aims of the Bogan LEP, particularly with regard to conserving agricultural land and promoting efficient and equitable provision of public infrastructure.

Regarding natural resources, the proposal is not located within land zoned as water sensitive under the Bogan LEP. The northern corner of the subject land is mapped as biodiversity sensitive in the Bogan LEP; however, the proposed development footprint avoids this area.

Land zoning

The development area is zoned RU1 Primary Production under the Bogan LEP. Electricity generating works is not listed among developments that are permitted within the zone. However, the ISEPP takes precedence over an LEP and permits electricity generating works with consent in the RU1 zone. The SRD SEPP provides for the declaration of SSD and declares that the Independent Planning Commission (IPC) is the consent authority for certain SSD (see below).

The Bogan LEP states that the consent authority must have regard to the objectives for development in a zone when determining a development application. The objectives of the RU1 zone are:

- Encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- Encourage diversity in primary industry enterprises and systems appropriate for the area.
- Minimise the fragmentation and alienation of resource lands.
- Minimise conflict between land uses within this zone and land uses within adjoining zones.

The proposal would have negligible impact on primary industry production within the Bogan LGA. The degree of permanent land disturbance as a result of construction and operation of the solar farm is small and would not result in fragmentation and alienation of resource lands. Some agricultural activity is still possible whilst the solar farm is operating (e.g. grazing), and it is likely that agricultural activities that occurred before solar farm construction would resume once the solar farm is decommissioned and infrastructure removed. By maintaining a degree of shading and establishing perennial pasture across the site, soil properties are highly likely to improve, and dust and erosion reduced, as a consequence of the proposal.

4.2.4 Development Control Plans and Council policies

The Bogan DCP applies to all land within the LGA of Bogan Shire. Step 2: Type of development, of the DCP details design requirements for industrial developments relating to setbacks, fencing, traffic and access, landscaping, lighting, noise, signage and parking.

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

4.2.5 State Environmental Planning Policy (Infrastructure) 2007

The ISEPP was introduced to facilitate the effective delivery of infrastructure across the State by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW.

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

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

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

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

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

The aims of the SRD SEPP are to identify development that is SSD and SRD.

State Significant Development

Clause 8 of the SRD SEPP provides that development is declared to be SSD for the purposes of the EP&A Act if:

- *the development is not permissible without consent under Part 4 of the EP&A Act.*
- *the development is specified in Schedule 1 or 2 of the SRD SEPP.*

Clause 20 of Schedule 1 of the SRD SEPP includes:

> *"Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*
>
> *(a) has a capital investment value of more than $30 million.*

The proposal has an estimated capital investment value of approximately $42 million, therefore the proposal is classified as SSD under Part 4 of the EP&A Act.

4.2.7 State Environmental Planning Policy No. 55 – Remediation of Land

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

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

A search of the NSW Environment Protection Authority (EPA) contaminated land public record (NSW EPA 2018) was undertaken for contaminated sites within the Bogan LGA on 28 November 2019. The research returned no results for contaminated land within the Bogan LGA.

The risk that contamination associated with agricultural activities (e.g. pesticides) could be present on the site is considered to be low and no evidence of contamination was observed during the site assessment.

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

SEPP 33 defines and regulates the assessment and approval of potentially hazardous or offensive development. The SEPP defines 'potentially hazardous industry' as:

> *"…development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*
>
> *(a) to human health, life or property, or*
>
> *(b) to the biophysical environment,*
>
> *and includes a hazardous industry and a hazardous storage establishment"*

'Potentially offensive industry' defined as:

> *…a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

SEPP 33 provides for systematic assessment of potentially hazardous and offensive development for the purpose of industry or storage. For development proposals classified as 'potentially hazardous

industry' the policy requires a preliminary hazard analysis (PHA) to determine risks to people, property and the environment.

A checklist and a risk screening procedure developed by DPIE is used to help determine whether a development is considered potentially hazardous industry (DoP, 2011). Appendix 3 of the *Applying SEPP 33* guidelines lists industries that may fall within SEPP 33; the lists do not include solar farms and energy storage facilities. The hazardous development status of the proposal is assessed in section 7.4.

A preliminary risk screening in accordance with SEPP 33 was undertaken and determined based on site-specific hazard mitigation measures that the proposal was not potentially hazardous. Therefore, a PHA was not completed (refer section 7.4).

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

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

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

(a) to facilitate the orderly economic use and development of lands for primary production.
(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources.
(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations.
(d) to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts.
(e) to encourage sustainable agriculture, including sustainable aquaculture.
(f) to require consideration of the effects of all proposed development in the State on oyster aquaculture.
(g) to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.

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

(a) to identify State significant agricultural land and to provide for the carrying out of development on that land,
(b) to provide for the protection of agricultural land:
i. that is of State or regional agricultural significance, and
ii. that may be subject to demand for uses that are not compatible with agriculture, and
iii. if the protection will result in a public benefit.

Land that is considered State Significant Agricultural Land is listed in Schedule 1 of the Primary Production SEPP. Schedule 1 of the SEPP is currently incomplete/blank, with mapping yet to be completed or publicly available (DPE *pers. comm.,* 12/06/19). The proposal is compatible with the aims of the Primary Production SEPP, as it would not entirely remove the development site from agricultural land use, with sheep grazing persist under the solar panels during operation, nor does the proposal permanently divert the land from future cropping, as the development site would eventually be returned to the landowner following decommissioning.

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

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

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

The proposal has not been identified as BSAL.

4.2.11 Protection of the Environment Operations Act 1997

The POEO Act is administered by the NSW EPA.

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

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

The works would not generate more than 30 MW of electrical power. Accordingly, an EPL is not required under the POEO Act for the proposal.

Sections 143 and 145 of the POEO Act also creates offences relating to pollution and the transport and disposal of waste and imposes a duty on the occupier of a site to notify certain 'pollution incidents.' The proponent must comply with the POEO Act in carrying out the proposal.

4.2.12 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads.

Any work within the road reserve, such as upgrades that interfere with the structure of the road, require consent from the road authority under section 138 of the Roads Act. TfNSW is the roads authority for Mitchell Highway, being the major access route to the area.

Section 138 consent would be required to upgrade the access point upgrade off Mitchell Highway.

4.2.13 Crown Lands Management Act 2016

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

The development site comprises privately owned farmland, which would be leased for the life of the proposal. Planning portal mapping shows Crown Roads in close proximity to the western and northern corners of the subject land but these would not be intersected or utilised by the proposal.

4.2.14 Water Management Act 2000

The *Water Management Act 2000* (WM Act), currently administered by the Department of Industry (Water), is progressively being implemented throughout NSW to manage water resources. The aim of the WM Act is to ensure that water resources are conserved and properly managed for sustainable use benefiting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

Water demand for the proposal would be relatively small, as construction of the solar farm is not water intensive. No surface or groundwater extraction of water is required. As such, water sources specified under the WM Act are not required.

4.2.15 Fisheries Management Act 1994

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

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

4.2.16 National Parks and Wildlife Act 1974

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

The provisions of the NPW Act have been considered for the proposal. The proposal area is not located within 5 km of any nature reserve or forest protected under the NPW Act (Figure 4-1), thus no impact on these areas are expected.

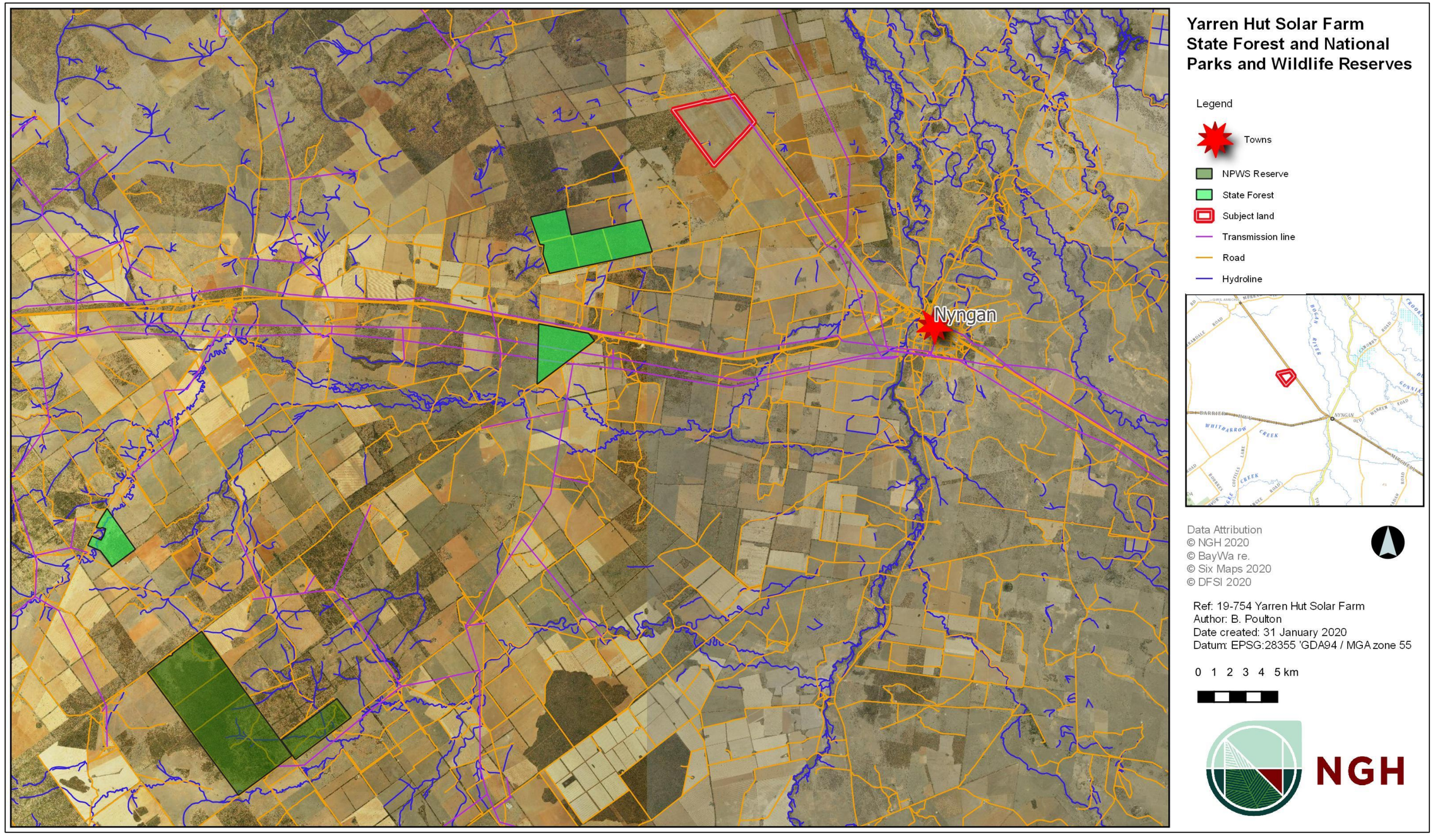

Figure 4-1 State Forests / reserves within 10 km of the proposal

An assessment of impacts to Aboriginal heritage is provided in section 6.9 and Appendix E. It is noted that under section 89J(d) of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for SSD.

4.2.17 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to conserve heritage values. The Heritage Act defines 'environmental heritage' as those places, buildings, works, relics, moveable objects and precincts listed in the Local or State Heritage Significance. A property is a heritage item if it is listed in the heritage schedule of the local Council's Local Environmental Plan or listed on the State Heritage Register, a register of places and items of particular importance to the people of NSW.

No relics or other items protected under the Heritage Act were located on the development site. Four Aboriginal sites were recorded within 10 km of the development site according to a search of the AHIMS (Aboriginal Heritage Information Management System) website. The closest site of State significance is located approximately 17 km south east of the proposal area in the town of Nyngan. No other items were located within 10 km of the development site.

Section 146 of the Heritage Act requires any person who believes they have discovered or located a relic (in any circumstances) to notify the NSW Heritage Council.

4.2.18 Biosecurity Act 2015

The objects of the *Biosecurity Act 2015* (Biosecurity Act) are:

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

The proponent as a land manager would comply with the general biosecurity duties under the Biosecurity Act through management of on-site weeds and pests.

Prior to commencement of each phase, a weed management procedure would be developed as part of the Biodiversity Management Plan for the proposal to prevent and minimise the spread of weeds. This would include management protocol for declared priority weeds under the Biosecurity Act during construction, operation and decommissioning stages, and weed hygiene protocol in relation to plant, machinery, and fill. Weed and pest management is addressed in section 6.9.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can also potentially increase the risk of pest animals at the development site (mostly cat and fox). A pest management procedure would be developed and implemented by the proponent as part of a wider district baiting program where practicable.

4.2.19 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) establishes a new regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments. The BC Act contains provisions relating to flora and fauna protection, threatened species and ecological communities listing and assessment, a biodiversity offsets scheme (BOS), a single biodiversity assessment method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The BC Act is supported by the *Biodiversity Conservation Regulation 2017*.

Section 7.9(2) states that SSD development applications must be accompanied by a Biodiversity Development Assessment Report (BDAR) prepared in accordance with the BAM, unless the Secretary and Chief Executive of the OEH have determined that the proposed development is not likely to have any significant impact on biodiversity values. A BDAR has been prepared as part of this EIS (Appendix F) and is summarised in section 6.9.

4.2.20 Conveyancing Act 1919

The purpose of the *Conveyancing Act 1919* (Conveyancing Act) is to amend and consolidate the law of property and to simplify and improve the practice of conveyancing, and for such purposes to amend certain Acts relating thereto.

The subject land will be leased from one private landowner. When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under s.7A *Conveyancing Act 1919* (NSW) (formerly s.327A *Local Government Act 1919* now repealed) is required when the total of the original term of the lease, together with any option for renewal, is more than five years.

A portion on the north east corner of Lot 21 DP 704061 (as shown in Figure 3-4) would be leased under an arrangement between the landholder and the proponent for a period for the life of the proposal. A small subdivision for the purpose of the switching station which is to be built by the proponent and transferred to Essential Energy.

4.2.21 Waste Avoidance and Resource Recovery Act 2001

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

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

Adopting the above principles would encourage the most efficient use of resources and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development (section 4.4.1).

4.3 COMMONWEALTH LEGISLATION

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

The EPBC Act identifies nine MNES:

- World heritage properties.
- National heritage places.
- Ramsar wetlands of international significance.
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water source, in relation to coal steam gas development and large coal mining development.

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

A search of the Commonwealth Protected Matters Search Tool on 25 November 2019 indicated that there are no World Heritage Properties or National Heritage Places within the proposal area. Search results listed three Wetlands of International Importance (Ramsar) that are either known to occur or have potential to occur within 10 km of the proposal site (including Banrock station wetland complex, Riverland, and the Coorong and lakes Alexandrina and albert wetland). Section 6.2 discusses the results of searches in relation to threatened species, ecological communities and migratory species. Table 4-2, Table 4-3 and Table 4-4 summarises the results of the searches.

Table 4-2 Summary of Matters of National Environmental Significance (10 km search radius)

Matters of National Environmental Significance	Addressed in this EIS
World Heritage Properties	N/A
National Heritage Places	N/A
Wetlands of International Significance	Section 6.9 and Appendix F
Great Barrier Reef Marine Park	N/A
Commonwealth Marine Areas	N/A
Threatened Ecological Communities	Section 6.9 and Appendix F
Threatened Species	Section 6.9 and Appendix F
Migratory Species	Section 6.9 and Appendix F

Table 4-3 Summary of other matters protected by the EPBC Act (10 km search radius)

Other Matters Protected by the EPBC Act	Addressed in this EIS
Commonwealth Lands	N/A
Commonwealth Heritage Places	N/A
Listed Marine Species	13
Whales and Other Cetaceans	N/A
Critical Habitats	N/A
Commonwealth Reserves	N/A

Table 4-4 Summary extra information (10 km search radius)

Extra Information	Addressed in this EIS
State and Territory Reserves	N/A
Regional Forest Agreements	N/A
Invasive Species	20
Nationally Important Wetlands	N/A

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in the Biodiversity section (section 6.9) and the BDAR in Appendix F. A significant impact to any of these entities is considered highly unlikely and the proposed activity is considered highly unlikely to be a controlled action.

No other matter of national environmental significance would be affected by the proposed activity.

4.3.2 Native Title Act 1993

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

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

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests, and public reserves.
- Some types of pastoral lease.

- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the Register of Native Title Claims completed on 25 November 2019 did not indicate any native title claims, land use agreements, applications or determinations within the development site.

4.3.3 Renewable Energy (Electricity) Act 2000

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

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

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

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

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

4.3.4 Hazardous Waste (Regulation of Exports and Imports) Act 1989

The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Hazardous Waste Act) regulates the export, import and transit of hazardous waste to ensure humans and the environment are protected from the harmful effects of hazardous wastes. Pursuant to section 40 of the Hazardous Waste Act, *"A person must not export hazardous waste unless:*

(a) the person is the holder of an export permit authorising the person to export the waste; or
(b) the person is the holder of a transit permit authorising the person to export the waste; or
(c) the export has been ordered under section 34 or 35A."

Presently, there is no plan to establish a battery storage facility as part of the proposal. Should this change in the future, a modification would be sought addressing the handling and disposal of hazardous waste in accordance with the Hazardous Waste Act.

4.4 OTHER RELEVANT POLICIES AND MATTERS

4.4.1 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all State and Territory Governments endorsed the *National Strategy for Ecologically Sustainable Development*.

In NSW, the concept has been incorporated in legislation such as the EP&A Act and EP&A Regulation. For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline principles which can be used to achieve ESD. These principles are presented below along with a description of how the proposal and this EIS have considered each principle.

a) *The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

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

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

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

b) *Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Potential impacts of the proposal are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. The proposal is considered to be highly reversable in terms of protecting the natural values of the site. Importantly, the proposal provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing carbon emissions intensity of electricity generation.

c) *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*

The impacts of the proposal on biodiversity have been assessed in detail in section 6.9. The proposal includes measures to minimise impact on biodiversity including avoidance of higher conservation value areas where possible and management measures to minimise, manage and offset residual impacts. The impacts are considered to have been reduced as much as possible in this context and is justifiable.

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

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

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

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

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

The aims, structure and content of this EIS have incorporated the principles of ESD. The mitigation measures in section 8.2 set out an auditable environmental management commitment by the proponent.

Based on the social and environmental benefits generated by the proposal at a local and regional level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of ESD and is justifiable.

4.4.2 NSW Large-scale Solar Energy Guideline for State Significant Development

The *NSW Large-scale Solar Energy Guideline for State Significant Development* provides the proponent and regulators with general guidance on the planning framework for the assessment and determination of state significant large-scale solar energy projects under the EP&A Act.

The objectives of the *NSW Large-scale Solar Energy Guideline for State Significant Development* are to:

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

The proposal has addressed the requirements of the *NSW Large-scale Solar Energy Guideline for State Significant Development* through the assessment of environmental impacts (section 6), site suitability (section 2.5), community and agency consultation (section 5.1) and policy and framework requirements (section 4).

4.4.3 NSW Central West and Orana Regional Plan 2036

The NSW Central West and Orana Regional Plan 2036 aims to meet the needs of changing communities, particularly for the ageing population, by promoting greater housing choices, improved housing affordability, access to health and education services and public and community transport (DPE, 2019).

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

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

Table 4-5 Directions, actions and consideration of the NSW Central West and Orana Regional Plan 2036

Goal 1: Direction and Actions	EIS Consideration
Direction 1: Protect the region's diverse and productive agricultural land 1.1 Release a regional agricultural development strategy that: • maps important agricultural land. • identifies emerging opportunities for agriculture. • sets the direction for local planning of agricultural development. 1.2 Protect important agricultural land from land use conflict and	The DPIE is conducting a 3-year program to map and recognise important agricultural land. The significance of the land has been assessed under the Primary Production SEPP 2019, the former Rural Lands SEPP 2008, the Mining SEPP 2007 and the Land and Soil Capability (LSC) Scheme. It has been determined that the land is not classified as significant under the relevant SEPPs, and as Class 4 under the LSC Scheme. Use of the subject land for the proposal will not cause conflict or fragment the landscape, given that agricultural

Goal 1: Direction and Actions	EIS Consideration
fragmentation and manage the interface between important agricultural lands and other land uses. 1.3 Implement the NSW Government's Agriculture Industry Action Plan – Primed for growth: Investing locally, connecting globally. 1.4 Undertake biosecurity risk assessments, taking into account biosecurity plans and the need for appropriate buffer areas.	activities in the form of grazing can continue on the site. The proposal also provides additional agricultural and economic diversification opportunities for the relevant landowners and broader community.
Direction 2: Grow the agribusiness sector and supply chains 2.1 Encourage agribusiness diversification and value-adding opportunities by reviewing local plans to ensure land use zoning and definitions reflect industry requirements. 2.2 Guide local and strategic planning to protect agricultural land and manage the interface with other land uses. 2.3 Facilitate investment in the agricultural supply chain by protecting assets such as freight and logistics facilities from land use conflict and the encroachment of incompatible land uses	The current land use zoning is compatible with electricity generating works under the ISEPP. The proposal has the potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. As mentioned above, agricultural activities in the form of sheep grazing can continue on the site. It is the intention of the proponent and the relevant landowners to continue at 85% of existing strategic grazing on the site. Strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels while reducing potential bushfire fuel load.
Direction 9: Increase renewable energy generation 9.1. Identify locations with renewable energy generation potential and access to the electricity network. 9.2. Facilitate small-scale renewable energy projects using bioenergy, solar, wind, small-scale hydro, geothermal or other innovative storage technologies through local environment plans. 9.3. Promote best practice community engagement and maximise community benefits from all utility-scale renewable energy projects.	The proponent reviewed the solar generation potential of many areas in NSW. The proposed site was selected because it provides the optimal combination of manageable environmental constraints, generally level terrain, high quality solar resources, compatible land zoning, capacity in the grid transmission system and onsite access to connect to the network. The proposal would have only minor impacts on the residential and farming community. No residential dwellings are located within 5 km of the development site and the surrounding farming land is largely owned by the involved landholder. The proponent sent a letter to residences within 10 km informing them of the proposal and inviting them to attend a community information session on 2 December 2020. Only two community members attended, and they indicated support for the proposal. Public interest in the proposal has been minimal.

4.5 SUMMARY OF LICENSES

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

Table 4-6 Summary of licenses required.

Instrument	Licence or approval requirement
EP&A Act, Part 4	SSD applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPIE.
Roads Act, section 138	Any works to public or classified roads requires consent under the Roads Act from the road authority. TfNSW is the roads authority for Mitchell Highway.
***Local Government Act 1993*, Section 68**	Approval is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Bogan Shire Council would be required for use of a standpipe and to operate an onsite sewage management system.
Oversize Overmass Permit	An oversize overmass permit will be required from the relevant road authority (TfNSW) for any oversized vehicles.

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

5 STAKEHOLDER CONSULTATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Consultation –

During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders.

In particular, you must undertake detailed consultation with affected landowners surrounding the development and Bogan Shire Council.

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

Further consultation after 2 years –

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

In addition to consultation requirements stipulated in the SEARs under the NSW Large-scale Solar Energy Guideline (DPE, 2018), the proponent is encouraged to engage with relevant stakeholders at all stages of the EIS, from scoping through to post-approval. These include:

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

5.1 AGENCY CONSULTATION

5.1.1 Secretary's Environmental Assessment Requirements (SEARs)

As the proposal is classified as SSD, a Scoping Report was prepared, and the SEARs requested for a 28 MW AC solar farm at Nyngan. The SEARs were issued by DPIE on 6 February 2020 (refer to Appendix A). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

The following sections provide a summary of the SEARs from the various agencies and cross reference where each agency's specific matters are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice prior to EIS lodgement.

Department of Planning, Industry and Environment (DPIE)

Issue summary	Addressed in EIS
General Requirements – ***The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.*** ***In particular, the EIS must include:***	

Issue summary	Addressed in EIS
• ***a stand-alone executive summary.***	Executive Summary
• ***a full description of the development, including.***	
– ***details of construction, operation and decommissioning.***	
– ***a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development but the subject of a separate approvals process).***	Figure 1-3 and section 3
– ***a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.***	
• ***a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential).***	Figure 3-3 Sections 2 and 0
• ***an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:***	
– ***a description of the existing environment likely to be affected by the development.***	
– ***an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing, proposed or approved developments in the region (including the Nyngan Solar Farm and the approved Nyngan Scandium Mine), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice.***	Sections 6, 7 and 8
– ***a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and***	
– ***a description of the measures that would be implemented to monitor and report on the environmental performance of the development.***	
• ***a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and***	
• ***the reasons why the development should be approved having regard to:***	Section 8.2
– ***relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development.***	
– ***the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses.***	
– ***- feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.***	
• ***a detailed consideration of the capability of the project to the security and reliability of the electricity in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.***	
• ***a detailed evaluation of the merits of the project as a whole.***	
The EIS must also be accompanied by a report from a suitably qualified person providing:	
• ***a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived.***	
• ***certification that the information provided is accurate at the date of preparation.***	Appendix G

Issue summary	Addressed in EIS
The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).	
Biodiversity – • ***an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM and documented in a Biodiversity Development Assessment Report (BDAR), unless BCD and DPIE determine that the proposed development is not likely to have any significant impacts on biodiversity values.*** • ***the BDAR must document the application of the avoid, minimise and offset framework including assessing.***	Section 6.9
Heritage – ***including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.***	Section 6.10 Section 7.2

Land –
• ***an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:***
  ○ ***a consideration of agricultural land, flood prone land, Crown lands, mining, quarries, mineral or petroleum rights (including mineral exploration licences EL8631 and EL8730).***
  ○ ***a soil survey to determine the soil characteristics and consider the potential for erosion to occur.***
  ○ ***a cumulative impact assessment of nearby developments.***
• ***an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:***
  ○ ***consideration of the zoning provisions applying to the land, including subdivision.***
  ○ ***completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide.***
	Section 6.3

Visual – ***Including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.***	Section 6.1
Noise – ***Including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry 2017, and cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.***	Section 6.5
Transport – • ***an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation.***	Section 6.6

Issue summary	Addressed in EIS
• ***an assessment of the likely transport impacts to the site access route (including Mitchell Highway and Nyngan townsite), site access point, any rail safety issues, any Crown land, particularly in relation to the capacity and condition of the roads.*** • ***a cumulative impact assessment of traffic from nearby developments.*** • ***a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required).*** • ***a description of the measures that would be implemented to mitigate any transport impacts during construction.***	
Water – • ***an assessment of the likely impacts of the development on surface water and groundwater resources (including flood zones, drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts.*** • ***details of water requirements and supply arrangements for construction and operation.*** • ***a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).***	Sections 6.7 and 6.8
Hazards – - ***an assessment of potential hazards and risks associated with bushfires.*** - ***an assessment of the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.***	Section 7.4
Socio-Economic – ***including an assessment of the likely impacts on the local community, demands on Council infrastructure and a consideration of the construction workforce accommodation.***	Section 6.4
Waste – ***Identify, quantify and classify the likely waste stream to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.***	Section 7.5
Consultation – ***During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders.*** ***In particular, you must undertake detailed consultation with affected landowners surrounding the development and Bogan Council.*** ***The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.*** **Further consultation after 2 years –**	Section 5

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

Bogan Shire Council

Issue summary	Addressed in EIS
On review of the proposal and in particular the submitted EIS, Council seeks the following amendments to the EIS:	
1. ***A commitment to employing/training locals to undertake much of the construction phase work, rather than DIDO/FIFO. This will help to build the skill base and resilience of the local workforce.***	Section 6.4
2. ***Provide details of where any 'imported' construction workers are to be accommodated and how they are to be transported to and from the site.***	
3. ***A commitment to employing/training locals to fill the proposed 2-3 FTE operations jobs.***	
4. ***Provide a detailed Waste Management Plan that includes the types and quantities of waste to be disposed of, including details of licensed facilities that are proposed to accept the waste.***	Section 7.5
5. ***Provide details of water source and quantity for construction phase.***	Section 6.8
6. ***A commitment to securing a Voluntary Planning Agreement with Council (negotiations currently underway).***	Section 5

DPIE Water and Natural Resource Assets Regulator (NRAR)

Issue summary	Addressed in EIS
The SEARs should include:	
• ***The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.***	Section 6.8
• ***A detailed and consolidated site water balance.***	
• ***Assessment of impacts on surface and groundwater sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.***	
• ***Proposed surface and groundwater monitoring activities and methodologies.***	
• ***Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).***	

DPIE Division of Resources and Geoscience

Issue summary	Addressed in EIS
The Division requires the following project specific requirements:	
• ***The Environmental Impact Statement (EIS) must include a dated mineral, coal and petroleum titles and applications search through the Division's MinView application, with results shown***	Section 6.3

Issue summary	Addressed in EIS
on a map(s) including the location and extent of the project site and any electricity transmission infrastructure and transmission lines. Current mining and exploration titles and applications can be viewed at: http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/geoscienceinformation/services/online-services/minview.	
• ***The proponent must consult with Australian Consolidated Gold Holdings Pty Ltd and Ochre Resources Pty Ltd. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including associated electricity transmission infrastructure) in relation to the exploration title boundaries.***	Section 5.3
• ***The Division specifically requires the proponent to check for new mineral and energy titles that may be granted in the vicinity of the subject site (including areas proposed for electricity transmission infrastructure and transmission lines) during all decision-making stages of the project to ensure that other stakeholders (such as title holders) with interest in the area are aware of the solar farm project.***	Section 6.3
• **The Division requests to be consulted in relation to the proposed location of any biodiversity offset areas (both on and off site) or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.**	Section 5.1

NSW Rural Fire Service (RFS)

Issue summary	Addressed in EIS
The subject land is mapped as bushfire prone land by Bogan Shire Council and can include unmanaged grassland vegetation. The NSW RFS is also the primary response agency for fighting structural fires within the site and surrounding locality. ***The NSW RFS recommends that the SEARS for the project include a requirement to address the following, having regard to the requirements of Planning for Bush Fire Protection 2019:*** • ***potential bushfire threats to the facility.*** • ***potential hazards to firefighters.*** • ***management of bushfire (including grass fire) impacting on and structural fire emanating form, the proposed solar farm and its associated infrastructure.*** • ***firefighting water supplies.*** • ***vehicle access and defendable space around the solar array.*** • ***land and vegetation management opportunities.*** • ***proposed emergency management procedures.*** ***Ultimately, as part of any consent issued for the project, the NSW RFS will require the proponent to develop a Fire Management Plan, in consultation with the local NSW RFS District Fire Control Centre.***	Section 7.4

DPIE Biodiversity Conservation Division

Issue summary	Addressed in EIS
OEH recommends that the EIS appropriately address the following • ***Biodiversity and offsetting.*** • ***Aboriginal cultural heritage.*** • ***Historic heritage.*** • ***Water and soils.*** • ***Flooding.***	Section 6 Appendix F Appendix E Appendix I Appendix H
Biodiversity - 1. ***Biodiversity impacts related to the proposed Yarren Hut Solar Farm are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2017 the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method, unless DPIE and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values.*** 2. ***The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.*** 3. ***The BDAR must include details of the measures proposed to address the offset obligation as follows:*** • ***The total number and classes of biodiversity credits required to be retired for the development/project.*** • ***The number and classes of like-for-like biodiversity credits proposed to be retired.*** • ***The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.*** • ***Any proposal to fund a biodiversity conservation action.*** • ***Any proposal to conduct ecological rehabilitation (if a mining project).*** • ***Any proposal to make a payment to the Biodiversity Conservation Fund.*** ***If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.*** 4. ***The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM.*** 5. ***The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016.***	Section 6.8 Appendix F
Aboriginal cultural heritage – ***The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010), and guided by the Guide to investigating, assessing and***	Section 6.9 Appendix E

Issue summary	Addressed in EIS
reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with DPIE regional branch officers.	
Historic heritage – ***The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:*** ***a) outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996).*** ***b) be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria).*** ***c) include a statement of heritage impact for all heritage items (including significance assessment).*** ***d) consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant).*** ***e) e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.***	Section 7.1
Water and soils – ***1. The EIS must map the following features relevant to water and soils including:*** ***a. Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).*** ***b. Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).*** ***c. Wetlands as described in s4.2 of the Biodiversity Assessment Method.*** ***d. Groundwater.*** ***e. Groundwater dependent ecosystems.*** ***f. Proposed intake and discharge locations.*** ***2. The EIS must describe background conditions for any water resource likely to be affected by the development, including:*** ***a. Existing surface and groundwater.*** ***b. Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.*** ***c. Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.*** ***d. Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.***	Section 6.8

Issue summary	Addressed in EIS
e. ***Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions http://www.environment.nsw.gov.au/research-andpublications/publications-search/risk-based-framework-for-considering-waterway-healthoutcomes-in-strategic-land-use-planning*** 3. ***The EIS must assess the impacts of the development on water quality, including:*** a. ***The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards*** **achievement of the Water Quality Objectives over time** ***where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.*** b. ***Identification of proposed monitoring of water quality.*** c. ***Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan).*** 4. ***The EIS must assess the impact of the development on hydrology, including:*** a. ***Water balance including quantity, quality and source.*** b. ***Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.*** c. ***Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.*** d. ***Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).*** e. ***Changes to environmental water availability, both regulated/licensed and unregulated/rules based sources of such water.*** f. ***Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.*** g. ***Identification of proposed monitoring of hydrological attributes.***	
Flooding – 1. **The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:** a. ***Flood prone land.*** b. ***Flood planning area, the area below the flood planning level.*** c. ***Hydraulic categorisation (floodways and flood storage areas).*** d. ***Flood hazard.*** 2. **The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the probable maximum flood, or an equivalent extreme event.**	Section 6.7 Appendix H

Issue summary	Addressed in EIS
3. ***The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:*** a. ***Current flood behaviour for a range of design events as identified in 14 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.*** 4. ***Modelling in the EIS must consider and document:*** 5. ***Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.*** 6. ***The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.*** 7. ***Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.*** 8. ***Relevant provisions of the NSW Floodplain Development Manual 2005.*** 9. ***The EIS must assess the impacts on the proposed development on flood behaviour, including:*** a. ***Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.*** b. ***Consistency with Council floodplain risk management plans.*** c. ***Consistency with any Rural Floodplain Management Plans.*** d. ***Compatibility with the flood hazard of the land.*** e. ***Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.*** f. ***Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.*** g. ***Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.*** h. ***Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.*** i. ***Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.*** j. ***Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.*** k. ***Any impacts the development may have on the social and economic costs to the community as consequence of flooding.***	

Transport for NSW (TfNSW)

Issue summary	Addressed in EIS

Following a review of the submitted documentation TfNSW have identified and recommend the following
 	
key issues are further addressed in the EIS being prepared in support of the project:
 	
• ***A Traffic Impact Assessment (TIA) prepared in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments 2002, undertaken by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12:***
  ○ ***Road transport volumes, distribution and vehicle types broken down into:***
  ▪ ***Hours and days of construction.***
  ▪ ***Schedule for phasing/staging of the project.***
  ○ ***The origin, destination and routes for:***
  ▪ ***Employee and contractor light traffic.***
  ▪ ***Heavy vehicle traffic.***
  ▪ ***Over size and over mass traffic.***
• ***Travel/ haulage routes inclusive of the materials, volumes to be transported along each route including haulage volumes and materials to be transported by rail (if any).***
• ***The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.***
• ***The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.***
• ***Consideration of project traffic volumes and potential implications with intersections with the local road network, in particular through the township of Nyngan and beyond as part of identifying the proposed haulage routes for this proposal will be further outlined.***
• ***Haulage times/scheduling should consider the cumulative impacts of any surrounding developments.***
• ***The total traffic impact of existing and proposed development on the road network with consideration inclusive of:***
  ○ ***Existing background traffic.***
  ○ ***Project-related traffic throughout each stage including construction, operation and decommissioning.***
  ○ ***Projected cumulative traffic volumes and the potential impact between each stage of the project.***
• ***The volume and distribution of traffic generated by the proposed development, inclusive of:***
  ○ ***Ratio of project light vehicles to heavy vehicles.***
  ○ ***Peak times for existing traffic.***
  ○ ***Peak times for project-related traffic.***
  ○ ***Transportation hours.***
• ***Impact of project related traffic with any rail interfaces.***
• ***The layout of the internal road network, parking facilities and infrastructure within the project***
• ***boundary.***
• ***Impacts of road traffic noise and dust generated along the primary haulage route/s.***
	Section 6.6
	
	Appendix D

Issue summary	Addressed in EIS

• ***Preparation of a Traffic Management Plan to be developed in consultation with TfNSW and Bogan Shire Council for all project employees, including but not be limited to:***
  ○ ***A map of the primary haulage routes highlighting critical locations.***
  ○ ***Safety initiatives for haulage through residential areas and/or avoidance during school zone hours or local school bus pick up / drop off locations times.***
  ○ ***Consideration of the use of shuttle buses to transport employees to and from site.***
  ○ ***An induction process for vehicle operators and regular toolbox meetings.***
  ○ ***A complaint resolution and disciplinary procedure.***
  ○ ***Any community consultation measures for peak haulage periods.***
  ○ ***Local climatic conditions that may impact road safety of employees throughout all project phases (e.g. fog, wet and significant dry, dusty weather).***
• ***It is noted a 66 kV electrical transmission line to connect the proposal to the existing Essential Energy transmission line is proposed. Any works within the road corridor as part of this component will require concurrence pursuant to Section 138(2) of the Roads Act 1993 from TfNSW, further detail should be provided in the EIS pertaining to this.***	

NSW Environment Protection Agency (EPA)

Issue summary	Addressed in EIS
The EPA recommends that the following issues are addressed in the EIS:	
• ***Dust – The EIS should identify the impacts from dust generated during construction phase and appropriate mitigation measures are implemented.***	Section 7.1
• ***Storage of chemicals and fuels – The EIS should describe the control measures that are to be implemented to minimise the risk of spills polluting land or water, such as appropriate storage and bunding of chemicals and fuels.***	Section 7.4
• ***Waste management – The EIS should incorporate options and strategies for waste minimisation, reuse and recycling. Waste management should be a high priority given the issues that other solar developments in the region have experienced in managing the large volume of waste that is generated during construction.***	Section 7.5

Since the SEARs were issued on 6 February 2020, agencies further consulted in preparation of this EIS include:

- Bogan Shire Council on the proposal generally, worker accommodation, landowner consent for the access upgrade on Mitchell Highway, subdivision, construction and operational water and community contributions in the form of a VPA.
- TfNSW in preparation of the Traffic Impact Assessment.
- BayWa r.e. searched for additional contact details to discuss the proposal with exploration licence holders but were unable to find any either online of through the Mining, Exploration and Geoscience Division of DPIE. Correspondence from the Department is provided in Appendix C.1.3.
- Crown Lands for the purpose of identifying any Crown Land Reserves in proximity to the development site.

5.2 ABORIGINAL COMMUNITY CONSULTATION

5.2.1 Local Aboriginal Land Council and Registered Aboriginal Parties

Consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the guide provided by OEH. The guide outlines a four-stage process of consultation as follows:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix A of the ACHAR (Appendix E). A summary of actions carried out in following these stages, are as follows.

Stage 1. Letters outlining the development proposal and the need to carry out an ACHAR were sent to the Bogan Local Aboriginal Land Councils (LALCs) and various statutory authorities including BCD, as identified under the OEH guide. An advertisement was placed in the local newspaper, the *Nyngan Observer* on the 26 November 2019 seeking registrations of interest from Aboriginal people and organisations. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, two Aboriginal groups registered their interest in the proposal. These groups were:

- Bogan Aboriginal Corporation.
- Corroboree Aboriginal Corporation.

No other party registered their interest.

Stage 2. On 4 December 2019, an Assessment Methodology document for the proposal was sent to the Nyngan LALC and all other registered groups and individuals as listed above. This document provided details of the background to the proposal, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the proposal. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties however all expressed an interest in participating in fieldwork.

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

The fieldwork was organised, and the two registered groups were asked to participate in the fieldwork. The fieldwork was carried out between 27 and 28 February 2020 by an archaeologist from NGH with local Aboriginal representatives.

Stage 4 In early April 2020, a draft version of the ACHAR for the proposal was forwarded to the Registered Aboriginal Parties (RAPs) inviting comment on the results, the significance assessment, and the recommendations. A minimum of 28 days has been allowed for responses to the document.

5.2.2 Aboriginal community feedback

Community consultation occurred throughout the project. The draft report was provided to each of the RAPs and feedback was sought on the recommendations, the assessment and any other issues that may have

been important. The period for RAPs comments on the draft assessment has closed, with the report finalised with any additional comments.

5.3 BROADER COMMUNITY CONSULTATION

As part of the EIA process, dedicated community engagement and consultation has taken place to support development of appropriate mitigation measures, where required, to be documented in the EIS. In 2015, the NSW Government conducted its own investigation into community attitudes towards renewable energy and found people's views to be generally favourable of solar farms (OEH, 2015).

Community engagement has been undertaken by BayWa r.e. in order to address the requirements of the SEARs and the NSW DPE's Community & Stakeholder Engagement Guideline, part of the Draft EIA Guidance Series (June 2017). Guidance has also been taken from the DPE's (2007) Guidelines for Major Project Community Consultation and the Australian Renewable Energy Agency's (ARENA's) Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA n.d.). Due to the absence of near neighbours residing within 5 km of the development site and low level of interest expressed by the local community, community consultation for the proposal has not been extensive.

5.3.1 Community engagement approach

The approach followed for the proposed Yarren Hut Solar Farm community engagement was aligned with the Public Participation Spectrum developed by the International Association for Public Particiation (IAP2) (https://www.iap2.org.au/Resources/IAP2-Published-Resources). The IAP2 Public Participation Spectrum '*is designed to assist with the selection of the level of participation that defines the public's role in any community engagement program...'.*

Although the proposed Yarren Hut Solar Farm is only in the EIS stage, wherever possible, the supporting community engagement was aligned and demonstrated to achieve the public participation goals of:

- *Consultation* – to work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.
- *Involvement* – to partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.

Specific goals for community engagement are as follows:

- Ensure all stakeholders have up to date information about the project, BayWa r.e. and its contractors.
- Provide timely opportunity for stakeholders to have direct input into aspects of the Yarren Hut Solar Farm's development.
- Ensure stakeholders and community know where and how to get information relevant to their needs.

Consultation and *involvement* will continue to be key community engagement goals should the project be approved.

5.3.2 Identified communities and stakeholders

I&APs were identified as those community members and stakeholders potentially being impacted by the solar farm proposal or having an interest in the proposal (Table 5-1).

Table 5-1 Impacted or interested stakeholder groups identified as part of the project scoping engagement

I&AP group		Defining characteristics
Community	Adjacent neighbours	Neighbours are considered those with properties directly adjacent to the proposed subject land. These neighbours are deemed to possibly be affected by the proposal, for example, by a belief that solar infrastructure might impact the agricultural productivity on their own land. These neighbours may be either landowners or lessees. Four private landowners of adjacent land have been identified (Figure 6-1) and were contact by phone or email during June 2020, None of these neighbouring property owners expressed concern about the proposal. Figure 6-1 also shows the locations of residential buildings in the locality.
	Residents within a 3 km radius from the subject land	Considered a major development within a small town. Direct impacts may be of interest to local residents and businesses (mixed cropping/grazing farms). Based on upfront discussions with the DPIE, a 3 km radius from the proposed subject land has been used to capture the values and potential impacts to this group of I&APs. It will further assist the assessment process and development of appropriate mitigation strategies from a local landowner/lessee perspective. No residences have been identified within 5 km of the development site or along the preferred haulage route of the private track off Mitchell Highway.
Stakeholders	Special interest groups	The following relevant special interest groups were identified for this proposal: • Sustainable Nyngan Agricultural Group. • Mineral Exploration Tenement Holders. • Essential Energy. Depending on the community engagement feedback, consultation with these groups may take place during the assessment process.
	Media	The local newspaper, the *Nyngan Observer* was utilised in November 2019 to notify local registers Aboriginal parties about the proposal. A project-specific website has been developed for the proposal. This is the main information portal for I&APs to gain an understanding of the proposal, as well as learn more about the impacts and mitigations around solar farm. A further advertisement was placed in the Nyngan Observer on 20 May 2020, informing the community of the proponent's intention to lodge the EIS.
	Broader community & representative bodies	Based on early communications with neighbouring landholders and residents, the proposal has been of little interest to the broader local and regional community. Neighbouring residents listed in Appendix C.2.2 were invited to attend a community information session on 2 December 2019. Only

I&AP group		Defining characteristics
		two community members attended this event and indicated that they were supportive of the proposal. A letter dated 5 May 2010 was sent to neighbours residing within 10 km of the proposal informing them of the proponent's intention to lodge the EIS (Appendix C.2).
Government departments & consent authorities	Department of Planning, Industry & Environment	Key regulatory decision-maker for this proposal.
	Bogan Shire Council	As the subject land is located in the Bogan Shire LGA, upfront engagement has been undertaken with senior shire staff. This engagement is important to understand local planning needs as well as to identify any specific concerns the shire might have that need to be included in the assessment process.

It is noted that every effort has gone into accurately defining the exact location of residential, land and/or businesses of community members contributing to the project's engagement process to date including the community information session held on 2 December 2019 and ongoing consultation with Bogan Shire Council.

5.3.3 Engagement strategies

A range of community consultation were used with regards to the proposal. These include:

- Development of a project website to provide information and updates https://yarrenhutsolarfarm.com.au. The website went live on 13 November 2019 and is regularly updated. An online feedback form can be filled in to submit comments, suggestions and importantly registration for prospective suppliers and employment.
- E-mail and telephone correspondence via an established email address for feedback to info@baywa-re.com.au. A contact phone number is also provided to the community.
- Conducting a Community Information Sessions for broader community engagement, comprising:

  Open Day No.1: 2 December 2019 (Nyngan Bowling Club)

  - This information session was used to introduce the broader community to the project, explain the overall EIA process and determine where community engagement was considered key. Also, to provide feedback on preliminary specialist studies undertaken by that time.
  - Only two people registered their attendance at this event.

5.3.4 Addressing community comments

The proposal has received little feedback from the community and stakeholders. From the community engagement database, captured and documented comments can be summarised into cumulative response areas, defined as follows:

- Main community concerns and queries including:
  - Environmental-related:
    - Nil.
  - Health and safety-related:

  - Nil.
- Socio-economic-related:
  - Additional employment opportunities.
  - Flow on effects to benefit local businesses.
  - Local source or renewable electricity production.

No community members have registered any concerns about the proposal.

5.3.5 Continued community and stakeholder engagement

Engagement activities would continue throughout the EIS determination period.

The proponent has written to neighbouring landowners and residents listed on the communications register to inform them of up-to-date details of the proposal and the proponent's intention to lodge the EIS. An advertisement has also been placed in the Nyngan Observer informing the broader community that the EIS will be lodged and additional information on the project can be obtained on the project website: www.yarrenhutsolarfarm.com.au.

5.3.6 Communication with non-government organisations

BayWa r.e. wrote to the two mining exploration tenement holders on 11 December 2019 but received no response by June 2020. The MEG was then contacted in attempt to source additional contact details for the two exploration licence holders. Alchemy Resources (EL 8631) was contacted by phone on 3 August 2020, with the letter provided in Appendix C.2.4 forwarded to them by email. The holders of EL 8730 were also contact by phone (on the number provided by MEG).

Conversation with Essential Energy regarding connection to their transmission line and construction of a substation, which would be owned by them post construction, have been ongoing. During a phone conversation on 31 January 2020, Essential Energy expressed their preference for the substation to be assessed under Part 5 of the EP&A Act rather than as a part of this EIS. Written correspondence from Essential Energy is provided in Appendix 10C.2.7.

6 ENVIRONMENTAL IMPACT ASSESSMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *a stand-alone executive summary.*
- *a full description of the development, including:*
  - *details of construction, operation and decommissioning.*
  - *a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process).*
  - *a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.*
- *a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential).*
- *an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:*
  - *a description of the existing environment likely to be affected by the development.*
  - *an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing, proposed or approved developments in the region (including the Nyngan Solar Farm and the approved Nyngan Scandium Mine), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice.*
  - *a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below).*
  - *a description of the measures that would be implemented to monitor and report on the environmental performance of the development.*
- *a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and the reasons why the development should be approved having regard to:*
  - *relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development.*
  - *the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and*
  - *feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.*
- *a detailed consideration of the capability of the project to the security and reliability of the electricity in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.*
- *a detailed evaluation of the merits of the project as a whole.*

BIODIVERSITY CONSERVATION DIVISION REQUIREMENTS

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

1. *Biodiversity and offsetting.*
2. *Aboriginal cultural heritage.*
3. *Historic heritage.*
4. *Water and soils.*
5. *Flooding.*

6.1 IMPACT ASSESSMENT APPROACH

Following the preparation of the Scoping Report, an impact assessment was undertaken to characterise the likely adverse environmental risks associated with the construction, operation and decommissioning of the proposal. The aim of the impact assessment was to ensure that all relevant risks were identified, investigated and mitigated as part of the EIS submission, relative to the degree of environmental risk they represented.

The environmental impact assessment below addresses all impacts likely to be attributed to the proposal (including the solar farm and transmission infrastructure). This includes consideration of:

- Direct impacts - impacts directly attributable to the construction, operational and decommissioning phases such as:
  - Disturbances to native vegetation, soil, water and air quality.
  - Potential to impact on cultural features and values.
  - Noise generated by equipment and traffic movements.
  - Public safety, pollution risks and hazards.
- Indirect impacts – follow-on or cascading impacts such as:
  - Impacts on the local economy.
  - Potential to impact existing and future land uses.
- Cumulative impacts - the combined potential effects of different impact types as well as the potential interaction with other developments in the region. For example:
  - The combined impact of construction noise, traffic and visual impacts for nearby residences.
  - The combined effects of the construction phase coinciding with other large infrastructure works that may be planned in the area.

Table 6-1 summarises the results of the impact assessment. Fourteen environmental impact were investigated.

Table 6-1 Analysis of adverse environmental issues**.**

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
Visual	• Site selected 5 km away from the nearest residential receiver. • Strategic screening plantings approximately 7 m.	Low	Low
Land use	• Two mining exploration licences intersect the development site. Licence holders do not object to the proposal. • Income diversification can increase farmer resilience to drought and market prices.	Medium	Low
Socioeconomic	• The proposal would provide approximately 40 FTE jobs during construction and one to two FTE during operation. • The proposal would diversify employment opportunities, reducing reliance on the agriculture sector (vulnerable to climate and market fluctuations) in the Bogan LGA.	Low	Low

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
Noise and vibration	• Site selected 5 km away from the nearest residential receiver.	Low	Low
Traffic, transport and road safety	• Would implement shuttle buses during construction to alleviate traffic movements.	Medium	Low
Water use, quality and hydrology	• Desktop investigations suggest that the proposal would improve soil health and structure over time. • Soil stability is suitable to support solar farm infrastructure. • Existing landform and drainage would not be altered by the proposal. • The development site is located outside the 1% AEP flood zone.	Medium	Low
Biodiversity	• Site selected with low biodiversity constraints. • Screening plantings would increase the amount of native vegetation present. • No barbed wire would be used on security fencing.	Low	Low
Aboriginal heritage	• Design modified to avoid one hearth which would be retained within the development site.	Medium	Low
Climate and air quality	• The proposal would contribute renewable energy to the national electricity network reducing generation of GHG emissions. • Dust generation would be minimised through regular watering of internal roads.	Low	Low
Historic heritage	• No registered heritage places would be impacted by the proposal.	Low	Low
Soil	• Desktop investigations suggest that the proposal would improve soil health and structure over time. • Soil stability is suitable to support solar farm infrastructure. • Existing landform and drainage would not be altered by the proposal.	Low	Low
Hazards	• Fire preparation measures would include a 10 m APZ, 20,000 L water storage and fire extinguishers available at strategic locations across the proposal.	Medium	Low

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
	• Limited remnant native vegetation surrounds the development site.	Medium	Low
Resource use and waste generation	• Packaging would be minimised and recycled where practicable. • Packaging would be made from biodegradable materials where practicable. • Solar arrays would be constructed largely from recyclable materials. • The proposal would contribute renewable energy to the national electricity network reducing reliance on fossil fuels.		
Cumulative impacts	• Site selected 5 km away from the nearest residential receiver. • Shuttle buses would be implemented during construction to alleviate pressure on Mitchell Highway.	Low	Low

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

- Visual amenity.
- Land use and resources.
- Socio-economic and community.
- Noise and vibrations.
- Traffic, transport and road safety.
- Water use and quality.
- Biodiversity.
- Aboriginal cultural heritage.

In addition, the following were also identified as being environmental assessment issues of lower risk: climate change & air quality, historic heritage, soil, health and safety-related hazards, resource use and waste, and cumulative impacts.

Full visual impact and quantitative noise assessments are provided in sections 6.1 and 6.5, whereas the reports for biodiversity and Aboriginal heritage, flood potential and traffic are attached as Appendices G, F, I and E, respectively (also summarised in section 6). Land use has been assessed in section 6.3 and addresses guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013) and the *Land and Soil Capability Assessment Scheme* (OEH, 2012). Lower risk issues are addressed in section 6.9.

6.2 VISUAL AMENITY

This Visual Impact Assessment (VIA) provides a full assessment of the visual impacts associated with the proposal.

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

Visual – *including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.*

6.2.1 Approach

The VIA was completed in the following stages:

1. Background investigations and mapping, including identifying Land Character Units (LCUs), defining where infrastructure may be visible in the landscape, and identifying key viewpoints such as major travel routes, potential residences and built up areas.
2. Field survey including reconnaissance, ground truthing and photography, and understand the likely sensitivity of LCUs within the landscape.
3. Consultation, including understanding community values and documenting community perception.
4. Impact assessment, describing the potential impact on visual amenity during construction and operation of the proposal.
5. Visual impact mitigation measures were developed in consultation with near neighbours including significant vegetation buffers and screening for people who would have a view of the residence.

The impact assessment methods used in this VIA for operational impacts is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, United States Department of the Interior (n.d.). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project. Key steps undertaken to assess the visual impact are as follows:

- Define Landscape Management Zones (LMZ) for the representative viewpoints, based on:
    - The scenic quality of the study area's LCU.
    - The expected sensitivity at representative viewpoints.
    - The proximity of each representative viewpoint.
- Evaluate the degree of contrast the solar farm would generate at representative viewpoints in consideration of the management objectives of the relevant LMZ.
- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

For the purpose of this VIA, a maximum rotation height of 4 m for the solar array was used as the basis for visual impacts from the majority of selected viewpoints. The substation, with an approximate maximum height of 12 m was assessed for viewpoint 3 and 4 only. This VIA functions by comparing existing views from selected viewpoints to views of proposal infrastructure without mitigation measures (but with existing obstacles e.g. roadside trees and hills). Unmitigated views from viewpoints are then compared with projected views after mitigation measures proposed by BayWa r.e. have been implemented.

6.2.2 Community values

BayWa r.e. wrote to the residents of dwellings within 15 km of the development on 15 November 2019 to inform them of the proposal and invite them to attend a community meeting on 2 December 2019. Two residents attended the meeting and were supportive of the proposal. No members of the local community have expressed concern about the visual impacts of the proposal.

6.2.3 Landscape character

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to summarise differences in the receiving environment that may affect the visual impact of the proposed solar farm at different locations.

Four LCUs were identified within Nyngan and surrounding areas:

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

The scenic quality was rated in each LCU as follows:

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

The four LCUs identified are characterised in Table 6-2 in terms of their scenic quality.

Table 6-2 Key features of LCUs within Nyngan and surrounds

Rural LCU
Rural and agricultural lands within the study area are used predominantly for agriculture, grazing and rotational cropping of grains, cereals and pulses. The development site is positioned on flat land at approximately 170 m above sea level. The land then increases in altitude gradually to the west. Expansive views within this LCU are generally limited given the undulating relief and screening provided by vegetation particularly along Mitchell Highway to the east uncleared native vegetation to the west. Mitchell Highway is the main vantage point that provides public views of agricultural areas. From the road corridor, agricultural and grazing land can be seen openly. Patches of native vegetation screen views of agricultural land from the roadway. In addition to sections of road, overhead transmission lines are visible that reinforce rectilinear shapes and are common in rural landscapes. Surrounding lots are made up of primary production land uses, with residences within this landscape being sparsely distributed but more concentrated towards the Nyngan townsite to the southeast. Residences are commonly associated with some additional vegetation plantings. Other infrastructure includes agricultural sheds, buildings and low open fences. **Scenic quality is considered moderate. Built elements are production-related and include linear fences, powerlines, roads, agricultural buildings and rural homes. Forms are typically uniform, on flat land and linear. This LCU is common and the dominant LCU in the study area. The proposed solar farm is located within this LCU.**
Residential LCU
Residential areas of Nyngan and surrounds include viewpoints from the road near residents' homes. Much like the Rural LCU, the area is relatively flat to undulating with expansive views generally limited by screening of native vegetation. Residents are broadly and unevenly distributed over the landscape, with properties commonly associated with additional vegetation planting and screening. **No residential dwellings are located within 5 km of the proposal. No residents have views of the development site from their homes. This LCU is excluded from the assessment.**
Industrial LCU
Industrial areas within the study area include the Mitchell Highway and the transmission lines that run parallel to them. Common features in the LCU include the two-way sealed road, road reserve, fencing,

powerlines and regular small and large vehicles.

Scenic quality is considered low, with features matching the land use. Some screening is present along Mitchell Highway, with broken views of surrounding rural land visible through existing native vegetation. This LCU is common in the study area, with the development site located approximately 270 m from Mitchell Highway.

Commercial LCU

Commercial lands within the study area include primarily the Nyngan central business district, made up of two churches, post office, hotel, bowling club etc.

The development site is not visible from the Nyngan townsite, and as such is excluded from the assessment.

The BLM methodology requires identification of representative viewpoints in the study area.

Four representative viewpoints were identified using the BLM methodology and within the Zone of Visual Influence (ZVI) and are mapped in Figure 6-1.

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

Criteria for proximity are as follows:

- Foreground 0 – 1 km.
- Middle ground 1 – 2 km.
- Background More than 2 km.

Criteria for scenic quality are as follows:

- High sensitivity:
  - high use routes or areas.
  - routes or areas of national or state significance.
  - areas with high scenic quality.
- Moderate sensitivity:
  - moderate use routes or areas.
  - routes or areas of regional or local significance.
  - areas with moderate scenic quality.
- Low sensitivity:
  - low use routes or areas.
  - routes or areas of low local significance.
  - areas with low scenic quality.

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

- Rural viewpoints were assessed as generally having a low scenic quality given the surrounding agricultural activities. Rural views are located to low use routes, or areas only accessed by local traffic. As motorists use private access tracks, views increase as vehicles approach the development site. Regional and local significance is low, with scenic quality being moderate.
- Industrial viewpoints along Mitchell Highway are areas around existing powerlines were assessed as having low sensitivity. Any views from these areas would be fleeting due to vehicle speed, hard to discern and fragmented by existing roadside vegetation. Built structure is more commonly functional than aesthetic in these settings.

The sensitivity of each viewpoint is provided in Table 6-3.

Table 6-3 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	Distance to site	Scenic quality	Sensitivity
1	Rural	Background	Moderate	Low
2	Industrial	Middle ground	Low	Low
3	Industrial	Foreground	Moderate	Low
4	Industrial	Middle ground	Low	Low

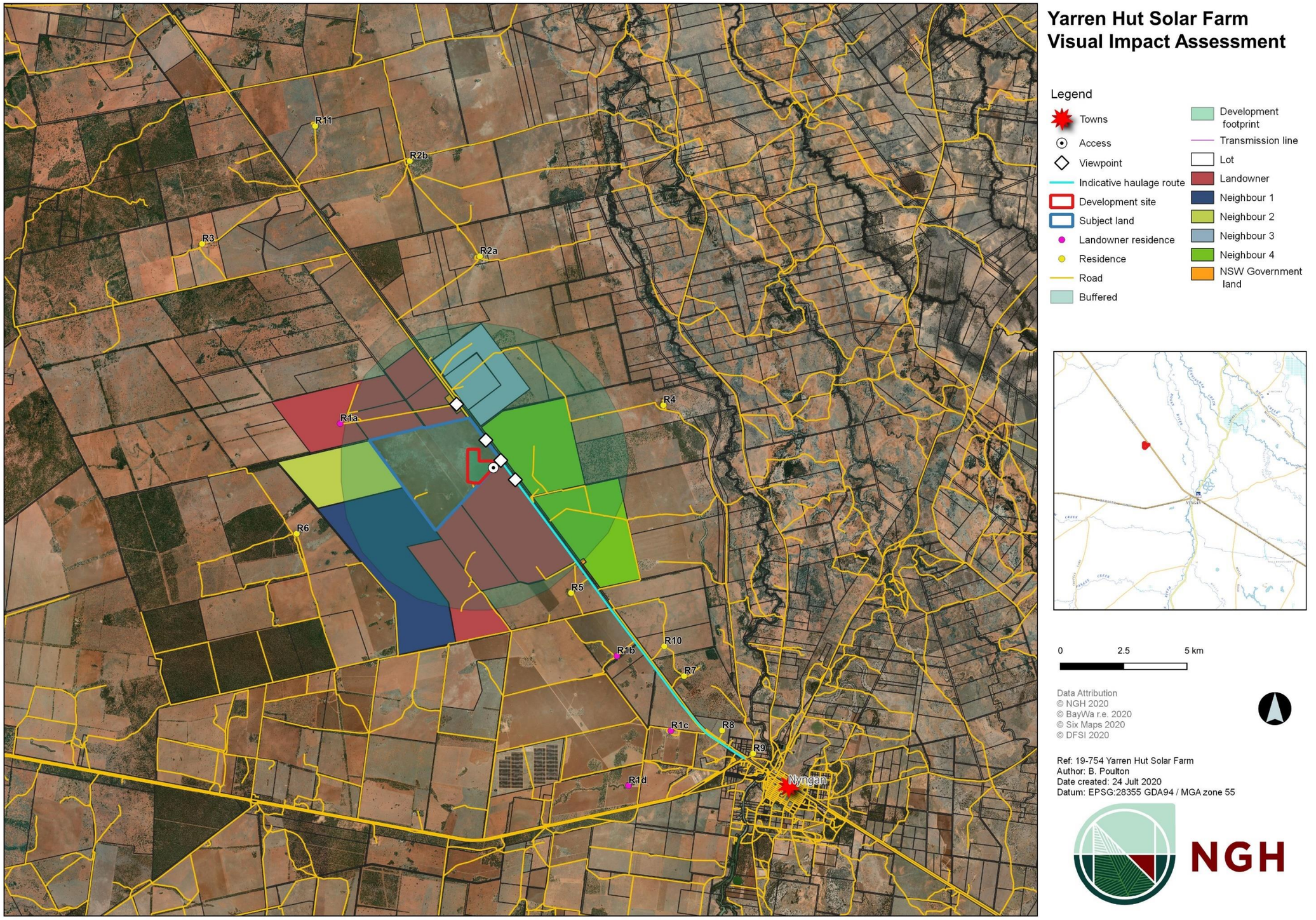

Figure 6-1 Visual impact assessment locations

6.2.4 Definition of landscape management zones

Visual LMZs were assigned to each representative viewpoint. The zones were derived by combining scenic quality (from the LCUs described in Table 6-3), viewer sensitivity and the distance to the proposed solar farm. Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 6-4.

Table 6-4 Visual Landscape Management Zone decision matrix

		Proximity / sensitivity						
Scenic quality		Foreground High	Middle ground High	Background High	Foreground Moderate	Middle ground Moderate	Background Moderate	Foreground Low
	High	A	A	A	A	B	B	B
	Moderate	A	B	B	B	B	C	C
	Low	B	B	B	B	C	C	C

Each zone has associated objectives to guide management of visual change and to help evaluate proposed project impacts. These are shown in Table 6-5.

Table 6-5 Visual Landscape Management Zone management objectives

Management priority	Management objectives
A	Maximise retention of existing visual amenity. Landscapes are least able to absorb change. Developments may lead to a major change.
B	Maintain existing visual amenity, where possible. Protect dominant visual features. Developments may be allowed to be visually apparent.
C	Less importance for retaining existing visual amenity. Landscapes are able to absorb change. Developments may be allowed to dominate but should reflect existing forms and colours where possible.

6.2.5 Potential impacts

An operational visual impact assessment was conducted considering:

- The proposed solar farm components.
- The potential for the proposed solar farm to be viewed from representative viewpoints.
- The degree of contrast the proposed solar farm would have within the identified landscape management zones (LMZs). LMZs were assigned to viewpoints based on the results of the fieldwork, and the contrast at that viewpoint was evaluated, as described below.
- The potential impact from glare.

Evaluation criteria

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

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

- Indistinct: contrast would not be seen or would not attract attention; the visual change would be imperceptible.

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

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

For high impact viewpoints, mitigation must be considered.

Evaluation results

No sensitive receivers fall within 5 km of the development site. Four public viewpoints along Mitchell Highway and the private access track belonging to the landholder were assessed gauge the visual impact of the proposal for local roads. The flat terrain and intermittent tree cover limits long range views in the locality. Adverse visual impacts are considered minimal and unlikely.

Table 6-6 evaluates the expected level of visual impact from the four representative viewpoints along Mitchell Highway. The private access track near R6 to the west of the development site was not selected as a viewpoint to the extent of remnant vegetation blocking the view.

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

PUBLIC VIEWPOINT 1		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural	
Scenic Quality	Moderate	
Proximity	Background (<2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	

Residual Visual Impact	LOW	Taken from Mitchell Highway facing the development site heading south. The viewpoint is representative of the industrial views of the major highway. Dominate features include the dual lane sealed road, grazing and cropping paddocks, fencing, and vegetation. Motorists would have a clear view of the proposed infrastructure, though existing roadside vegetation and planned screening would break up the views **No mitigation is required**

PUBLIC VIEWPOINT 2		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from the Mitchell Highway facing southwest towards the proposal. The viewpoint is representative of the industrial views of an arterial highway. Dominate features include the dual lane sealed road, grazed and cropped paddocks, fencing, vegetation and the powerline running parallel to the road. Proposed infrastructure would be discernible by motorists for a short period of time using Mitchell Highway. Existing roadside vegetation and planned screening would break up views of infrastructure. **No mitigation is required**
Scenic Quality	Low	
Proximity	Middle ground	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

PUBLIC VIEWPOINT 3		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from the Mitchell Highway facing west towards the proposal. The viewpoint is representative of the industrial views of the major highway. Dominate features include the dual lane sealed road, grazing and cropping paddocks, fencing, and vegetation. Motorists would have a clear view of the proposed infrastructure, though existing roadside vegetation and planned screening would break up the views **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground	
Sensitivity	Low	
LMZ Objective	B	
Contrast	Indistinct	
Residual Visual Impact	MEDIUM	

PUBLIC VIEWPOINT 4		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	

Scenic Quality	Low	Taken from the Mitchell Highway facing northwest towards the proposal. The viewpoint is representative of the industrial views of an arterial highway. Dominate features include the dual lane sealed road, grazed and cropped paddocks, fencing, vegetation and the powerline running parallel to the road. Proposed infrastructure would be discernible by motorists for a short period of time using Mitchell Highway. Existing roadside vegetation and planned screening would break up views of infrastructure. **No mitigation is required**
Proximity	Middle ground	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

Medium impact – mitigation should be considered

Medium impacts are seen for arterial roads where views of the solar farm infrastructure would be clearly visible.

Low impact – no mitigation required

Low impacts are seen for arterial roads, residences and businesses, where views of the solar farm infrastructure would be difficult to perceive or is indistinct. Low impacts are expected for the majority of the study area and representative viewpoints due to distance to infrastructure or existing vegetative screening.

Residential receivers

The nearest residential receiver to the proposal is the landowner located approximately 5 km from the development site boundary. A further 10 uninvolved residential receivers, with several receivers owning multiple properties, are located between 5 km and 15 km from the development site. None of these residences would have a clear view of the development site, with views obscured by topography, existing vegetation and distance. Unmitigated and residual visual impacts for each of these residences is assessed as:

Unmitigated visual impact	Residual visual impact
LOW	LOW

Landscaping plan

Screening vegetation has been considered in accordance with the draft planting layout provided in Figure 1-3. The purpose of the screening is to break up the view into the site form Mitchell Highway:

- Plantings would be one row deep and where practical, planted on the outside of the permitter fence, to break up views of infrastructure including the fencing.
- The plant species to be used would be native, derived from the naturally occurring vegetation community in this area.
- Planting would occur over winter to ensure the best chance of survival.
- Plantings would be monitored and maintained to meet a success rate target of 80% survival over the first two years.
- The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.

6.2.6 Glare

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

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

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

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

It is noted that solar panels are designed to absorb as much sunlight as possible. They therefore reflect a very low percentage of the light and are not considered likely to result in glare or reflections that would affect traffic or nearby receivers.

6.2.7 Potential cumulative impacts

Adverse cumulative impacts occur when the infrastructure or activities at the solar farm site exacerbate the negative impacts of other infrastructure or activities occurring nearby. There are no residential receivers or structures on the subject land or within 5 km of the development site. As such, cumulative impacts are unlikely to occur as a result of the proposal.

6.2.8 Safeguards and mitigation measures

Table 6-7 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
VA1	Screening vegetation would be planted along the eastern border of the development site facing Mitchell Highway in accordance with a Landscape Plan (LP)		**O**	**D**
VA2	Prior to the commencement of construction, a detailed LP will be prepared including: • Screening location. • Species type. • Planting density and spacing. • Method for planting. • Management measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method, replacing dead plants). • A program to manage, monitor and report on the effectiveness of implemented measures.	**Design stage**		
VA3	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	**Design stage**		

No.	Safeguards and mitigation measures	C	O	D
VA4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	**C**		
VA5	Construction night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be directed away from roads and residents so as not to cause light spill that may be hazardous to drivers.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

6.3 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

The nature of a development determines whether a permanent land use change occurs or whether the development is reversible. Apart from direct uses of the land, such as agriculture, electricity generation or mining, associated impacts, such as the degree of visual impact and traffic regimes, can affect the compatibility of alternative land uses. These issues as they relate to the proposal are discussed below.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Land – *Including:*

- *an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:*
  - *a consideration of agricultural land, flood prone land, Crown lands, mining, quarries, mineral or petroleum rights (including mineral exploration licences EL8631 and EL8730).*
  - *a soil survey to determine the soil characteristics and consider the*
  - *potential for erosion to occur.*
  - *a cumulative impact assessment of nearby developments.*
- *an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:*
  - *consideration of the zoning provisions applying to the land, including subdivision, and*
  - *completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide.*

DPIE (RESOURCES AND GEOSCIENCE) REQUIREMENTS

The Division has identified Exploration License (EL) 8730 held by Australian Consolidated Gold Holdings Pty Ltd and EL8631 held by Ochre Resources Pty Ltd overlie the project site.

The Division requires the following project specific requirements:

- *The Environmental Impact Statement (EIS) must include a dated mineral, coal and petroleum titles and applications search through the Division's MinView application, with results shown on a map(s) including the location and extent of the project site and any electricity transmission infrastructure and transmission lines. Current mining and exploration titles and applications can be viewed at:* http://www.resourcesandenergy.nsw.gov.au/miners-andexplorers/geoscienceinformation/services/online-services/minview.
- *The proponent must consult with Australian Consolidated Gold Holdings Pty Ltd and Ochre Resources Pty Ltd. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including*

associated electricity transmission infrastructure) in relation to the exploration title boundaries.

- *The Division specifically requires the proponent to check for new mineral and energy titles that may be granted in the vicinity of the subject site (including areas proposed for electricity transmission infrastructure and transmission lines) during all decision-making stages of the project to ensure that other stakeholders (such as title holders) with interest in the area are aware of the solar farm project.*
- *The Division requests to be consulted in relation to the proposed location of any biodiversity offset areas (both on and off site) or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.*

6.3.1 Existing environment

Agriculture and land capability

The rural land within the region is used primarily for agriculture including cropping and grazing. The current land use on the development site is mixed cropping and grazing agriculture. The development site comprises one paddock, which has been previously cleared and repeatedly cropped. Mixed (non-irrigation) cropping and grazing agricultural land activities like those of the proposal area are widespread in the region. There is no evidence of horticulture or other intense farming activities within the proposal area.

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

The land is classified as Class 4 under the Land and Soil Capability Assessment Scheme (OEH, 2012). The land is readily used for a range of crops and pastures:

"Class 4 land is considered to have moderate to severe limitations where pasture improvement relies on minimum tillage techniques and the productivity may be seasonally high but overall is low as a result of major environmental constraints."

There are no mineral titles and two exploration licences relevant to the proposed development site indicated in the Minview database (DPE 2018) (Appendix C.1). A letter from GSNSW received on 27 November 2019 confirms that there are no current mineral, coal or petroleum titles on no extractive industries over the site or adjacent lands.

For the construction period, there would be a complete cessation in agricultural activities within the development site. During the operational phase, not all agricultural activities would be precluded, and it is highly likely sheep grazing could continue. The nature of the agricultural activities would change from cropping and grazing to grazing within the development site.

When the solar farm is decommissioned at the end of its operational life, all infrastructure (above and below ground) would be removed. It is expected that the land would be returned to its previous production uses, as solar farms typically do not have significant permanent impacts on soil and landform.

Overall, the adverse impacts related to alienation of resources are expected to be low and restricted only to the period of operation, with benefits resulting from shading and perennial pasture maintenance, in comparison to ongoing cropping of this land

Agriculture is the main employing industry in the Bogan LGA, providing work for 26% of the population (ABS, 2019a). The number of agricultural businesses has declined in recent years from 243 in 2014 to 237 in 2018 (ABS, 2019a).

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

It is important to note that solar farms do not preclude the use of land for agriculture. Additionally, the degree of permanent land disturbance in the construction and operation of solar farms is small, and upon decommissioning of the proposal, the development footprint would be rehabilitated to restore land to pre-existing (or improved) agricultural capacity. Groundcover growth under solar panels at the operational Lilyvale Solar Farm in Queensland is shown in Figure 6-2 as an example of the ability to maintain agricultural productivity.

Figure 6-2 Groundcover beneath solar panels at Lilyvale Solar Farm

Surrounding land uses

Land use activities surrounding the development site are predominantly cropping and grazing agriculture with associated rural dwellings. The development site is zoned RU1 (primary production) (Figure 6-3). Surrounding agricultural land generally consist of cropping and grazing. Other land uses in the locality include:

- Township of Nyngan 17 km from the site, comprising retail, health, accommodation and community services (refer to section 6.4).
- Residential dwellings and associated dwellings.
- Electricity connection and transmission infrastructure.
- Public road network.
- Bogan River 8.4km north east of the development site.

- Macquarie Marshes extensive 220,000 Ha wetland 80km north east of the development site.

Geological Survey of NSW (GSNSW) was consulted by email on 27 November 2019 (Appendix C.1), in regard to implications for access and prospective mineralisation. No onsite biodiversity offsets are proposed.

The Geological Survey of NSW identified two mineral titles over the site requiring consultation.

EL8631

Ochre Resources Pty Ltd

GPO Bow 2815

West Perth 6001 WA

EL8730

Australian Consolidated Gold Holdings Pty Ltd

PO Box 334

Bermagui NSW 2546

There are no mineral titles and two exploration licences relevant to the proposed development site indicated in the Minview database (DPE 2019) (Appendix C.1). A letter from GSNSW received on 27 November 2019 confirms that there are no current mineral, coal or petroleum titles on no extractive industries over the site or adjacent lands.

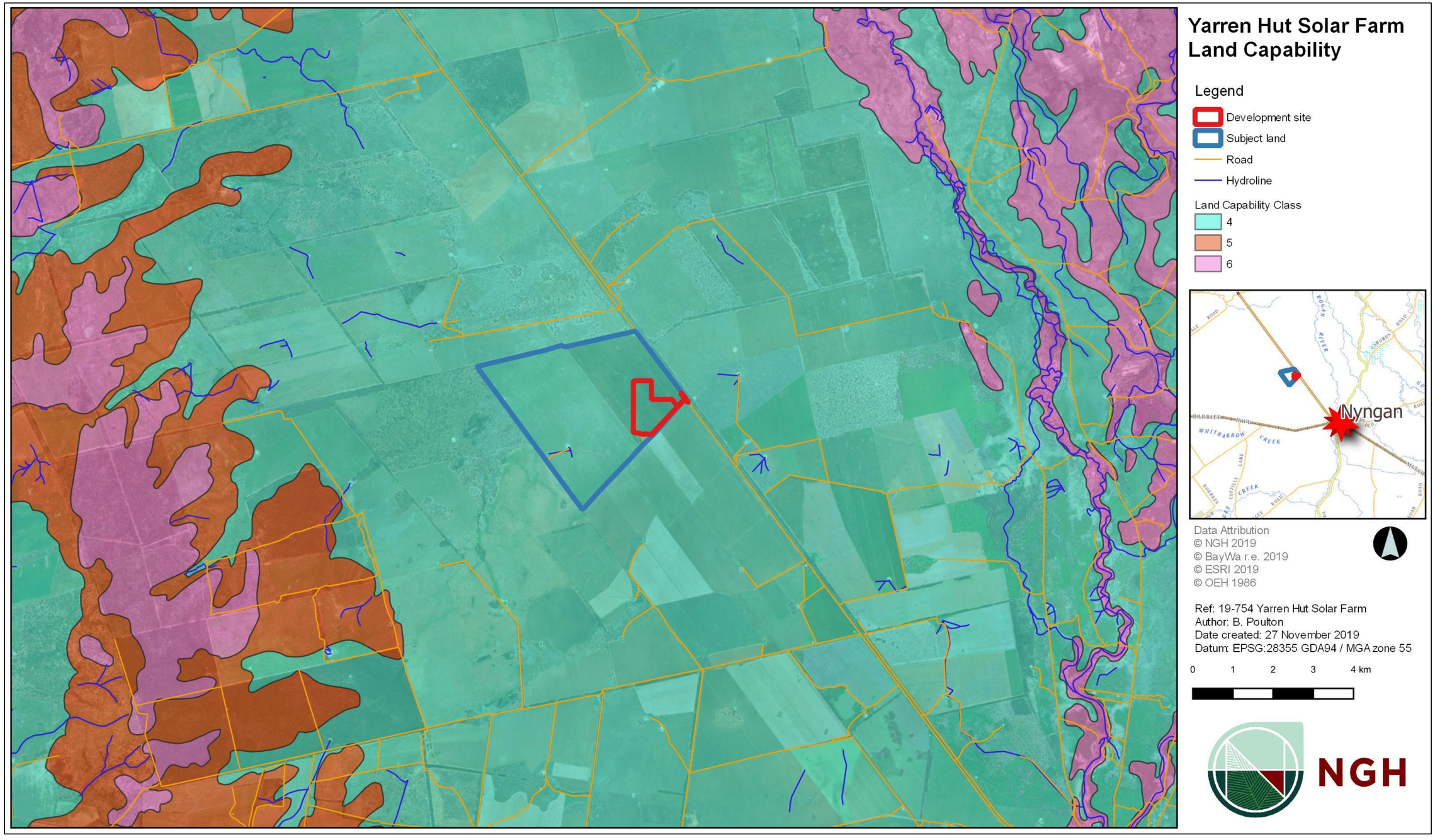

Figure 6-3 Land and soil capability of the development site and surroundings

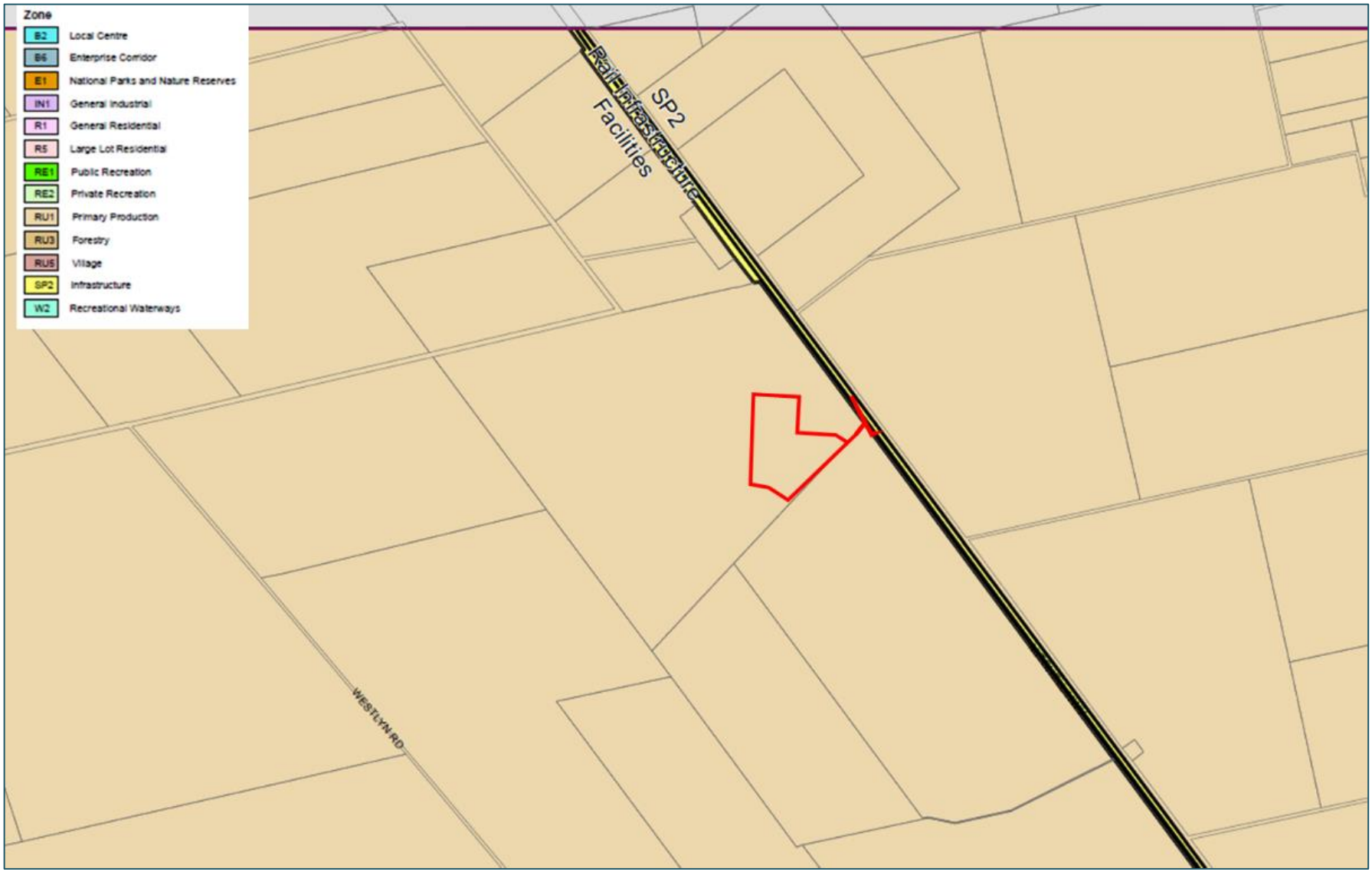

Figure 6-4 Planning zones surrounding the development site (Bogan Shire Council 2011), indicated by the red line.

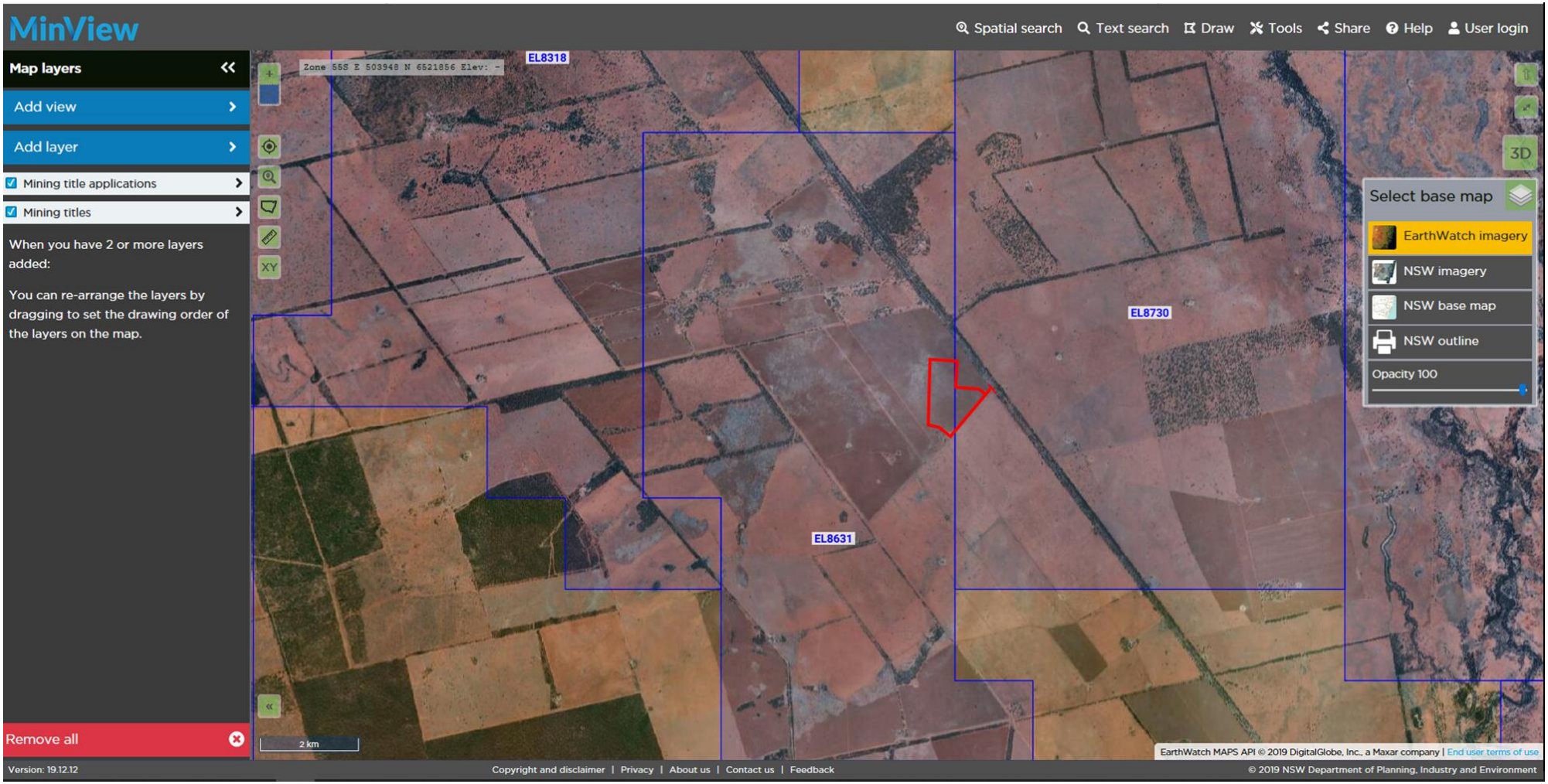

Figure 6-5 Exploration Licences for the development site and surrounding land (DPIE, 2020). *The development site is outlined in red*.

6.3.2 Approach

Land use conflict risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). Given the proposed solar farm is different to the surrounding land use activities, primarily agriculture, this assessment aims to identify and rank potential land use conflicts so that they may be adequately managed. Where expected conflicts are adequately managed, the rights of the existing and proposed land uses can be protected.

The risk ranking in Table 6-9 has been determined using the risk ranking matrix shown in Table 6-8, and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). The matrix ranks the risk of impacts according to the probability of occurrence and the consequence of the impact. Probability 'A' is described as 'almost certain' to probability 'E', which is described as 'rare'. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk (DPI, 2011).

Table 6-8 Risk ranking matrix (Source: DPI, 2011)

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

6.3.3 Potential impacts

Potential impacts are assessed against the land use conflict risk assessment table from the *Land Use Conflict Risk Assessment Guide* (DPI 2011) in Table 6-9.

Table 6-9 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Agricultural land use					
Agricultural spraying (aerial)	C4	8	There is unlikely to be an impact to aerial spraying activities given low levels of glare and the limited height of infrastructure.	D4	8
Contaminated surface water runoff	D3	9	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	A4	16	Dust generated during the construction and decommissioning stages to be	D5	2

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			managed using water carts when required. Dust is not expected to generate a significant land use conflict during operation. It is likely to be less than cropping activities currently undertaken.		
Fire/ bushfire	C1	22	Implementation of a Bushfire Management Plan and higher than required APZ would substantially reduce the probability of solar farm operation starting a fire or a bushfire damaging the solar farm infrastructure. Improved site access would also improve the manoeuvrability of emergency response vehicles.	D3	9
Visual amenity	D3	9	There would be no visual impacts on residential receivers. Screen landscaping where identified in section 6.1 would mitigate visual impacts from Mitchell Highway.	D4	5
Noise	D3	9	Noise generated during construction and decommissioning stages would be minimised through the implementation of mitigation measures. There would be no noise impacts on residential receivers.	D4	5
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely however the impact would be temporary and able to be managed (refer to section 6.6). Traffic is not expected to generate a land use conflict during operation.	C4	8

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Weed and pest control	B3	17	Implementation of pest and weed management plan during construction and operation phases	D4	5
Mining land use					
Resource extraction/exploration	D3	9	The proposal would temporarily sterilise the development site from exploration and mining activities for the life of the solar farm. After decommissioning, the solar farm infrastructure would be removed, and the site made available for alternate land uses including for mining purposes, if desirable.	D5	2

Construction and operation

The range of scores in the mitigated risk rating were medium to low, demonstrating that the proposed construction and operation of the solar farm will have minimal impact to the area.

The expected impact on surrounding land uses during construction is considered to be minimal given the temporary nature of the work and the implementation of mitigation strategies would further reduce the level of impact.

Once construction of the solar farm commences, agricultural activities would cease temporarily in the areas involved in access and construction. Grazing of the development site would then recommence once construction has been completed.

There may be some disruption to local traffic, during the construction and due to construction traffic movements, however operation of surrounding land uses is unlikely to be significantly impacted. This would be a temporary impact and could be managed in consultation with local landholders. Grazing could continue to ensure the grass fuel load is maintained at a low level.

It is considered unlikely that traffic movements associated with the proposal activities would generate a land use conflict with movement of local stock. The likelihood of conflict can be further minimised by consulting with local landholders.

Connection of transmission lines to the existing Essential Energy overhead power line would be undertaken in consultation with Essential Energy. The power line is located within the development site and is unlikely to generate a land use conflict with surrounding landholders.

The potential operational land use impact has been assessed in accordance with guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013)*, The Land and Soil Capability Assessment Scheme* (OEH, 2012) and the Large-scale Solar Energy Guideline for State Significant Development (DPE, 2018).

LAND AND SOIL CAPABILITY IMPACTS

The proposal is not expected to adversely affect the biophysical nature of the land which determines its capability. During any broad area or trench line excavations at the site, topsoil would be removed, stockpiled separately and replaced to restore the original soil profile. Topsoil salvaged from the construction of the access tracks and other works would also be securely stored for use in site rehabilitation. Following construction, a perennial cover would be established to protect soils, enhance landscape function and prevent wind and water erosion. Perennial groundcover and resting the soil from cropping is expected to increase the soil's structure and water retention through carbon sequestration over time.

Soil testing at six locations across the development site eliminated the need for lime to reduce acidity.

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

- Broadacre cropping including wheat and canola would not be possible over the life of the proposal. However, the opportunity to rest the land would provide a multitude of benefits including returning soil organisms, soil carbon, soil moisture and soil structure to the areas previously cropped and grazed. Diversity in groundcover and native perennial species of grasses would be encouraged to increase soil stability, increase organic material and reduce evaporation losses.
- Sheep grazing may continue within development site. Continuing grazing would maintain groundcover, reduce fire risk (compared to no grazing) and reduce soil compaction (Figure 6-6).

Figure 6-6 Sheep grazing amongst solar panels at Lilyvale Solar Farm in Queensland

Resource loss and fragmentation

The proposal would not impact on land identified by the NSW Government as BSAL. Construction works involve only minor excavation with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to section 7.3 and section 6.8 for soil and water quality impacts). At the end of the operational period, solar farm infrastructure would be removed, the land would be rehabilitated to its pre-existing condition and available for agricultural use. The proposal would not result in the permanent removal of agricultural land.

The proposal has been designed to minimise the development footprint.

The proposal will not result in rural land fragmentation or alienation of resource lands as defined under the former Rural lands SEPP. It is considered that the proposal would not generate any land use conflicts or have an impact on the nature of existing surrounding agricultural holdings given the proposal will not alter the existing environment. The proposed subdivision and consolidation of lots would help facilitate the management of the solar farm while ensuring surplus land remains productive agricultural land.

Disturbance to farming operations and livestock

Adjacent farming operations are compatible with the proposal. Noise from nearby farming practices over the day would not be impact on the proposed solar farm. The proposed solar farm construction and decommissioning would largely occur in daylight hours and would not conflict with adjacent farming activity.

When grazing recommences following construction, livestock would become accustomed to the solar panels as they do not inhibit ground cover, and provide valuable shade, wind and rain cover for cattle.

The impacts from dust on local and regional air quality, and farming operations are expected to be negligible during operation. During regular operation, only a small number of vehicles would be present at the site on a regular permanent basis and would be largely restricted to the compound where site offices would be located.

Changes in biosecurity risks – pest, diseases and weed risks

The proposal would result in the increased movement of vehicles and people to the development site. The primary risk to biosecurity is the spread of weeds that may result from the increased movement of vehicles in and out of the development site. Weed seeds can be transported through and from the development site on the tyres and undercarriages of vehicles and on staff clothing. The risk of weed dispersal would primarily be mitigated by confining vehicle and machinery movements to formed access tracks during all phases of the proposal and BayWa r.e. will implement a strict wash down procedure for vehicles entering the development site.

A Pest and Weed Management Plan would be prepared for the construction and decommissioning phases, based on Bogan Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls. During operations, the Pest and Weed Management Plan would manage impacts associated with weeds such as the risk of weed ingress along the boundary of the development site and the importation and spread of weeds through vehicle movements. The plan would focus on weed control techniques including herbicide and grazing pressure.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can potentially increase the risk of pest animals at the development site (mostly cats and foxes). Covered rubbish bins and regular waste removal during construction and operation would minimise this risk by removing the food source. Rabbit and fox numbers would be controlled through targeted pest management during the operational phase of the proposal. Grazing pressure and reduced plant biomass would also reduce resources and cover for pest species.

HEAT ISLAND EFFECT

Around the world and within Australia, cattle graze within solar farms. Livestock and crops, including those proposed to be within the proposal during operations would not be impacted as the design of the solar farm would ensure no significant build-up of heat at the site, therefore animals and crops on neighbouring properties would not be affected. This is because the structure of the solar farm would not be thermally massive. The solar panels are thin, <4 cm, so they do not retain heat over the long term. Spacing between rows would be between 5 m and 16 m.

During the daytime, panels track the sun from sunrise to sunset as the use of single axis tracking technology would be utilised and not fixed panels, therefore avoiding the trapping of warm air underneath (Figure 6-7). Fthenakis and Yu (2013), report solar plants completely cooled overnight, so the effect was limited in duration (Figure 6-8).

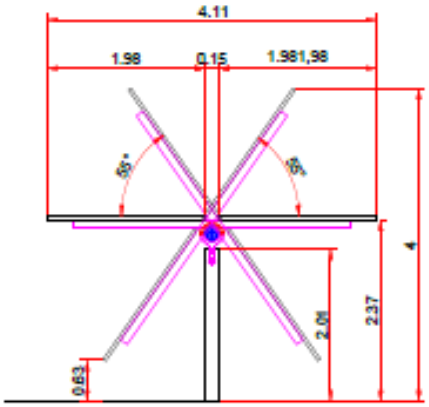

Figure 6-7 Indicative cross section of a tracking array

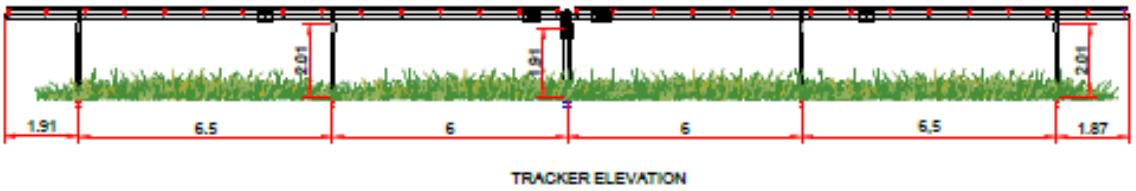

Figure 6-8 Indicative tracker elevation

Published papers relevant to this item include:

- Armstrong A, Ostle N and Whitaker J (2016), *Solar park microclimate and vegetation management effects on grassland carbon cycling.*
- Barron-Gafford, GA, Minor, RL, Allen, NA, Cronin, AD, Brooks, AE & Pavao-Zuckerman, MA (2016). 'The photovoltaic heat island effect: Larger solar power plants increase local temperatures' *Scientific Reports, vol 6, 35070.* DOI: 10.1038/srep35070.
- Fthenakis, V.,& Yu, Y. (2013). *Analysis of the potential for a heat island effect in large solar farms,* Photovoltaic Specialists Conference (PVSC), 2013 IEEE 39th**.**
- Yang L, Gao X, Lv F, Hui X, Ma L, and Hou X (2017). Study on the local climatic effects of large photovoltaic solar farms in desert areas Solar Energy: 144, 244–253.

The topic has also been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton for solar farms proposed by Neoen and X-Elio. This is detailed in the *Panel Report for the Greater Shepparton Solar Energy Facility Planning Permit Application 2017-162, 2017-274, 2017-301 and 2017-344* (Panel Report, 2018). Neoen, in preparation of a response to key issues raised in objecting submissions, commissioned a *Statement of Evidence by Greg Barron-Gafford* from the Research Group Biography, Ecosystem Science (University of Arizona) (Barron-Gafford, 2018).

Barron-Gafford (2018), in his Statement of Evidence (SoE) to the Victorian Planning Panel included results on the radius of the measured heat effects. This identified that the PVHI effect was

indistinguishable from air temperatures over native vegetation when measured at a distance of 30 m from the edge of the PV array (Figure 6-9). In his SoE he states that:

'this pattern held true for both daytime and night-time conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstorey" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the PVHI quickly dissipates'.

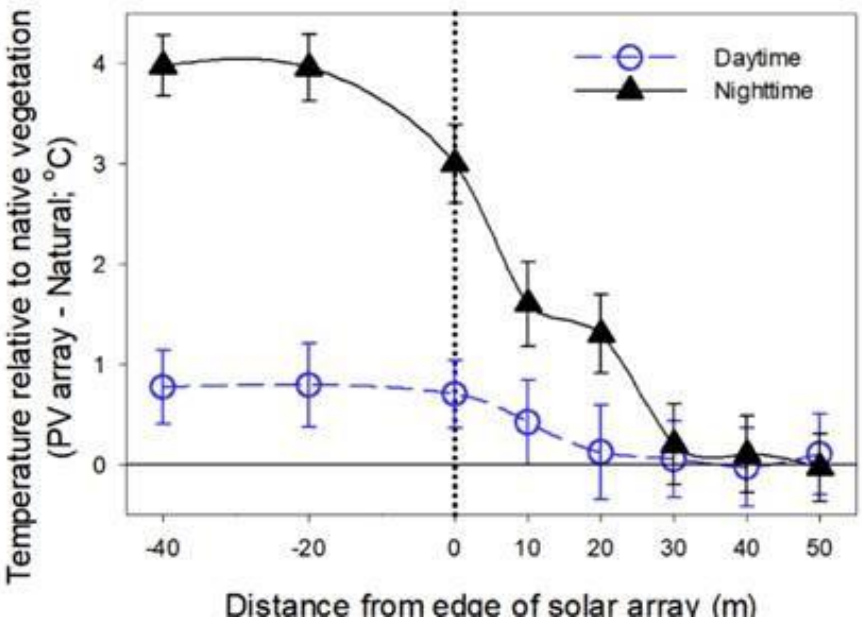

Figure 6-9 Measures of air temperature within and outside of the PV array (source:- Barron-Gafford, 2018)

In conclusion, the Victorian Planning Panel Report (Panel Report, 2018), accepted that solar arrays will affect air and soil temperatures within the solar array perimeter, but that in relation to outside of the solar array perimeter a heat island effect is unlikely to occur. It identified that any temperature increase within the solar array would be marginal and a 30 m setback from any neighbouring property boundary could be implemented. BayWa r.e. have designed the project, implementing extensive setbacks in a number of areas and have also ensured 30m+ setbacks from the solar array to from any uninvolved landowner's property boundary to the solar array.

Existing and planned vegetation screening would serve to insulate neighbouring properties. All vegetation around the site – either planned or existing, together with the site's APZ and infrastructure layout, have been designed to include at least 30 m setback from uninvolved neighbouring property boundaries, even though not a legislative requirement.

MINING IMPACTS

The proposed solar farm is located within an area that has been identified as a mining resource with two current mining exploration licences exist over the development site. In the short term, access to the land for mining operations would not be available, though long term impacts on mining would be negligible to the limited 50-year life of the proposal. After decommissioning, the solar farm infrastructure would be removed and the site made available for alternative land uses, including mining purposes, if desirable.

RESOURCE IMPACTS

The proposal would require approximately 2,300 m^3 of gravel to surface the access road and internal service track network and CPU and substation hardstand. Loam mix may be required for the bedding

of underground cables, depending on the electrical design and ground conditions. Approximately 500 m^3 of concrete would be required to construct the inverter, substation, CCTV and foundations. The availability of these resources is not declining or limited in the region.

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

In view of the nature of the resources, the limited quantities required and the opportunities for recycling, the proposal is unlikely to place significant pressure on the availability of local or regional resources for other land uses in the area. It is estimated that approximately 3,500 kL of water would be required during construction, mostly for dust suppression but also for cleaning, concreting, on-site amenities and landscaping. The precise amount of water used during construction would be heavily affected by prevailing weather conditions and the need for watering to suppress dust generation. Operational water consumption would not exceed 60 kL per annum.

A small amount of potable (drinking) water would be imported to the site during the construction period. The potable water supply would be augmented by rainwater collection in tanks installed beside site buildings as constructed. Any requirement for potable water would be limited, confined to the construction phase and would not place pressure on local drinking water supplies.

Decommissioning

As the proposal would have relatively low levels of impact on the soil surface, both in the installation of infrastructure and the commitment to maintain ground cover vegetation, where practical, during operation, the proposal is considered to be highly reversible in terms of the preserving agricultural capability of the development site.

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

6.3.4 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-10.

Table 6-10 Safeguards and mitigation measures for land use impacts

No.	Safeguards and mitigation measures	C	O	D
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	**C**	**O**	**D**
LU2	Consultation would be undertaken with Essential Energy regarding connection to the overhead energy transmission infrastructure.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with DPIE and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above and below ground infrastructure. • Removal of gravel from internal access tracks where required in consultation with landowners. • Reverse any compaction by mechanical ripping. • Targets and standards to indicate successful rehabilitation of disturbed areas. These targets and standards should be			**D**

No.	Safeguards and mitigation measures	C	O	D
	applied to rehabilitation activities once the proposal is decommissioned.			
LU4	A Pest and Weed Management Plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The Pest and Weed Management Plan must be prepared in accordance with Bogan Shire and DPIE requirements. Where possible integrate weed and pest management as a part of district-wide control measures.	**C**	**O**	
LU5	The proponent would consult with GSNSW and tenement holders in relation mineral exploration, or potential for sterilisation of mineral resources.	**C**		
LU6	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	**C**	**O**	**D**
LU7	Underground cabling and all underground infrastructure would be removed on decommissioning.	**C**		
LU8	Grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		**O**	

C: Construction; O: Operation; D: Decommissioning

6.4 SOCIOECONOMIC AND COMMUNITY

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

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Socio-Economic –

including an assessment of the likely impacts on the local community, demands on Council infrastructure and a consideration of the construction workforce accommodation.

BOGAN SHIRE COUNCIL REQUIREMENTS

Socio-Economic –

1. *A commitment to employing/training locals to undertake much of the construction phase work, rather than DIDO/FIFO. This will help build the skill base and resilience of the local workforce.*
2. *Provide details of where any 'imported' construction workers are to be accommodated and how they are to be transported to and from site.*
3. *A commitment to employing/training locals to fill the proposed 2-3 FTE operations jobs.*
4. *A commitment to securing a Voluntary Planning Agreement with Council (negotiations currently underway).*

6.4.1 Existing environment

Socio-economic profile

The proposal is located in the Bogan LGA, located in western NSW, approximately 170 km northwest of Dubbo. The Bogan Shire is within the Orana Region of central NSW and contains several small towns including Nyngan, Coolabah, Girilambone, Canonba, Hermidale, Pangee and Bobadah. The LGA is 14,610 km² (equivalent to about 1.8% of the State's land surface) with a population of 2692 as at the 2016 Census (ABS 2019).

Nyngan, the Shire's administrative centre, is located on the Bogan River at the junction of the Mitchell and Barrier Highways. Nyngan is known for its abundance of productive agricultural land for sheep, cattle and large scale cropping enterprises. Nyngan has three Motels, two Caravan parks and hotels for visitor accommodation. Three licensed clubs, restaurants and take-away food outlets are available for dining. The Bogan Shire has a high school, five primary schools, a pre-school, a mobile pre-school, TAFE Campus, and training facilities at the Nyngan NetWork. Healthcare in the area is serviced by the Nyngan Hospital as well as health care professionals including a nursing home complex, baby health centre and community health centre. Recreation and sporting are supported in the region with facilities for bowls, golf, tennis, dancing, swimming, rugby union, rugby league, touch football, cricket, netball, fishing, soccer, little athletics and pony club (Bogan Shire Council, 2020).

Points of interest for tourists include the Bogan River located 8.4 km north east of the development site. Macquarie Marshes extensive 220,000 ha wetland representing one of the largest semi-permanent wetlands in south-eastern Australia (located 80 km north east of the development site). The Nyngan Museum and Mid State Shearing Shed offer insight into the history of the area including the importance of the railway to the area and contribution of the shearing industry to the region. Finally, the Big Bogan statue (erected in 2015) is a photo opportunity and tourist destination to see a 5.96 m tall 1500 kg bogan stainless steel sculpture.

Critical to the town's history is the floods of April 1990 in which Nyngan and the surrounding district suffered heavy rainfall and severe flooding, with a breach of the levee leaving the town submerged with an estimated $50 million in damages. With the town's services cut the entire population was airlifted to safety. The town was rebuilt with an additional metre added to the new levee to protect the town.

The Bogan shire community strategic plan 2027 outlines a variety of goals for the town of Nyngan (Bogan Shire, 2017), including:

- Social: to encourage an inclusive community that works together and is able to access services and opportunities to support a comfortable country living.
- Infrastructure: to construct and manage reliable and efficient community assets that provide access to quality services.
- Environmental: to support, enhance and preserve the environment of the shire through sound planning and management practices to ensure a sustainable, healthy and safe community.
- Economic: to create a vibrant local economy with a diversity of successful businesses that provide local employment opportunities and contribute to a prosperous community.
- Civic Leadership: through strong, transparent and effective governance with an actively engaged community to ensure the town remains fit for the future.

The median age of persons in Bogan LGA is 40; this is only slightly higher than the Australian average of 38 (ABS 2019). The 2016 census records state that 16.5% of the population are Aboriginal and Torres Strait Islander people (ABS 2019). A large portion, 83.3% of the community were born in Australia; 0.7% in England, 0.7% in New Zealand and 0.5% in India (ABS 2019a).

The median income in Bogan as of 2018 was $43,269 per year. The largest employment industries in Bogan LGA are Agriculture, forestry and fishing (57.7%), Rental, hiring and real estate services (6.3%),

Construction (5.3%), Retail trade (4.9%), and Transport, postal and warehousing (4.1%) (ABS, 2019a). The unemployment rate for Bogan LGA is 5%, which is less than the national rate of 6.9% (ABS, 2019a).

Nyngan would be the key service centre of the Yarren Hut Solar Farm construction work force, with other service centres including Dubbo (150 km east) and other smaller surrounding towns such as Bourke (205 km north) and Cobar (130 km west). The nearest major city is Sydney located 550 km south east.

Community make up and priorities

Bogan Shire Council has five key strategic themes and goals in their Community Strategic Plan 2027 (Bogan Shire Council, 2017). The Shire's vision for the future is:

"Comfortable Country Living"

The plan identifies the community's main priorities and aspirations for the future. The four key themes and goals include:

- Social - An inclusive community that works together and is able to access services and opportunities to support our comfortable country living.
- Infrastructure - Construct and manage reliable and efficient community assets that provide access to quality services.
- Environmental - To support, enhance and preserve the environment of our shire through sound planning and management practices to ensure a sustainable, healthy and safe community.
- Economic - A vibrant local economy with a diversity of successful businesses that provide local employment opportunities and contribute to a prosperous community.
- Civic Leadership - Strong, transparent and effective governance with an actively engaged community to ensure we remain Fit for The Future.

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with particular reference to "A vibrant local economy with a diversity of successful businesses that provide local employment opportunities and contribute to a prosperous community"

6.4.2 Approach

Potential socio-economic impacts of the proposal incorporates the views expressed by local community members and Bogan Shire Council, local and regional strategic plans and likely financial impacts on local businesses.

General attitudes to renewable energy projects

Research indicates there is widespread support for solar energy as a source of energy for electricity generation in Australia (ARENA n.d.); 78% of respondents to the ARENA survey were in favour of largescale solar energy facilities and 87% are in favour of domestic installations. The largescale solar energy sector is still at a relatively early stage of development in Australia. However, while most members of the community are aware of largescale solar energy, many do not know a great deal about their impacts (ARENA n.d.).

Three approaches to improving community understanding of the visual impacts of largescale installations include:

- Provision of images (from many angles) of largescale solar facilities, particularly in the early stages of a proposal.
- Understanding the similarities between highly supported domestic scale installations and large-scale facilities.
- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for (Source: extracted from ARENA n.d.).

Section 6.1 of this EIS assesses the visual impacts of the proposal on the rural landscape and visual amenity of the area..

6.4.3 Potential impacts

Construction

During construction, the proposal would generate both positive and adverse socio-economic impacts.

Likely positive impacts include:

- Significant generation of short-term employment of up to 40 workers during peak construction (five months) and many of these could be drawn from the local area.
- The skills obtained during the employment would open up further opportunities to individuals and suppliers, creating long term benefits.
- Temporary boost to the local and regional economies through increased demand for accommodation, goods and services.
- Increased resilience for local farmers and the community in the event of drought or lower agriculture commodity prices, by proving an additional source of income (drought proof and independent of agriculture).

Likely adverse impacts include:

- Manageable increase in traffic on local roads during peak construction (refer to section 6.6).
- Limited change in the rural landscape character and visual amenity of the area (refer to sections 6.2 and 6.3).
- Influx of workers may put pressure on local accommodation, health and broader services during peak construction.

Overall, it is considered that the proposal would have a positive socio-economic impact given the significant economic boost the proposal would generate. It is considered that adverse impacts would be manageable given the temporary nature of the construction phase. These temporary impacts would be managed through the implementation of safeguards. Large-scale solar farms are not new to Nyngan and the proposal is smaller-scale than others that have already been approved and constructed such as the 100 MW Nyngan Solar Farm.

Operation

During operation, the proposal would generate largely positive socio-economic impacts as described below.

EMPLOYMENT BALANCE

The development site belongs to one privately owned mixed cropping and grazing farm. The farm is currently family operated. During specific times of the year, contractors are engaged to assist with sowing and harvesting. These activities are seasonal and would typically employ several people. In an employment context, the loss of jobs associated with the reduction of agricultural activities would minimal due to the limited size of the development site, which is smaller than other large-scale solar farms. One or two FTE jobs created to support solar farm operations.

DIVERSIFIED INCOME FOR LANDHOLDERS

Agribusinesses are vulnerable to multiple factors having the potential to impact their long-term viability, such as:

- Increasing input costs (e.g. water, fertiliser, soil ameliorants, herbicide).
- Environmental events (e.g. drought, floods, biosecurity infestation, fire).

- Fluctuating commodity prices.

The private landholder leasing part of their agricultural land for the proposal would benefit from an alternative source of income. These lease payments would be regular and independent of the agriculture sector, providing resilience to cope with uncertainty relating to the factors listed above. Income diversification can also assist farmers to offset running costs and thus improve yields in land retained in agricultural production.

COMMUNITY RESILIENCE

Providing jobs and sources of income independent of agriculture, has the potential to lessen the blow to commercial and retail businesses in small regional towns because household disposable income across the community becomes more stable.

Operation and decommissioning

The development of rural land uses compatible with agricultural activities, such as solar power generation, has the potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. They also provide a substitute for carbon emission producing electricity production that is stable, renewable and consistent with State and National greenhouse emission reduction objectives.

The installation of solar array modules that involve little soil disturbance and provide an alternative income stream for large agricultural properties, can be seen as an important local economic benefit.

It is estimated that the solar farm would require around $39,290 per MW AC per year of spending to maintain, or about $1.1 million per year.

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

Although the number of employees required during decommissioning would be less than that for construction, it is considered likely to offer a similar economic benefit in terms of opportunities for local staff and industries. Decommissioning may also include local recycling of infrastructure components.

It is generally considered that land prices around the development site are strongly linked to the agricultural productivity of the land. Agricultural productivity on surrounding land would not be affected by the proposal. It is therefore considered unlikely that land prices would be adversely affected by the proposal.

6.4.4 Safeguards and mitigation measures

Table 6-11 Safeguards and mitigation measures for socioeconomic and community impacts

No.	Safeguards and mitigation measures	C	O	D
SE1	A Community and Stakeholder Engagement Plan (CSEP) would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	**C**	**O**	
SE2	Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**	**O**	

No.	Safeguards and mitigation measures	C	O	D
SE3	Liaise with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaise with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

6.5 NOISE AND VIBRATION IMPACTS

Noise and vibration impacts are an important consideration in the planning and implementation of the proposal's construction and maintenance activities.

NGH conducted noise modelling against established noise criteria for the construction and operational phases of the proposal, presented below.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Noise –

including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry (2017), cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.

6.5.1 Existing environment

The existing noise sources from land use on and adjacent to the development site generally consist of:

- Road traffic noise from Mitchell Highway.
- Livestock grazing and management.
- Spraying, cultivation and harvesting of crops.
- Hay baling or harvesting and transport.

Existing noise generating equipment or activities include tractors, headers, bailers, grain and livestock transport, quad bikes, light vehicles, loaders, crushing plants, excavators, and heavy vehicles. Agricultural land use characterises the background noise within the area. Noise levels from farm activities are concentrated at peak times during the year such as seeding and harvesting whereas traffic noise from Mitchell Highway and local roads is more continuous throughout the year.

Traffic volumes for Mitchell Highway were obtained from the TfNSW traffic volume viewer. The most recent traffic volumes were recorded for 2018 at a location 280 m east of Pangee Street, Nyngan. The average daily traffic (adt) volumes were 1,238 vehicles per day (vpd) travelling in both north and south directions. Approximately 25% of traffic movements were heavy vehicles.

Mitchell Highway is located approximately 270 m from the north eastern boundary of the development site. The traffic noise on Mitchell Highway contributes to the noise character of the area.

Weather impacts on sound travel

Noise emission can also be influenced by prevailing weather conditions. Wind has the potential to increase noise at a residence when it is at low velocities and travels from the direction of the noise source. Prevailing winds for the proposal were obtained from the Bureau of Meteorology (BoM) weather station near Cobar 114 km to the west of the development site

(http://www.bom.gov.au/climate/averages/wind/selection_map.shtml). The wind rose shown in Figure 6-10 indicates that winds are unlikely to blow noise from the development site to the nearest residences 5 km away.

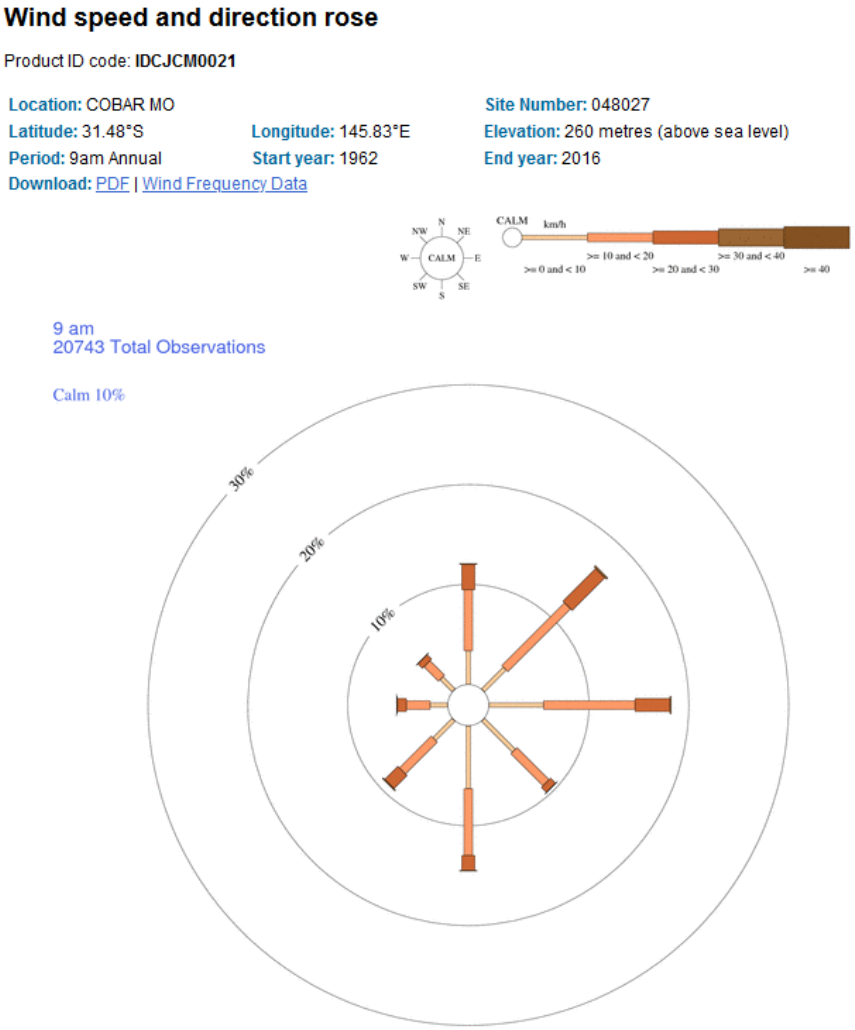

Figure 6-10 Cobar BOM annual wind rose (source BoM 2020b)

Background noise levels

Background noise monitoring has not been conducted for the proposal, hence, the minimum applicable RBL of 35 dB(A) for the daytime and 30 dB(A) for the evening and night-time periods was adopted for the noise assessment. It is anticipated that RBLs would exceed noise from the proposal at all times of day and night during construction and operations. Identified sources of background noise include traffic, predominantly on Mitchell Highway, farming machinery and livestock.

6.5.2 Approach

Construction noise

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

The ICNG provides direction on the calculation of 'noise management levels (NML)' for noise sensitive residences. The NMLs are relative to the time of day. During standard construction hours, construction noise levels measured at a residence should comply with Table 6-12. Residences are 'highly noise affected' when measured construction noise is above 75 dB(A) at the residence. Adhering to the levels described in the ICNG will minimise the impact of construction noise on adjacent residences. The **rating background noise level** (RBL) is a single figure that represents background noise levels for noise assessment purposes. The noise descriptor L_{AF90} is the noise level that is exceeded for 90% of the time and is used to measure the RBL. Measurements of the RBL are made at residences likely over seven days without rain, strong wind or extraneous noise.

Table 6-12 Construction noise levels.

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

Operational noise

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

- Intrusive noise levels.
- Amenity noise level.

The NPI describes the process for determining intrusive and amenity noise levels from an industrial noise source. Further, the NPI describes a process for determining acceptable levels of intrusive and amenity noise levels from an industrial noise source. The **L_{Aeq} descriptor** is used for measuring and describing intrusive noise levels and amenity noise levels. The **L_{Aeq} descriptor** is the equivalent continuous (energy-average) A-weighted noise level from the source measured over a 15-minute period (during operation).

Generally, the operational intrusive noise level is acceptable if it does not exceed the RBL by more than 5dB(A). The criteria for intrusive noise are described in Table 6-13. The night-time NML is not applicable to the proposal as no works would be undertaken or equipment utilized during darkness hours.

Table 6-13 NSW Noise Policy for Industry intrusiveness goals.

Time of day	RBL dB (A) L_{A90}	Intrusive noise = RBL + allowance	NML dB (A) $L_{A90\ (15min)}$
Day (Monday to Friday 7 am to 6 pm, Saturday to Sunday and public holidays 8 am to 6pm)	35	= RBL + 5	40
Evening (6pm to 10pm)	30	= RBL + 5	35
Night (Monday to Friday 10pm to 7am, Saturday to	30	= RBL + 5	35

Time of day	RBL dB (A) L_{A90}	Intrusive noise = RBL + allowance	NML dB (A) $L_{A90\ (15min)}$
Sunday and public holidays 10pm to 8am)			

The NPI describes a process for determining the project amenity noise levels. This aims to limit continuing increases in noise levels from industrial development. The recommended amenity noise levels (NPI Table 2.2) aim to protect against noise impacts such as speech interference, community annoyance and some sleep disturbance. The project amenity noise level (Table 6-14) represents the objective for noise from a single industrial development at a residence. Industrial noise during operation should not normally exceed the acceptable noise levels for rural properties. The NPI allows for the calculation of the project amenity noise level for industrial developments as the recommended amenity noise level minus 5 dB(A).

The night-time project amenity noise level is not applicable to the proposal as no works would be undertaken or equipment utilized during darkness hours.

Table 6-14 NSW Noise Policy for Industry amenity goals.

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

Sensitive residences

No residences were identified within 5 km of the development site boundary as shown in Figure 6-1.

6.5.3 Potential impacts

Construction noise impact assessment

Construction noise management levels (NMLs) at all residential receptors have been calculated for the project (Table 6-15). These NMLs will be used to manage impacts associated with noise sensitive receivers adjacent to the proposal. The NMLs for the project have been calculated based on the minimum applicable RBL and NSW ICNG (DECC 2009) criteria (Table 6-9). In addition, during standard construction hours, sensitive receivers experiencing construction noise at or above 75 dB (A) would be deemed highly noise effected. The night-time NML is not applicable to the proposal as no works would be undertaken or equipment utilized during darkness hours.

Table 6-15 Construction noise management levels

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

Construction noise sources

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

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

The proposed activities above use readily available construction equipment. As such, noise levels associated with that equipment (Table 6-16) and activity is well understood and able to be modelled. The construction activities selected above provide a **worst-case scenario** for noise generated from the site. It is common for the road work and compound construction activities to precede the construction of solar panel frames and cabling. The activities above rarely occur in the same location at the same time due to safety and logistics. As such, predictive modelling of the noise impacts during construction examines three scenarios, deemed to have the highest noise impact, that all of the plant listed in Table 6-16 would be operating simultaneously. It was envisaged that these scenarios would occur across the site, sequentially. Generally, earthworks for roads and hardstands (scenario one) would precede scenario two (cable installation and panel framing) and scenario two would precede scenario three (panel assembly). Noise predictions were modelled for a worst-case scenario and indicate that NMLs would be not be reached at any existing residential dwelling at any time over the life of the proposal.

Table 6-16 Construction noise scenario plant

Scenario 1		Scenario 2		Scenario 3	
Earthworks and road construction	**Sound power level ((dB)A)) at 7 m**	**Panel framing and cabling equipment**	**Sound power level ((dB)A)) at 7 m**	**Assembly of frames and panels**	**Sound power level ((dB)A)) at 7 m**
Grader (x 2)	88	**Telehandler (x 2)**	66	**Front end loader/telehandler (x 5)**	66
Excavator (x 2)	85	**Flatbed truck (x 1)**	85	**Power generator 100 kVA (x 1)**	60
Water cart (x 1)	82	**Piling rig (x 2)**	87	**Power generator 5 kVA (x 1)**	78
Vibratory roller (1)	84	**Light vehicle (x 5)**	78	**Power hand tools (x 5)**	60
Tipper truck (2)	85	**Power hand tools (x 4)**	60	**Bobcat (x 1)**	87

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

Construction scenarios

Three noise scenarios detailed were used to predict the likely impact of noise within a radius of the development site that indicates highly noise affected and NML zones for each scenario. Noise impact zones for each scenario are shown in Figure 6-11 to Figure 6-13.

It should be noted that weather conditions affect the way noise travels, leading to decreased accuracy of noise level estimates over 300 m.

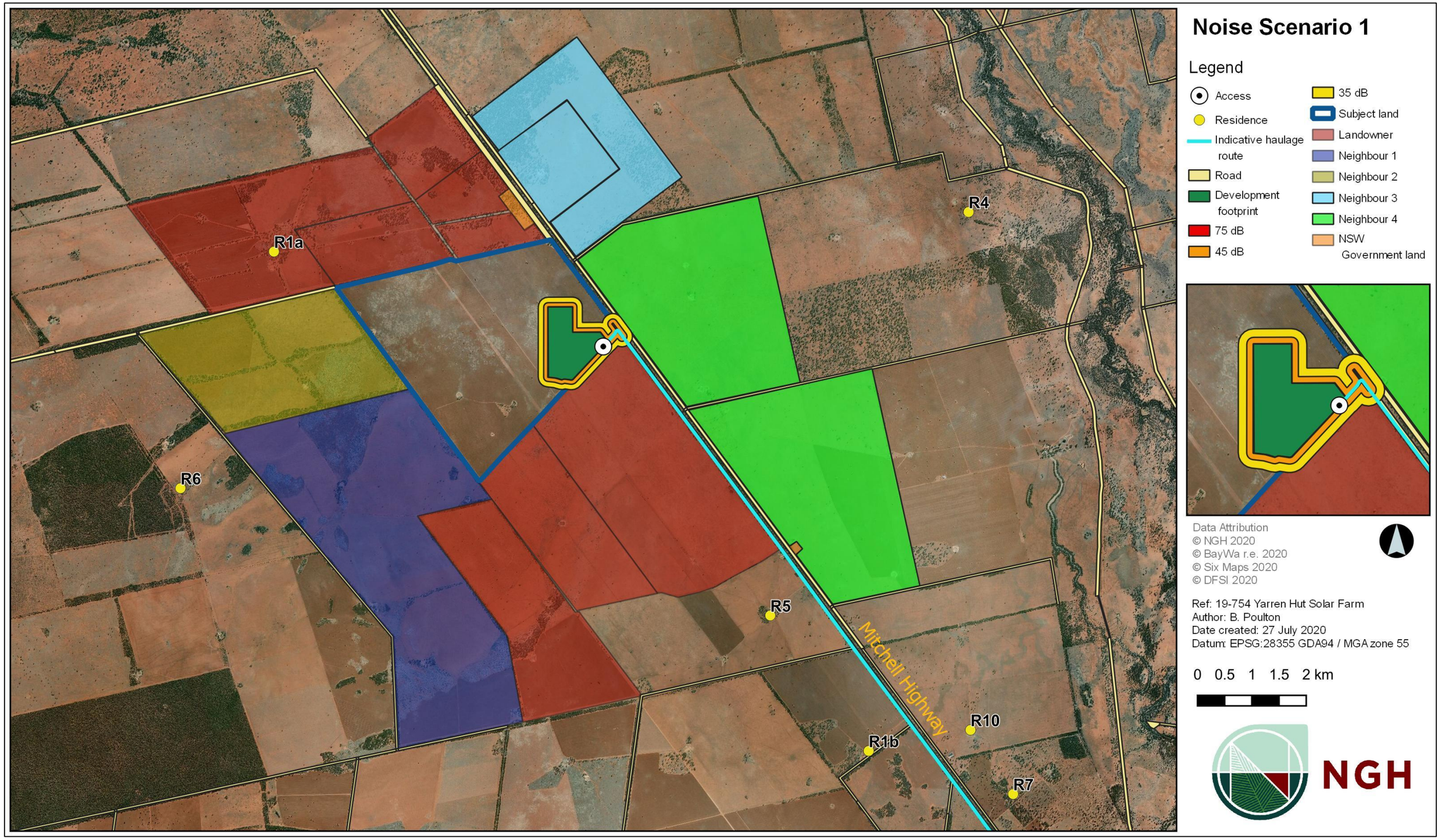

Figure 6-11 Noise impact under Scenario 1

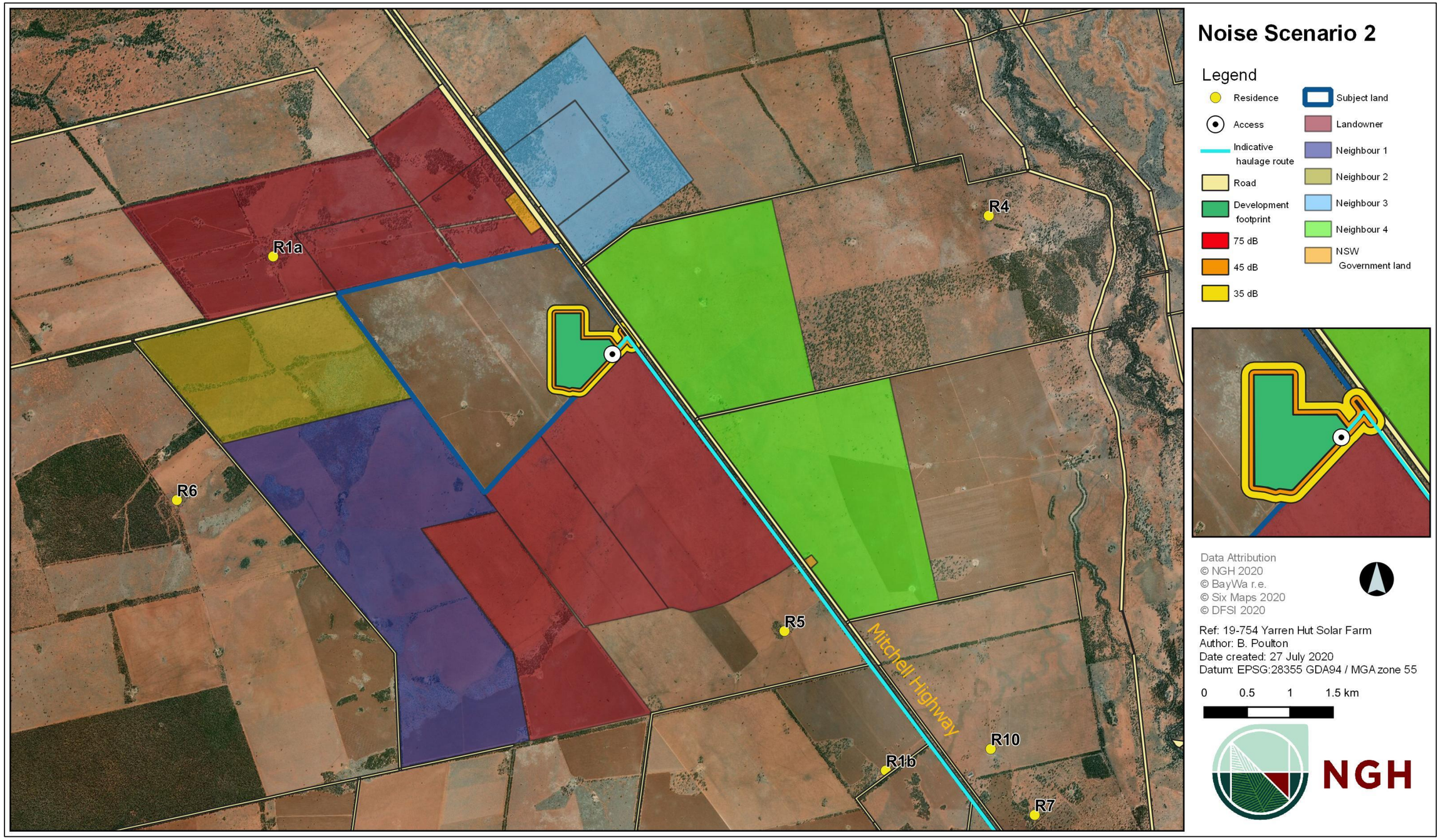

Figure 6-12 Noise impact under Scenario 2

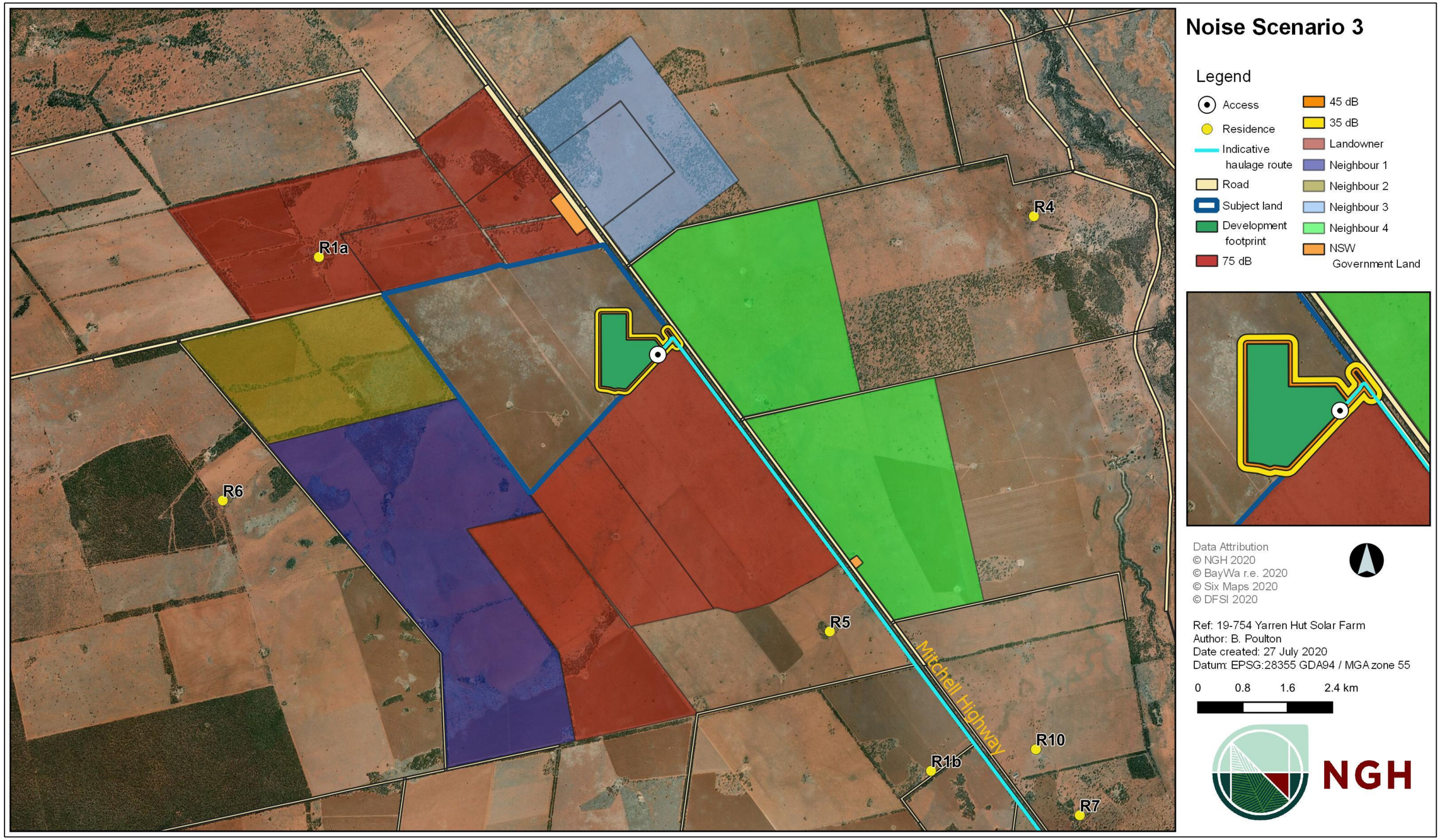

Figure 6-13 Noise impact under Scenario 3

Construction noise management plan

As shown in Figure 6-11 to Figure 6-13 construction noise is unlikely to be noticeable at any residence within the locality and therefore a construction noise management plan would not be required.

Operation noise assessment

OPERATION NOISE SOURCES

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

1. The substation (the switching station which is one part of the substation is to be assessed under a separate REF at Essential Energy's request).
2. Maintenance activities such as visual inspections of panels and structures, general maintenance (e.g. electrical repairs, replacing panels), cleaning of panels and emergency repairs (e.g. replacing torsion bars).
3. Tracking motors and movement of the solar panels.
4. Inverter stations.

The proposed activities above use readily available equipment. As such, noise levels associated with that equipment (Table 6-17) and activity is well understood and able to be modelled. The 'null effect distance' was modelled for each piece of equipment (Table 6-17). This represents the distance at which each individual piece of equipment no longer exceeds the intrusive NML criteria for the project.

Table 6-17 Operational equipment sound levels.

Equipment	Sound power level (dB (A)) at 7 m	Sound pressure level (dB) at 7 m	Null effect distance (m)
Substation transformers (x 2)	72	61	150
Light vehicle (x 1)	78	77	240
Tractor – slashing grass (x1)	92	81	700
Tractor – washing panels (x2)	92	81	700
Truck (x1)	83	72	350
Telehandler (x1)	81	70	300
Tracking motor (x10)	60	49	50
Modular inverters (x1)	70.4	59.4	130

OPERATIONAL NOISE ASSESSMENT

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

1. Operation of tracking motors (if used), substation and the inverter stations.
2. Maintenance vehicles accessing the site.
3. Grass slashing and panel cleaning.
4. Repairing faulty equipment.

These scenarios are deemed to have the highest noise impact, that is if all of the plant listed (refer to Table 6-19 Table 6-20, Table 6-21) would be operating simultaneously, which is unlikely. If repairs are carried out, then the inverter is switched off and isolated for safety reasons. The activities selected provide a worst-case scenario for noise generated from the site. As detailed below, for all scenarios, due to the considerable distance between any residence and the development site, no operational noise would be detected.

Scenario 1 – Operation of trackers, substation and inverters

During operations, the substation and inverters would generate low levels of continuous noise. If used, the tracking motors rotating the panels would generate low intermittent noise during the day, operating every 15 minutes for about 0.5 minutes.

The substation would contain one power transformer to transform 33 kV from the solar farm to 66 kV for transmission. Australian Standard AS 60076 Part 10 2009 'Power Transformers – Determination of Sound Power Levels' specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the 66 kV power transformer is not yet available, a conservative assumption is provided below based on ~32 MVA 66 kV power transformer. The specification for the ~32 MVA power transformer indicates that the sound power output from the transformer would be about 72 dB(A) at 7 m.

During operation, there would be approximately 7 - 8 modular inverters. Due to the considerable distance between any residence and the development site, no operational noise would be detected.

Table 6-18 Operational equipment for Scenario 1.

Equipment	Sound power level (dB (A)) at 7 m (per item)
Essential Energy substation – transformer (x 1)	72
Tracking motors	60
Inverters	70

Scenario 2 – Maintenance vehicle activity

During operations, staff would be required on-site to maintain the solar farm. At times several vehicles may access the development site per day. Maintenance activities would mostly be conducted inside a maintenance/control building located in the north eastern corner of the development site. Noise from other maintenance works (replacing/inspecting equipment) would be intermittent and low level.

An operational maintenance scenario includes up to two maintenance vehicles across the project site to carry out electrical works or complete inspections. The scenario also includes the continuous noise generated by the substation and invertor stations, and intermittent noise associated with the tracking motors rotating the panels (Table 6-19). Due to the considerable distance between any residence and the development site, no operational noise would be detected.

Table 6-19 Operational equipment for Scenario 2.

Equipment	Sound power level (dB (A)) at 7 m (per item)
Essential Energy substation transformer (x 1)	72

Equipment	Sound power level (dB (A)) at 7 m (per item)
Tracking motors	60
Inverters	70
Light vehicles (x 2)	81

Scenario 3 – Grass slashing and panel cleaning

During operations, intermittent grass slashing and panel cleaning may occasionally be required. Grass slashing along the APZ could generally occur in spring after vegetation growth has occurred and may be required after sporadic summer rainfall. Panel cleaning would occur after dusty conditions like summer or as required. BayWa r.e. would implement crash grazing to control biomass within the APZ so slashing may not be required.

An operational scenario includes one tractor with a slasher attached. Slashing and panel cleaning could be undertaken simultaneously within the same part of the development site, but this is highly unlikely. The scenario also includes the continuous noise generated by the substation, inverters and tracking motors. Due to the considerable distance between any residence and the development site, no operational noise would be detected.

Table 6-20 Operation equipment for Scenario 3.

Equipment	Sound power level (dB (A)) at 7 m (per item)
Tractor – slashing grass or panel cleaning (x1)	92
Essential Energy substation transformer (x 1)	72
Tracking motors	60
Inverters	70.4

Scenario 4 – Repairing faulty equipment

During operations, repair and replacement of broken or faulty equipment would be required intermittently. A repair scenario to consider, is for example, the replacement of a torsion bar that operates the movement of the panels (Table 6-21). The scenario also includes the noise generated by the substation, inverters and tracking motors. Due to the considerable distance between any residence and the development site, no operational noise would be detected.

Table 6-21 Operation equipment for Scenario 4.

Equipment	Sound power level (dB (A)) at 7 m
Truck (x 1)	55
Telehandlers (x 2)	81

Equipment	Sound power level (dB (A)) at 7 m
Light vehicle (x 1)	78
Essential Energy substation transformer (x1	72
Tracking motors	60
Inverters	70

Sleep disturbance

The NPI states:

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

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

TRANSMISSION LINE

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest residence from the overhead power line and the Essential Energy substation is 5 km (R1a), aeolian noise impacts are expected to be negligible.

Vibration

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

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at the nearest residential dwelling (5 km). Potential vibration impacts from operation are therefore not assessed any further.

6.5.4 Safeguards and mitigation measures

Table 6-22 Safeguards and mitigation measures for noise and vibration impacts

No.	Mitigation strategies	C	O	D
NS7	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**

C: Construction; O: Operation; D:

6.6 TRAFFIC, TRANSPORT AND ROAD SAFETY

Amber Organisation (2020) was engaged to complete a Traffic Impact Assessment for the proposal including potential impacts to the proposed construction transport route including Mitchell Highway. The full Traffic Impact Assessment is available in Appendix D.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Transport – including

- *an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation.*
- *an assessment of the likely transport impacts to the site access route (including Mitchell Highway and Nyngan township), site access point, any Crown land, particularly in relation to the capacity and condition of the roads.*
- *a cumulative impact assessment of traffic from nearby developments.*
- *a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required).*
- *a description of the measures that would be implemented to mitigate any transport impacts during construction.*

TRANSPORT FOR NSW REQUIREMENTS

Following a review of the submitted documentation TfNSW have identified and recommend the following key issues are further addressed in the EIS being prepared in support of the project:

- *A Traffic Impact Assessment (TIA) prepared in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments 2002, undertaken by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12:*
  - *Road transport volumes, distribution and vehicle types broken down into:*
    - *Hours and days of construction.*
    - *Schedule for phasing/staging of the project.*
  - *The origin, destination and routes for:*
    - *Employee and contractor light traffic.*
    - *Heavy vehicle traffic.*
    - *Over size and over mass traffic.*
    - *Travel/ haulage routes inclusive of the materials, volumes to be transported along each route including haulage volumes and materials to be transported by rail (if any).*
    - *The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.*
    - *The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.*
    - *Consideration of project traffic volumes and potential implications with intersections with the local road network, through the township of Nyngan and beyond as part of identifying the proposed haulage routes for this proposal will be further outlined.*

- *Haulage times/scheduling should consider the cumulative impacts of any surrounding developments.*

- *The total traffic impact of existing and proposed development on the road network with consideration inclusive of:*
  - *Existing background traffic.*
  - *Project-related traffic throughout each stage including construction, operation and decommissioning.*
  - *Projected cumulative traffic volumes and the potential impact between each stage of the project.*
- *The volume and distribution of traffic generated by the proposed development, inclusive of:*
  - *Ratio of project light vehicles to heavy vehicles.*
  - *Peak times for existing traffic.*
  - *Peak times for project-related traffic.*
  - *Transportation hours.*
- *Impact of project related traffic with any rail interfaces.*
- *The layout of the internal road network, parking facilities and infrastructure within the project*
- *boundary.*
- *Impacts of road traffic noise and dust generated along the primary haulage route/s.*
- *Preparation of a Traffic Management Plan to be developed in consultation with TfNSW and Bogan Shire Council for all project employees, including but not be limited to:*
  - *A map of the primary haulage routes highlighting critical locations.*
  - *Safety initiatives for haulage through residential areas and/or avoidance during school zone hours or local school bus pick up / drop off locations times.*
  - *Consideration of the use of shuttle buses to transport employees to and from site.*
  - *An induction process for vehicle operators and regular toolbox meetings.*
  - *A complaint resolution and disciplinary procedure.*
  - *Any community consultation measures for peak haulage periods.*
  - *Local climatic conditions that may impact road safety of employees throughout all project phases (e.g. fog, wet and significant dry, dusty weather).*
- *It is noted a 66 kV electrical transmission line to connect the proposal to the existing Essential Energy transmission line is proposed. Any works within the road corridor as part of this component will require concurrence pursuant to Section 138(2) of the Roads Act 1993 from TfNSW, further detail should be provided in the EIS pertaining to this.*

BOGAN SHIRE COUNCIL REQUIREMENTS

Provide details of where any 'imported' construction workers are to be accommodated and how they are to be transported to and from site.

6.6.1 Existing environment

Regional road network

Nyngan is located on the intersection of the Barrier and Mitchell Highways. Barrier Highway is a regional state highway, generally running in an east - west alignment. It has a carriageway width of 10 m, and one traffic lane of approximately 3.5 m wide in each direction. Mitchell Highway is a regional state highway, generally running in a north-south alignment.

Local road network

The TfNSW (2020) NSW Combined Higher Mass Limits and Restricted Access Vehicle Map indicates that Mitchell Highway is an approved heavy vehicle access routes (25/26 m B-double routes as a maximum) (Appendix D). As such, the major access and transport/haulage route from the south and the north would be Mitchell Highway. The major transport route is subject to further assessment, specialist input and consultation with the Bogan Shire.

The Nyngan townsite is accessible from several local roads including Mitchell Highway, Barrier Highway, Canonba Road and Old Warren Road. As such, selecting Mitchell Highway as the transport route to and from the proposal, would not adversely impact most of the traffic moving to and from the local town centres of Nyngan and Bourke.

There are no Crown paper roads or Council roads relevant to the proposal.

Traffic volumes

Traffic volumes for Mitchell Highway were obtained from the TfNSW traffic volume viewer. The most recent traffic volumes were recorded for 2018 at a location 280 m east of Pangee Street, Nyngan. The adt volumes were 1,238 vpd travelling in both north and south directions. Approximately 25% of traffic movements were heavy vehicles.

6.6.2 Approach

A Traffic Impact Assessment (TIA) prepared in accordance with the methodology set out in section 2 of the RTA's Guide to Traffic Generating Developments 2002 was prepared by Amber Organisation (2020) in accordance with the *Austroads Guide to Traffic Management*: Part 12.

6.6.3 Potential impacts

Traffic generation

The Roads and Traffic Authority's (now TfNSW) '*Guide to Traffic Generating Development'* (RTA 2002) does not outline specific trip generation rates for the construction and operation of a Solar Farm. As such, traffic generation demand has been determined through the analysis of the forecasted employee, workforce and goods and service vehicle deliveries.

CONSTRUCTION

It is expected that daily traffic generation during the peak of the construction would arise from:

- Up to 40 construction personnel traveling to and from the development site. Daily light vehicle movements are estimated at 30 light vehicle movements, which could be reduced by shuttling construction workers to the development site by bus.
- Up to 34 heavy vehicle movements including MRV/HRV vehicles.

Peak construction vehicle movements represent the worst case scenario of a maximum 68 vehicle movements per day and would be limited to the five month peak construction period.

OPERATION

An operational workforce plus service contractors visiting the proposal on an irregular basis is expected to generate minimal traffic movements.

Site access

The proposal would be accessed from one main point off Mitchell Highway. A separate access located on the same access track off Mitchell Highway would be supplied for the substation.

Proposal requirements

A traffic impact assessment was completed by Amber Organisation in March 2020 (Appendix D). Access requirements can be separated into the following categories:

- Cars - would be required by project management staff and site workers to access the site. Cars would make up the largest proportion of vehicles accessing the site.
- Shuttle buses – may be used to transport workers to and from the site to minimise traffic volumes and transit risks during construction.
- Utility vehicles – would be required to transport equipment and materials around the site and for local pick up of materials.

- Trucks – would be used to transport equipment and materials around the site and for local pick up of materials. Larger sized deliveries would be undertaken by trucks as opposed to utility vehicles.
- Standard articulate trucks – would be used to transport approximately 12 m containers from point of origin.
- Oversize and/or over-mass vehicles – may be required to deliver larger infrastructure components.

Vehicle access to the site would generally be confined to the standard hours of construction. Exceptions would occur as staff arrive and leave the site, before and after shifts. Additionally, the delivery of large components may take place outside normal working hours, but this would be avoided where practicable.

Internal access tracks would facilitate access to all parts of the proposal, in particular to the inverter stations.

Internal access tracks would remain unsealed but would be re-sheeted with gravel or crushed and compacted soil, to maintain their condition during the construction phase.

Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby residences.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by ‘platooning’ of construction traffic.

HAULAGE

While a detailed haulage program has not yet been developed, it is expected that the project’s components are most likely to be delivered by road from Sydney and in some instances Melbourne. From Sydney, the route would likely include the South Western Motorway (M5), the Great Western Highway (A22, A44 A32) and Mitchell Highway (A71, A32).

These roads are of sufficient capacity to accommodate the haulage of components required for the construction of the solar farm and transmission line.

INCREASED VEHICLE NUMBERS

Approximately 20 employees would be required during the first months of construction, rising to 40 employees during the peak construction period (five months duration). During the peak period, up to approximately 30 light vehicle movements per day would be expected to and from the site. Light vehicle movements would be limited by implementing a shuttle bus service. This is a safety management action and reduces impacts on the local road network. Based on the utilisation of bus services this would reduce the light vehicle traffic to around 68 movements during the peak construction time (considering movements to be a single trip).

For materials and equipment delivery, during the three-month initiation stage approximately 10 heavy vehicles would access the site each day. This would extend to an estimated peak of 17 heavy vehicles per day during the peak delivery period, equating to 38 heavy vehicle movements during this time. These heavy vehicle movements will predominantly be Truck and Dog configuration with a number of mixer trucks and articulated loads.

INCREASED COLLISION RISK

The increased collision risk relates primarily to traffic entering and exiting the site from Mitchell Highway. This relates to both oncoming traffic and traffic following vehicles that are turning off Mitchell Highway.

Based on a 110 km/hr speed limit and a reaction time of 2 seconds, a safe intersection sight distance of 248 m is required in accordance with the Austroads (2009) *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*. At the access track/Mitchell Highway intersection, sufficient sight distance is affordable for turning vehicles. Accordingly, the sight distance at the access is considered acceptable.

DAMAGE TO ROAD INFRASTRUCTURE

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along Mitchell Highway, the impact is expected to be negligible due to the existing capacity of the road network. However, the impact of turning traffic at the Mitchell Highway / access road intersection would likely require monitoring to ensure that the road is maintained in an adequate condition.

Mitchell Highway is already sealed at the single access point. The proponent would manage construction impacts on Mitchell Highway with a Traffic Management Plan. This may require periodic road improvements and lane closures to preserve traffic flow.

ASSOCIATED NOISE AND DUST

The increase in traffic during construction and decommissioning may increase noise and dust in the local area. However, noise and dust impacts are not anticipated to adversely impact the local community as there are no residences within 5 km of the development site. Dust will however be monitored and controlled to avoid indirect impacts on the surrounding environment and reduce soil erosion.

The increase in traffic and heavy vehicle movement during construction and decommission would result in a minor increase in noise as a result of the proposed works. Mitchell Highway is located directly east of the project and forms part of the intersection where the concentration of traffic is expected. Mitchell Highway already experiences moderate levels of traffic including heavy vehicles. The closest residence to the access point is (R5), which is located approximately 5.9 km to the south. This residence is also accessed from Mitchell Highway, but the house is located over 800 m from this arterial road. The traffic noise during construction and decommission would be unlikely noticeable at the nearest sensitive residence.

DISRUPTION TO EXISTING SERVICES

Increased traffic along Mitchell Highway during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along the road. These disruptions would be short term only to provide traffic control during road work.

SUMMARY OF CONSTRUCTION AND DECOMMISSIONING IMPACTS

Overall, the additional traffic associated with the construction and decommissioning of the solar farm would be a small component of the existing traffic loads on local and state roads. No substantive increased collision risk, damage to road infrastructure, noise or dust impacts, disruption to existing services or reduced level of service is expected to accompany construction or decommissioning.

Operation

Vehicles would use the designated road network to access and travel within the site during the operational phase (about 50 years). Only a small number of vehicle movements per day would be expected during normal operation of the solar farm. Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure. Operational staff would be confined to designated parking areas and access roads/tracks within the proposal area.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access or be above the background noise levels.

Additional risks to road safety from operational traffic would be minimal.

Potential cumulative impacts

Peak construction total traffic movements (return trips) for the proposal are estimated up to 68 per day. The Traffic Impact Assessment undertaken by Amber (2020) estimates the capacity of Mitchell Highway at approximately 141 vehicles per hour. It would be manageable to schedule heavy vehicle traffic movements to and from the development site outside peak worker transit periods, which would ensure that the capacity of Mitchell Highway is not exceeded.

The condition of Mitchell Highway between Bourke and Nyngan is sealed and approximately 7 m wide. Access to the development site from Mitchell Highway would be upgraded to meet the capacity for 36 m A -Double trucks and would be able to cater for a traffic flow capacity of more than 50 vehicles per hour per lane, substantially more vehicle movements than would be generated by the proposal.

6.6.4 Safeguards and mitigation measures

Safeguards for traffic, transport and associated safety impacts are listed in Table 6-23.

Table 6-23 Safeguards and mitigation measures for traffic, transport and safety impacts

No.	Safeguards and mitigation measures	C	O	D
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure and residential dwellings. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).	**C**		**D**
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The Traffic Management Plan would include but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network, to be undertaken in consultation with TfNSW. • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads (including internal roads) to minimise dust generation through increased traffic use.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	Following construction, a post condition survey of the relevant sections of the existing road network would be undertaken to ensure it is of similar condition as prior to construction.			
TT3	Obtain a section 138 Consent from the relevant council/agency to perform works within the road reserve.	**C**		
TT4	Any upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design Stage**		
TT5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

6.7 HYDROLOGY AND FLOODING

A Site Flood and Drainage Assessment Report was completed by GHD (2020) to assess the impact of the proposed permanent infrastructure on flooding. The report has been provided as Appendix H and summarised below.

Flooding –

1. *The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:*
   a) *Flood prone land.*
   b) *Flood planning area, the area below the flood planning level.*
   c) *Hydraulic categorisation (floodways and flood storage areas).*
   d) *Flood hazard.*
2. *The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the probable maximum flood, or an equivalent extreme event.*
3. *The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:*
   a) *Current flood behaviour for a range of design events as identified in 14 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.*
4. *Modelling in the EIS must consider and document:*
   a) *Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.*
   b) *The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.*
   c) *Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.*
   d) *Relevant provisions of the NSW Floodplain Development Manual 2005.*
5. *The EIS must assess the impacts on the proposed development on flood behaviour, including:*
   a) *Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.*
   b) *Consistency with Council floodplain risk management plans.*
   c) *Consistency with any Rural Floodplain Management Plans.*
   d) *Compatibility with the flood hazard of the land.*
   e) *Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.*

f) Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
g) Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.
h) Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.
i) Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.
j) Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.
k) Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

6.7.1 Existing Environment

The Bogan River is located 9 km east of the solar farm development site. The Bogan River floodplain is a complex broad floodplain consisting of multiple waterways. The Bogan River is the western most of these waterways.

The terrain on the west side of the Bogan River rises on the approach to the solar site. The terrain on the east side of the Bogan River falls towards Belar Creek and Gunningbar Creek. Gunningbar Creek is an effluent waterway which transfers flood flows from the Macquarie River to the Bogan River.

In large Bogan River flood events, flooding is expected to extend across an extremely broad floodplain encompassing the Bogan River and extending eastwards for approximately 20 km.

6.7.2 Approach

A Site Flood and Drainage Assessment (Appendix H) was completed by GHD using available terrain elevation data for the site consisting of:

- 5 m grid LIDAR derived digital elevation model (DEM) NSW Government dataset. This data was acquired in 2015. The dataset has a vertical accuracy of 1 m.
- 30 m grid Shuttle Radar Topographic Mission (SRTM) derived DEM Australian Government dataset.

6.7.3 Hydrologic modelling results

Any local runoff flooding from the catchment areas on the west side of the Mitchell Highway is expected to be relatively shallow (generally less than 0.3 m deep) and slow moving (generally less than 0.5 m/s) given the terrain conditions. The absence of any incised waterways in the vicinity of the development site is due to these benign hydraulic conditions. A farm dam is located directly south of the development site. The dam receives inflows from small local runoff open drains. The available terrain data indicates that overflows from this farm dam will discharge westwards approximately parallel with the solar development site perimeter boundary in the direction of two further farm dams located on the subject land (Figure 6-14).

PMF

It is possible that flooding from the Bogan River floodplain may impact on the development site in a Probable Maximum Flood (PMF). A PMF has a very low probability of occurrence and most forms of non-critical infrastructure development including a solar farm facility are not required to be free from PMF flooding.

Hazard vulnerability

Development on a floodplain can lead to changes in flooding conditions as a result of the following causes:

- Raised ground levels obstructing flow (i.e. land filling associated with the development).
- Structures obstructing flow (e.g. buildings, roadway embankments, fences).

The above obstructions can lead to floodwater being redirected, thereby exacerbating flooding where the additional flow is diverted to. It can also lead to higher flood levels and velocities due to floodwater banking up behind obstructions.

Higher flood levels and velocities are of particular concern where they occur on adjoining properties. In these circumstances, development has effectively increased the flood risk of the adjoining property.

There is no existing flood sensitive development (e.g. dwellings or rural shedding) within a 5 km radius of the proposed development.

The development site is not located on a designated floodplain. The Bogan River floodplain is located to the east of the Mitchell Highway, a considerable distance from the development. There are no waterways or wetlands located on the development site. The development site has been predominantly cleared for agriculture.

Given the above, the development is not expected to impact on floodplain environmental values.

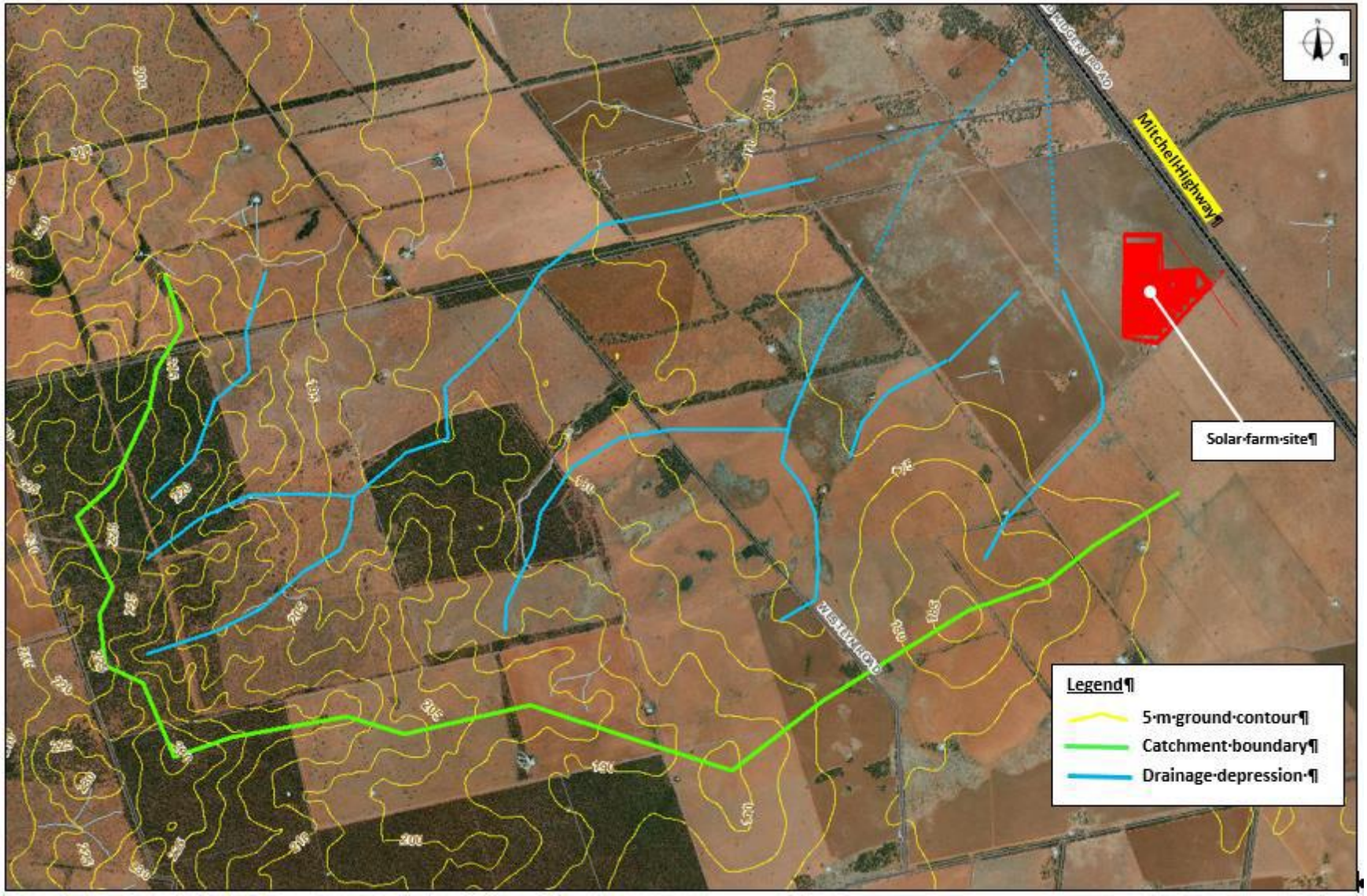

Figure 6-14 Local catchment plan (source: GHD 2020)

6.7.4 Potential impacts

Construction and decommissioning

The elevation of solar panels above the ground surface on pole supports means that solar panels can be positioned within areas which experience broad, shallow, low velocity flooding. Floodwater can pass below the elevated panels, with pole supports structurally strong enough to withstand any debris impact loads, whilst also being sparse enough to not significantly obstruct floodwater. As the proposal does not intend to raise ground levels or obstruct surface water flows, it is considered flooding would not be exacerbated.

The development components of a solar farm which are most sensitive to flooding impacts consist of the:

- Inverter stations.
- Substation.
- Office / storage buildings.

The above flood sensitive components would be positioned and / or designed to minimise their flood risk (e.g. by positioning them on a part of the development site which floods less frequently and less severely, and / or by elevating them above the ground level).

The inverter stations need to be positioned within the solar panel fields. The flood risk to the inverter stations can be reduced by having the inverters elevated 0.5 m above ground level.

Operation

The available ground survey elevation data indicates that the surface water flooding risk across the development site is low and quite uniform across the site. Riverine flooding is not expected to be impacting on the site. Local runoff flooding in the form of shallow slow moving inundation would occur in significant rainfall runoff events. The impact of proposed infrastructure on the hydraulic function of surface water drainage would be negligible, as the micro-topography and permeability of the soil's surface would not be altered with the exception of concrete footings for the 7 - 8 inverter stations, fence/CCTV/cable posts and ancillary facilities, which represent a very small proportion of the development site.

The proposed development is expected to pose an extremely low risk in relation to the safety of persons who may be present on the site during flooding.

The reasons for this are as follows:

- The expected benign nature of flooding conditions on the site. Flooding depths due to any local runoff flooding are not expected to exceed 0.3 m. Velocities are not expected to exceed more than 0.5 m/s.
- The nature of the proposed development is such that no persons will be occupying the site, except when carrying out maintenance and any other temporary work-related activities. There are no habitable buildings proposed for the site.
- The expected limited need for actions to minimise property flood damage (i.e. there is no need for persons to be on-site during flooding).

6.7.5 Safeguards and mitigation measures

The safeguards and mitigation measures relevant to flooding are based on the recommendation provided in the Site Flood and Drainage Assessment Report (GHD 2020).

Table 6-24 Safeguards and mitigation measures for hydrology and flooding.

ID	Safeguards and Mitigation Measures	C	O	D

F1	To mitigate the risk of flood sensitive components of the development being subject to flood damage, the following mitigation measures are proposed:
	• Inverter stations:
	  ○ Floor level of the inverter stations are to be elevated a minimum of 0.5 m above the surrounding ground surface level.
	  ○ Inverter stations are to be aligned such that their longer side is positioned in the north-south direction to minimise the potential for them to obstruct flow.
	• Substation and site office:
	  ○ The floor level of any flood sensitive facility buildings is to be elevated a minimum of 0.5 m above the surrounding ground surface level.
	• Solar array fields:
	  ○ The solar panels should be designed such that the whole of the panels are able to be elevated a minimum of 0.5 m above the ground surface level below (i.e. minimum height difference between the ground surface and the lowest part of the solar panel).
		Design		

F2	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal. The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	**C**	**O**	**D**
F3	A Business Floodsafe Plan would be prepared prior to construction in general accordance with the NSW SES Business Floodsafe Toolkit and Plan.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

6.8 WATER USE AND QUALITY (SURFACE AND GROUNDWATER)

The quality of water resources is closely linked to the surrounding environment and land use. Water usage, surface water and groundwater quality impacts are discussed below.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Water – *Including:*

- *an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources, drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulphate soils, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts.*
- *details of water requirements and supply arrangements for construction and operation.*
- *a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).*

BIODIVERSITY CONSERVATION DIVISION REQUIREMENTS

Water and soils –

1. *The EIS must map the following features relevant to water and soils including:*
   a) *Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).*
   b) *Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).*
   c) *Wetlands as described in s4.2 of the Biodiversity Assessment Method.*
   d) *Groundwater.*
   e) *Groundwater dependent ecosystems.*
   f) *Proposed intake and discharge locations.*
2. *The EIS must describe background conditions for any water resource likely to be affected by the development, including:*
   a) *Existing surface and groundwater.*
   b) *Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.*
   c) *Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.*
   d) *Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.*
   e) *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions http://www.environment.nsw.gov.au/research-andpublications/publications-search/risk-based-framework-for-considering-waterway-healthoutcomes-in-strategic-land-use-planning*
3. *The EIS must assess the impacts of the development on water quality, including:*
   a) *The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.*
   b) *Identification of proposed monitoring of water quality.*
   c) *Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan)*
4. *The EIS must assess the impact of the development on hydrology, including:*
   a) *Water balance including quantity, quality and source.*
   b) *Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.*
   c) *Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.*
   d) *Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).*
   e) *Changes to environmental water availability, both regulated/licensed and unregulated/rules based sources of such water.*
   f) *Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.*

g) Identification of proposed monitoring of hydrological attributes.

DPIE – WATER AND NATURAL RESOURCES ACCESS REGULATOR REQUIREMENTS

The EIS should include:

The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.

- *A detailed and consolidated site water balance.*
- *Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.*
- *Proposed surface and groundwater monitoring activities and methodologies.*
- *Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).*

BOGAN SHIRE COUNCIL REQUIREMENTS

Construction water –

Provide details of water source and quantity for construction phase.

6.8.1 Existing environment

Surface water

There are no watercourses or wetlands within or near the development site, nor is it located within any floodplains. The closest river is the Bogan River that runs approximately 9 km east of the development site.

Six man-made dam exists within the subject land of Lot 21 DP 704061. The nearest, shown in Figure 3-2, is located directly south of the development site. None of these dams would be impacted by the proposal.

The development is not expected to affect any water resource. Runoff from the development site would continue to drain northwards as it does under existing conditions with little or no concentration of runoff, consistent with existing surface runoff conditions. No harvesting of runoff is proposed and runoff from the development site would ultimately discharge to the Bogan River, approximately 15 km north east of the development site

Groundwater

The Australian Groundwater Explorer database (accessed 15 January 2020) of groundwater lists two bores within 1 km of the development site (GW802495 and GW802497). The status of bore GW802495 is listed as abandoned. GW802497 is listed as removed as shown in Figure 6-15. The presence and potential impacts on Groundwater Dependent Ecosystems (GDEs) are addressed in section 6.9.

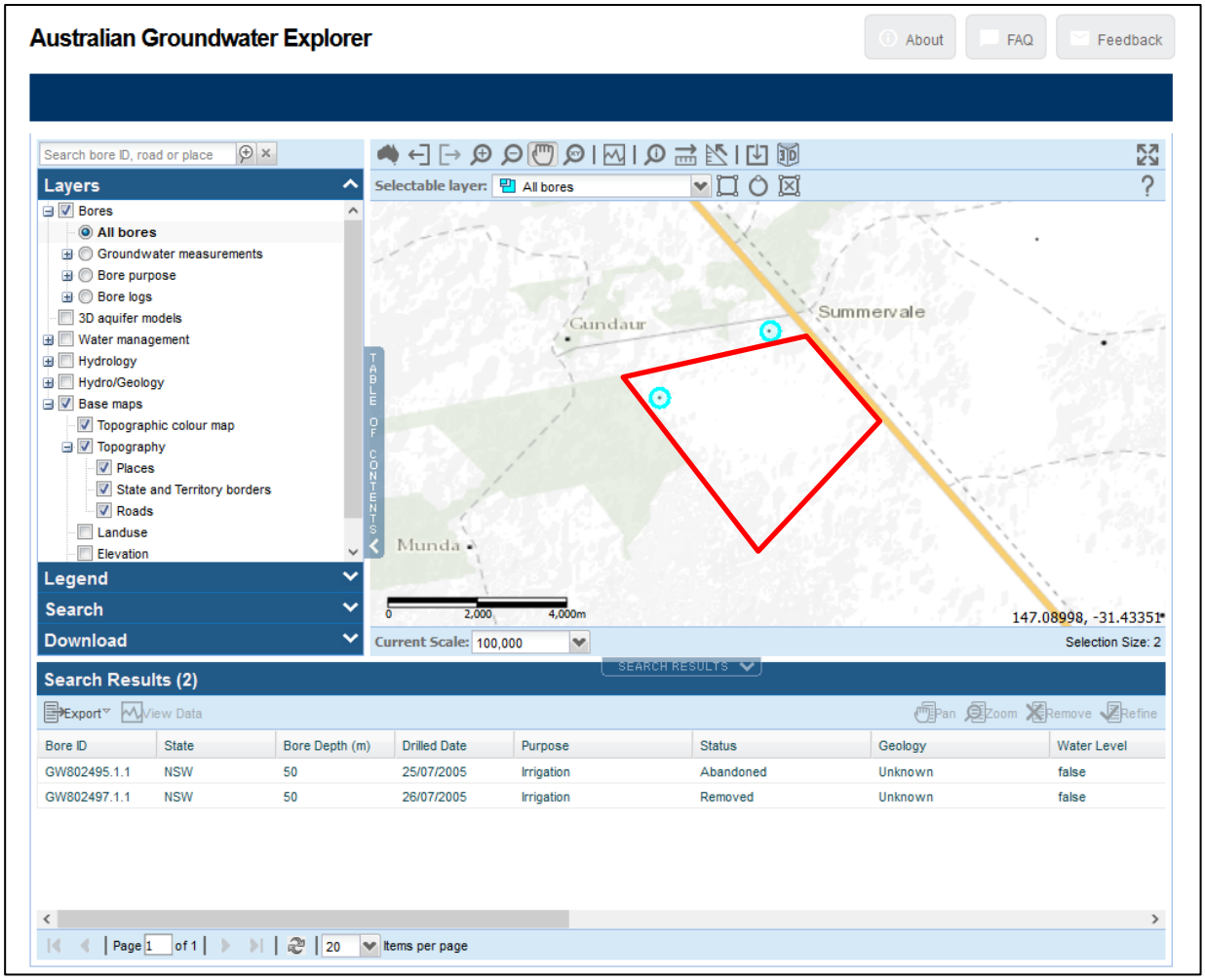

Figure 6-15 Groundwater works in the area (BoM 2020a). *The subject land boundary is indicated by the red line.*

Acid sulphate soils

A background search for acid sulphate soil potential using available SEED mapping (NSW Government 2020) was undertaken on 6 April 2020. No known acid sulphate soil deposits occur in proximity to the subject land as shown in Figure 6-16.

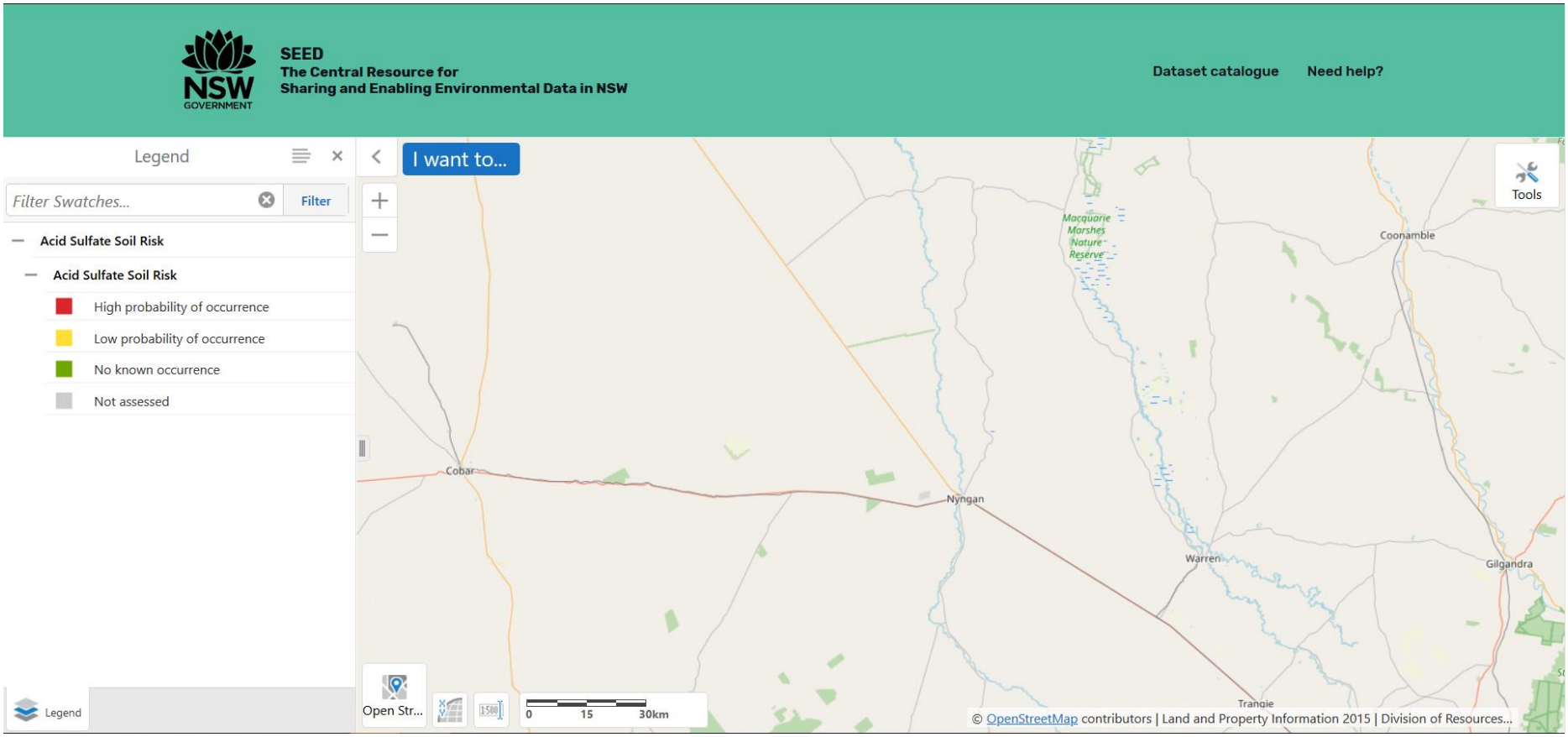

Figure 6-16 Acid sulphate soils (source: NSW Government 2020)

6.8.2 Potential impacts

Construction and decommissioning

WATER USE

Water use during construction would be minimal and largely used for dust suppression on unsealed roads and for the construction of new roads. The water requirement would vary, dependent on weather conditions, and is estimated to be up to 3,500 kL of grey water in total, based on an estimated 1 kL of water per km of internal road for dust suppression. About 60 kL of potable water would be required for employees and contractors (refer to Table 6-25).

Table 6-25 Water requirements during construction

Water quality	Annual construction water requirement (kL)	Potential sources	Availability
Potable (drinking)	60 (for ~10 months)	Bogan Shire Council standpipe	Available as required commercial supply
Non-potable	3,500 (for ~10 months)	Bogan Shire Council standpipe	Available as required

Water can be purchased (per kilolitre) from a Bogan Shire Council standpipe where the volume is available and stored onsite.

SURFACE WATER

The proposal would not directly affect surface water quality during construction as there are no watercourses or farm dams within the development site.

Indirectly, the proposed works would involve a range of activities that could disturb soils and potentially lead to sediment laden runoff, affecting local water ways including the irrigation channels, during rainfall events. These potential impacts are unlikely to significantly impact on water quality. No incised open drains or internal access track culverts are proposed as part of the site works within the solar panel fields. The intention is for the natural drainage characteristics to be largely retained, with any local runoff free to discharge over the pervious ground surface below the elevated solar panels. As no waterbodies exist within the development site and the drainage line impacting the farm dam directly south of the development site does not run through the development site either, no surface water monitoring is proposed.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides, none of which are considered difficult to manage. Bunds for fuel storage would be implemented if applicable.

Detention ponds, if required to manage surface water during construction and operation, would be detailed in the design phase, specific to the array layout. Erosion and sediment control measures would be implemented to mitigate any impacts in accordance with Landcom (2004); refer to section 7.3.

An appropriate wastewater management system for the site office would be developed according to the requirements of the Bogan Shire Council. The sizing and location of any retention basin / sedimentation basin for surface runoff from the site office / substation area would be finalised during the detailed design stage.

GROUNDWATER

It is unlikely that ground water would be extracted during construction. If required, a licence will be obtained for water extraction. There is no groundwater vulnerability under the Bogan LEP. It is considered that the proposal would have negligible impact on groundwater quality given the low pollution potential of the solar farm. Impacts to groundwater as a result of the proposed works are unlikely.

AQUATIC BIODIVERSITY

Groundwater Dependent Ecosystems (GDEs)

There are no watercourses within or near the development site, nor is it located within any floodplains. The closest river is the Bogan River that runs through the town of Nyngan, 17 km to the southeast. The closest point of the Bogan River to the development site is approximately 9 km east, the floodplain of which is contained within the eastern side of the Mitchell Highway.

Six man-made dam exists within the subject land of Lot 21 DP 704061. None of these dams would be impacted by the proposal. As such, any impact to threatened aquatic systems are likely to be minimal.

Water demand for the proposal would be relatively small, as construction of the solar farm is not water intensive. No surface or groundwater extraction of water is required.

There are no aquatic groundwater dependant ecosystems (GDE) as shown in Figure 6-17. Terrestrial GDEs mapped within and in proximity to the development site are shown in Figure 6-18. There is a low potential for groundwater to be encountered during excavations and earthwork for the construction. This is likely to be highly localised and no inception of groundwater is considered.

Aquatic biodiversity

Due to the absence of any waterbody within the development site it was determined that there would be no impact to threatened aquatic species. No EECs listed under the FM Act were identified within the development site or would be impacted by the proposal.

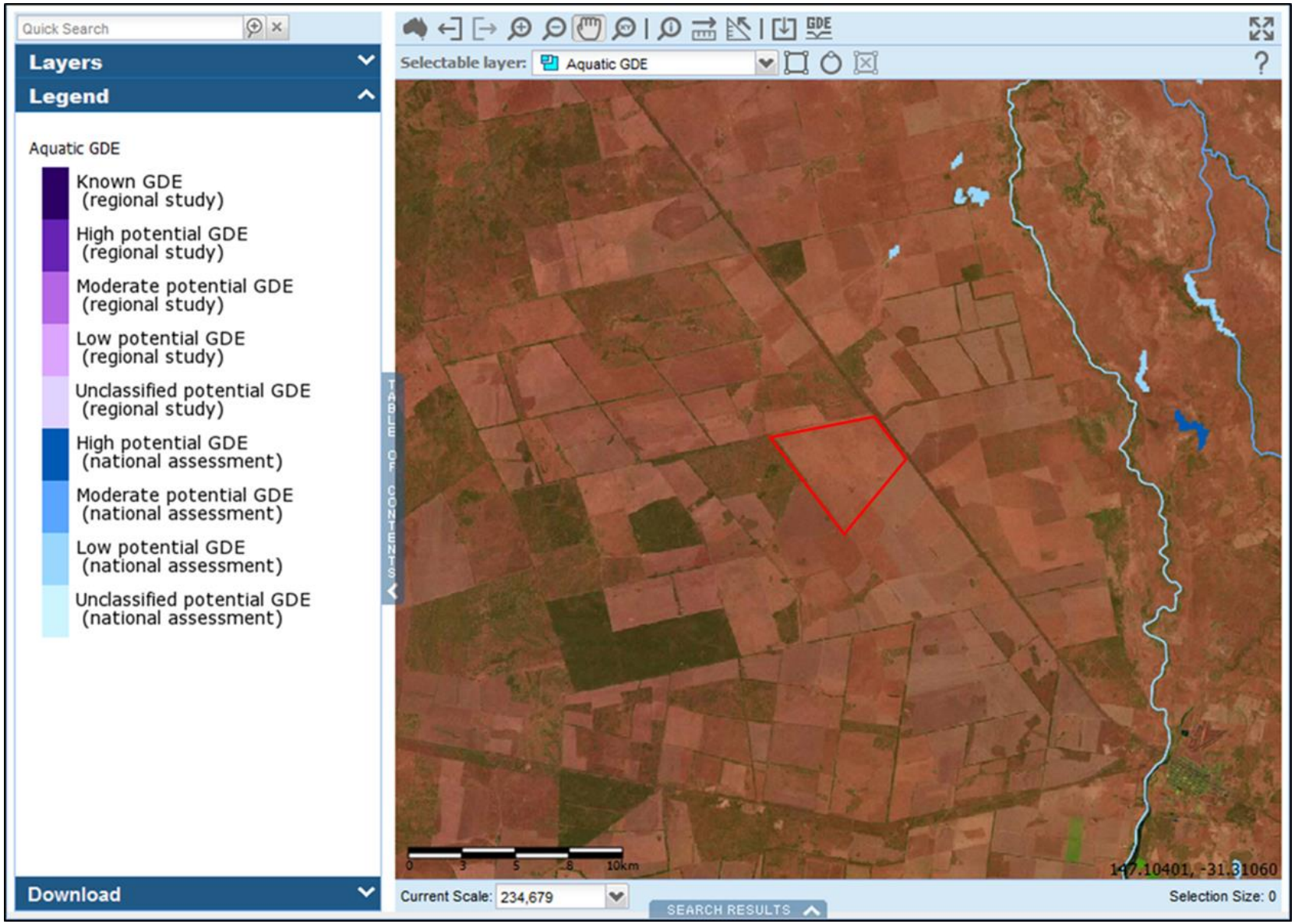

Figure 6-17 Aquatic GDEs in proximity to the development site (BoM 2020a)

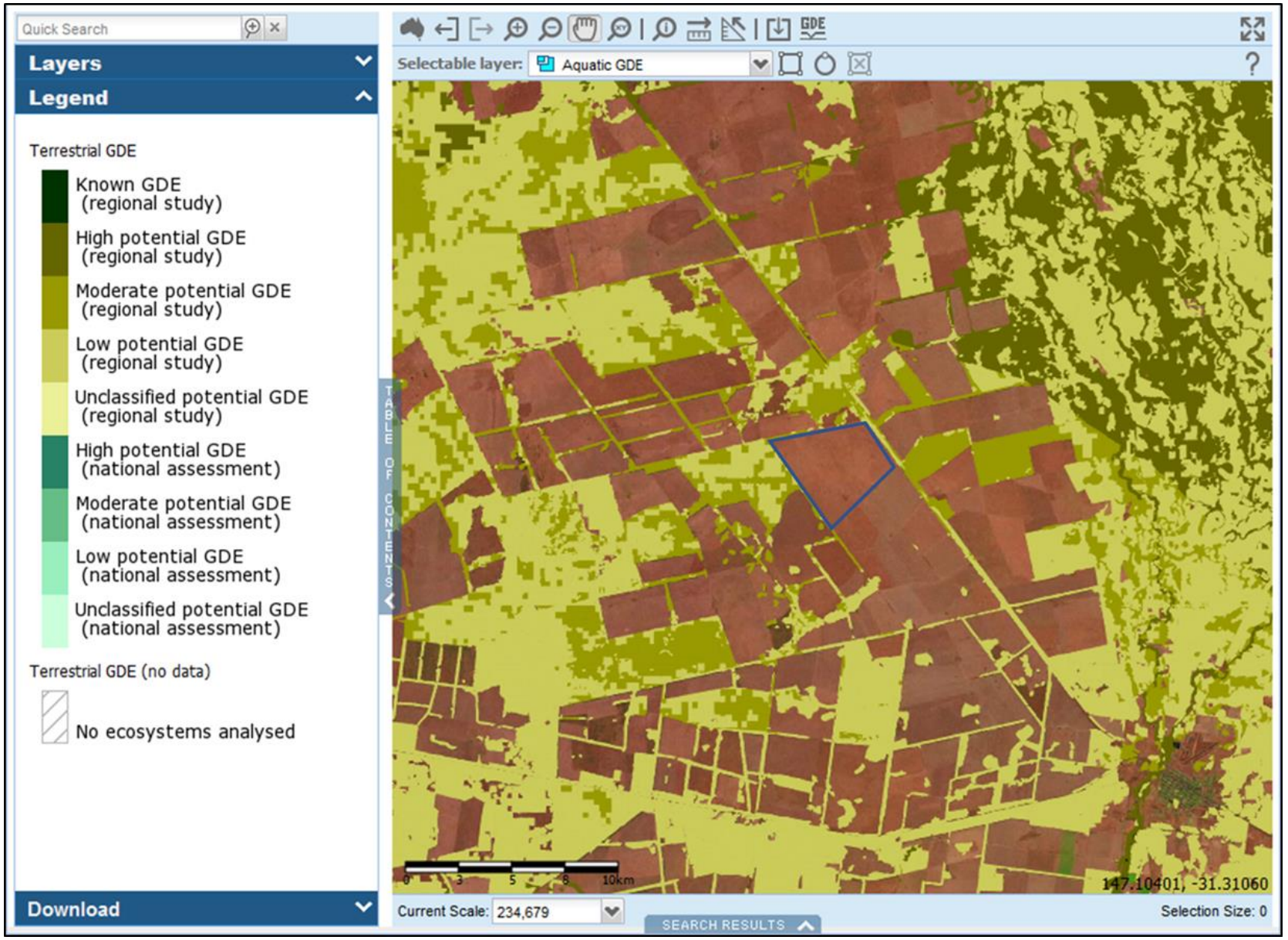

Figure 6-18 Terrestrial GDEs within and surrounding the development site (BoM 2020a)

Operations

WATER USE

Water use volumes during operation would be minimal, at approximately 60 kL per year, based on an estimate of 0.8 L per panel per year for washing and approx. 20 kL required for plant watering. Water would also be required for staff amenities at the control and maintenance building and for panel cleaning. Requirements would be extremely minor except for cleaning, which would be fully dependant on the weather. Some solar plants are never cleaned, others require more than two cleanings per year. Should water be required, it would be acquired from a local standpipe in the Nyngan townsite.

Ablution facilities would be connected to a septic tank installed in line with Bogan Shire Council requirements.

Approval under section 68 of the *Local Government Act 1993* is required to operate an onsite sewage management system and to draw water from a council standpipe.

SURFACE WATER QUALITY

During operation, there is minimal potential for any impact to surface water quality. Appropriate drainage features would be constructed along internal access roads to minimise the risk of dirty water leaving the site or entering waterways. Except for internal roads, parking areas and areas around site offices, the site would largely retain its existing groundcover. Risks to water quality impacts during operation would therefore be low.

There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

GROUNDWATER

No operational activities would affect groundwater.

6.8.3 Safeguards and mitigation measures

Safeguards to manage impacts relating to water use, water quality are listed in Table 6-26.

Table 6-26 Safeguards and mitigation measures for water quality impacts

No.	Safeguards and mitigation measures	C	O	D
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental chemical (e.g. fuel) spills.	**C**	**O**	**D**
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any drainage lines and would be stored in an impervious bunded area.	**C**	**O**	**D**
WA3	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 POEO Act).	**C**	**O**	**D**
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	**C**	**O**	**D**
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	**C**		**D**
WA6	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
WA7	Ensure appropriate drainage controls are incorporated into the design.	**Design**		

C: Construction; O: Operation; D: Decommissioning

6.9 BIODIVERSITY

NGH (2020a) prepared a BDAR (Appendix F) to provide an assessment of the biodiversity values associated with the development site.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Biodiversity – including

- *an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless BCD and DPIE determine that the proposed development is not likely to have any significant impacts on biodiversity values;*
- *the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.*

BIODIVERSITY CONSERVATION DIVISION REQUIREMENTS

Biodiversity –

1. *Biodiversity impacts related to the proposed Yarren Hut Solar Farm are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2017 the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method, unless DPIE and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values.*
2. *The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.*
3. *The BDAR must include details of the measures proposed to address the offset obligation as follows:*
    - *The total number and classes of biodiversity credits required to be retired for the development/project.*
    - *The number and classes of like-for-like biodiversity credits proposed to be retired.*
    - *The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.*
    - *Any proposal to fund a biodiversity conservation action.*
    - *Any proposal to conduct ecological rehabilitation (if a mining project).*
    - *Any proposal to make a payment to the Biodiversity Conservation Fund.*

    If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.
4. *The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM.*
5. *The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016.*

6.9.1 Existing environment

Landscape features

The development site falls within the Cobar Peneplain IBRA Bioregion. The Cobar Peneplain lies in central NSW west of the Great Dividing Range. The bioregion lies wholly within the Murray-Darling Basin and includes the Barwon, Macquarie, Yanda, Darling, Lachlan and Murrumbidgee catchments.

The Canbelego Plain Subregion is characterised by an undulating plateau with low stony ridges and stony rises; long low angle slopes and wide (>500 m) valley; some central sandy channels; a few swamps. The geology of the Canbelego Plain comprises of fine grained Ordovician and Silurian metasedimentary and sedimentary rocks, such as phyllite, slate and chert.

Vegetation communities within the subregion occupy suitable landscapes, such as:

- Mulga with green mallee.
- Red Box and numerous woody shrubs on ridges and slopes.
- Poplar Box, White Cypress Pine, Yarran shrubs and grasses in the valley.
- River Red Gum and Polar Box with sedges, lignum and nardoo in swamps and larger creeks.

Groundwater and surface water

The Ramsar listed Macquarie Marshes are located on the Macquarie River between Warren and Carinda. The marsh area covers more than 150,000 ha when fully flooded. It is also one of the most important colonial nesting waterbird breeding sites in Australia (NSW Government 2020).

The development site is not located in the immediate vicinity of any water courses, nor is it located within any floodplains. The closest river is the Bogan River, 10 km east of the site. Six man-made dams exist within the subject land.

Native vegetation

An assessment of native vegetation in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (NSW Government 2020) and field assessments. An estimated 417.2 ha of native vegetation occurs in the surrounding 1500 m study area. This vegetation, in the landscape surrounding the development site is predominantly shrubby woodland. Common species include Poplar Box *Eucalyptus populnea* subsp. *bimbil*, Ironwood *Acacia excelsa*, Wilga *Geijera parviflora* and Budda *Eremophila mitchellii.*

Four PCTs was identified within the study area including:

- PCT 103 – Poplar Box – Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion. PCT 103 is not listed under the BC Act or the EPBC Act.
- PCT 108 – Gum Coolabah – Mulga open woodland on gravel ridges of the Cobar Peneplain Bioregion. PCT 108 is not listed under the BC Act or the EPBC Act.
- PCT 125 – Mulga – Ironwood shrubland on loams and clays mainly of the Cobar Peneplain Bioregion. PCT 125 forms part of the *Acacia loderi* shrublands listed as Endangered under the BC Act.
- PCT 98 – Poplar Box – White Cypress Pine – Wilga – Ironwood shrubby woodland on red sandy-loam soils of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion. PCT 98 is not listed under the BC Act or the EPBC Act.

One PCT occurs within the development site as shown in Figure 6-19.

Cleared areas (non-indigenous vegetation)

An estimated 1076.2 ha occurs as cleared areas within the 1500 m buffer around the development site. These cleared areas are primarily agricultural lands used for cropping and modified pastures.

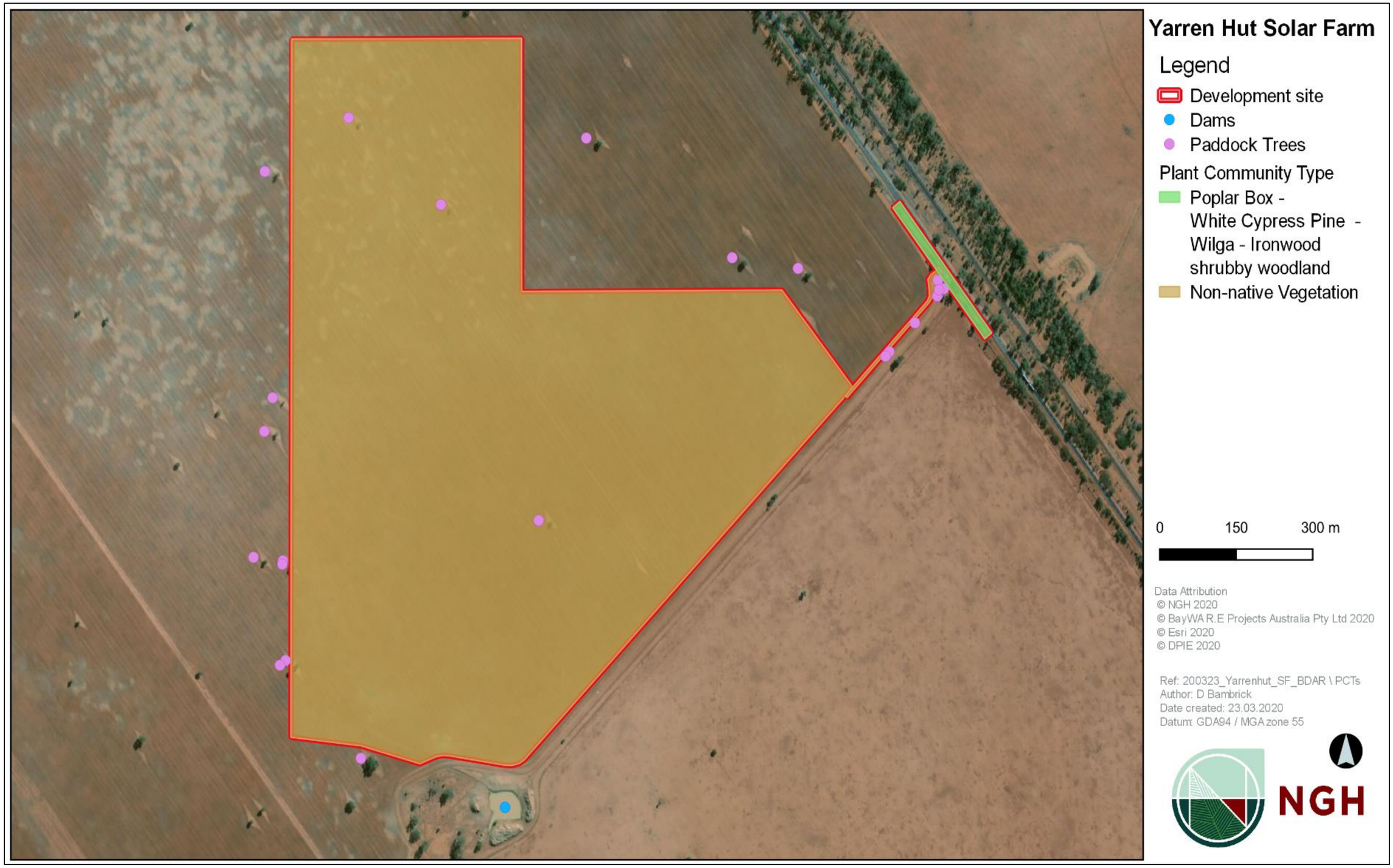

Figure 6-19 PCT 98 at the development site

Threatened species

The ecosystem credit species in Table 6-27 were returned by the BAM calculator as being associated with PCT 98 present on the development site. No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits.

Table 6-27 Threatened species returned from the BAM calculator as requiring survey

Common name	Associated PCT	NSW listing status	National listing status
Fauna			
Barking Owl ***Ninox connivens*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Black-breasted Buzzard ***Hamirostra melanosternon*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Brolga ***Grus rubicunda***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Corben's Long-eared Bat ***Nyctophilus corbeni***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Diamond Firetail ***Stagonopleura guttata***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Dusky Woodswallow ***Artamus cyanopterus cyanopterus***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Grey Falcon ***Falco hypoleucos***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Endangered	Not listed
Grey-crowned Babbler (eastern subspecies) ***Pomatostomus temporalis temporalis***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Hooded Robin (South-eastern form) ***Melanodryas cucullata cucullata***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Koala	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam	Vulnerable	Vulnerable

Common name	Associated PCT	NSW listing status	National listing status
Phascolarctos cinereus **(Foraging)**	soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion		
Kultarr ***Antechinomys laniger***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Endangered	Not listed
Little Eagle ***Hieraaetus morphnoides*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Little Pied Bat ***Chalinolobus picatus***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Major Mitchell's Cockatoo ***Lophochroa leadbeateri*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Masked Owl ***Tyto novaehollandiae*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Painted Honeyeater ***Grantiella picta***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Pied Honeyeater ***Certhionyx variegatus***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not Listed
Spotted Harrier ***Circus assimilis***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Square-tailed Kite ***Lophoictinia isura*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Superb Parrot (Foraging) ***Polytelis swainsonii***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Vulnerable
Varied Sittella ***Daphoenositta chrysoptera***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed

Common name	Associated PCT	NSW listing status	National listing status
White-bellied Sea-Eagle ***Haliaeetus morphnoides*** **(Foraging)**	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed
Yellow-bellied Sheathtail Bat ***Saccolaimus flaviventris***	PCT 98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Vulnerable	Not listed

The BAM Calculator predicted that the following 13 species credit species could occur at the development site (Table 6-28). A desktop assessment was undertaken for habitat constraints and geographic restrictions to determine which species could be excluded from targeted surveys. This determined that targeted surveys should be conducted for Bristle-faced Free-tailed Bat *Setirostris eleryi*, Koala *Phascolarctos cinereus* and Shrub Sida *Sida rohlenae* in the first instance; habitat constraints were considered likely to be met at the site for only these two candidate species (Shrub Sida and Bristle-faced Free-tailed Bat).

A subsequent onsite habitat assessment, including recording of important habitat features such as hollow-bearing trees, determined that no further targeted surveys would be required as the development site lacked the specific habitat constraints for all three remaining candidate species.

Table 6-28 Candidate species credit species requiring assessment

Credit species	Habitat and geographic restrictions[1]	Sensitivity to gain class	NSW listing status	National listing status	Habitat Components and abundance on site	Included or Excluded	Reason for Inclusion or exclusion
Fauna							
Barking Owl ***Ninox connivens*** **(Breeding)**	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	High	Vulnerable	Not listed	Suitable hollow bearing trees not present	Excluded	Habitat constraints not present
Black-breasted Buzzard ***Hamirostra melanosternon*** **(Breeding)**	Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts. The species is known to breed in sites with cropping, but also requires retained vegetation.	Moderate	Vulnerable	Not listed	No land within 40 m of riparian woodland. Lack of retained vegetation suitable for breeding.	Excluded	Habitat constraints not present
Bristle-faced Free-tailed Bat ***Setirostris eleryi***	Land within 500 m of watercourses or dams surrounded by eucalypts containing hollows.	High	Endangered	Not listed	Development site is within 500 m of a dam	Included	Habitat constraints present though of poor quality. Survey required and undertaken.
Bush Stone-curlew ***Burhinus grallarius***	Fallen/standing dead timber including logs.	High	Endangered	Not listed	Lack of fallen/standing dead timber including logs	Excluded	Habitat constraints not present
Koala	'Important' habitat (however this is not a mapped important habitat	High	Vulnerable	Not listed	Survey required to determine if	Included	Survey required and undertaken

Credit species	Habitat and geographic restrictions[1]	Sensitivity to gain class	NSW listing status	National listing status	Habitat Components and abundance on site	Included or Excluded	Reason for Inclusion or exclusion
Phascolarctos cinereus **(Breeding)**	area) is defined by the density of koalas and quality of habitat determined by on-site survey.				important habitat present		to determine if important habitat present.
Little Eagle ***Hieraetus morphnoides*** **(Breeding)**	Nest trees – live (occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat.	Moderate	Vulnerable	Not listed	One Class 3 and two Class 2 paddock trees present, however, both trees are small and unlikely to be utilised by the species	Excluded	Habitat constraints not present
Major Mitchell's Cockatoo ***Lophochroa leadbeateri*** **(Breeding)**	Living or dead tree with hollows greater than 10 cm diameter.	High (breeding)/ Moderate (foraging)	Vulnerable	Not listed	Suitable hollow-bearing trees absent within development site.	Excluded	Habitat components not present
Masked Owl ***Tyto novaehollandiae*** **(Breeding)**	Living or dead trees with hollows greater than 20 cm diameter.	High	Vulnerable	Not listed	Suitable hollow-bearing trees absent within development site.	Excluded	Habitat components not present
Square-tailed Kite ***Lophoictinia isura***	Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. Is	Moderate	Vulnerable	Not listed	Development site contains three paddock trees unlikely to be utilised for breeding given	Excluded	Habitat constraints not present

Credit species	Habitat and geographic restrictions[1]	Sensitivity to gain class	NSW listing status	National listing status	Habitat Components and abundance on site	Included or Excluded	Reason for Inclusion or exclusion
(Breeding)	sensitive to disturbance around nests.				this species known preferences.		
Squatter Pigeon (southern subspecies) ***Geophaps scripta scripta***	Grassy woodlands and plains, preferring sandy areas and usually close to water. Feed on the ground, on seeds of grasses, herbs and shrubs, as well as insects. Nest on the ground.	High	Critically Endangered	Vulnerable	Habitat absent within main development footprint. Habitat degraded within road reserve.	Excluded	Potential habitat limited to very thin road reserve which is degraded.
Superb Parrot ***Polytelis swainsonii*** **(Breeding)**	Living or dead E. *blakelyi*, *E. melliodora*, *E. albens*, *E. camaldulensis*, *E. microcarpa*, *E. polyanthemos*, *E. mannifera*, *E. intertexta* with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm.	High (breeding)/ Moderate (foraging	Vulnerable	Vulnerable	One hollow-bearing tree present within road reserve portion of the development site, however, this tree does not meet the breeding habitat constraint.	Excluded	Habitat components not present
White-bellied Sea-Eagle ***Haliaeetus morphnoides*** **(Breeding)**	Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	High	Vulnerable	Not listed	No living or dead trees present within 1 km of a river, creek, large dam, wetland or coastline.	Excluded	Habitat components not present
Flora							

Credit species	Habitat and geographic restrictions[1]	Sensitivity to gain class	NSW listing status	National listing status	Habitat Components and abundance on site	Included or Excluded	Reason for Inclusion or exclusion
Shrub Sida ***Sida rohlenae***	Grows on flood-out areas, creek banks and at the base of rocky hills. NSW specimens have been found along roadsides in hard red loam to sandy-loam soils. The species can become locally abundant and is often more common in disturbed sites.	High	Endangered	Not listed	Potential habitat present in Zone 1.	Included	Potential habitat present. Survey undertaken.

6.9.2 Approach

Inclusions based on habitat features

The BAM Calculator predicted the species credit species listed in Table 6-28 to occur at the development site. As per the BAM Operational Manual - Stage 1, an assessor must consider species recorded on or near the subject land even if they are not predicted by the BAM Calculator. Within 10 km of the development site, BioNet contains records of the following NSW threatened species:

- Grey-crowned Babbler (eastern sub-species).
- Kultarr.
- Hooded Robin (south-eastern form).
- Varied Sittella.
- Superb Parrot.

All of the above species have been assessed in this BDAR as either ecosystem credit species or species credit species. No other species were considered for inclusion.

Candidate species requiring confirmation of presence or absence

The species listed in Table 6-29 are those considered to have habitats present at the development site. Targeted surveys have been used to assess each species as summarised below. Details of the survey methodologies and results are provided for each surveyed species with locations shown on Figure 6-20.

Table 6-29 Summary of species credit species surveyed or assumed present at the development site

Species credit species	Biodiversity risk rating	Survey period	Assumed to occur/survey/expert report	Present on site?	Species polygon area
FAUNA					
Bristle-faced Free-tailed Bat ***Setirostris eleryi***	2	Oct-Mar	Surveyed Feb 2020	No	NA
Koala ***Phascolarctos cinereus*** **(Breeding)**	2	All year	Surveyed Feb 2020	No	NA
FLORA					
Shrub Sida ***Sida rohlenae***	2	Sep-Feb	Surveyed Feb 2020	No	NA

Site survey

The weather conditions during targeted surveys is summarised in Table 6-30 below. No data is available from the Nyngan Airport Station (051039), as such, data for the nearest weather station (Girilambone, 051164) has been used where available.

Table 6-30 Weather conditions during targeted surveys (source: BoM 2020b)

Date	Minimum (ºC)	Maximum (ºC)	Rainfall (mm)	Max Wind Gust (km/h Direction)
26 February 2020	22.1	35.6	0.2	No data
27 February 2020	19.4	31.4	2.2	No data

Date	Minimum (ºC)	Maximum (ºC)	Rainfall (mm)	Max Wind Gust (km/h Direction)
28 February 2020	18.0	30.3	0	No data

BRISTLE-TAILED FREE-TAILED BAT

Survey effort

One passive bat detector (Anabat Swift from Titley Scientific) was situated near a farm dam just outside the southern boundary of the development site. A harp trap was also situated in a gap in vegetation at this location that as it was a perceived potential fly-way. Both the Anabat and harp trap were in place across the evenings of 26 and 27 February 2020. Incidental sightings were made at this location each evening for microbats in flight.

Survey results

A total of 12 distinct microbat calls were detected. Of these, two are species listed under the BC Act:

- Little Pied Bat Chalinolobus picatus – V.
- Bristle-faced Free-tailed Bat Setirostris eleryi – V.

Little Pied Bat is an ecosystem credit species already assessed under this assessment; however, Bristle-faced Free-tailed Bat is the target species credit species. In accordance with the Bionet Threatened Biodiversity Data Collection (TBDC), the species polygon for Bristle-faced Free-tailed Bat is calculated by mapping a 500 m from the relevant habitat constraint. In this case a farm dam to the south of the development site. This buffer encompasses only Category 1 – Exempt Land within the development site, therefore, no species credits for Bristle-faced Free-tailed Bat are generated. A 200 m buffer was calculated around farm dams to determine the threatened species polygon (Figure 6-20).

KOALA

Survey effort

Spotlighting surveys were undertaken on the evenings of 26 and 27 February 2020. The surveyed area included the entirety of the development site and vegetation associated with a dam outside, but adjacent to the southern boundary of the development site. This area was surveyed each evening for approximately 1.5 person hours. Trees within this area were searched during the day on 27 February for signs of Koala such as scats and scratches. Incidental sightings of fauna were recorded during all of the above.

Survey results

No Koalas, signs of Koalas, or arboreal mammal activity of any kind was identified during the surveys.

SHRUB SIDA

Survey effort

Targeted Shrub Sida transects were undertaken on 27 February 2020. The area surveyed included the portion of the development site within the road reserve of Mitchell Hwy. 10 m wide transects were used in accordance with the NSW *Guide to Surveying Threatened Plants* (OEH, 2016).

Survey results

No Shrub Sida were detected within the surveyed area.

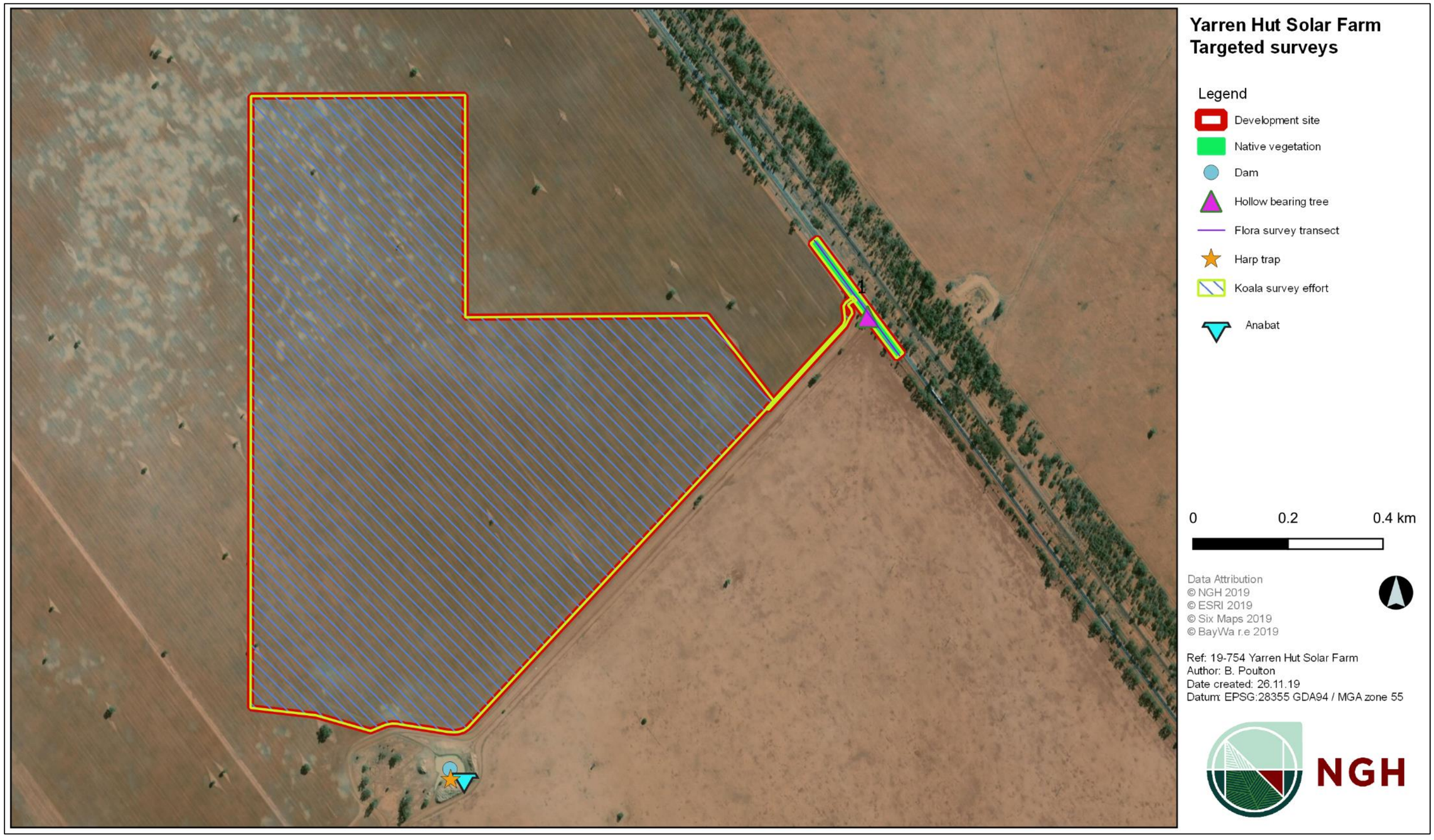

Figure 6-20 Species credit species survey locations

Additional habitat features relevant to prescribed biodiversity impacts

OCCURRENCE OF KARSTS, CAVES, CREVICES AND CLIFFS

As verified by the field inspection, there are no occurrences of karst, caves, crevices, or cliffs in the development site.

OCCURRENCE OF ROCK

As verified by the field inspection, there are no occurrences of surface rock in the development site.

OCCURRENCE OF HUMAN MADE STRUCTURES AND NON-NATIVE VEGETATION

As verified by the field inspection, there are no human made structures within the development site that could be utilised by threatened species. Exotic vegetation within the development site is currently used for cropping and pasture. The extent of productive agriculture land in the region is considerable and native animals benefiting from cleared exotic vegetation environments have ample access to suitable habitat in the surrounding areas.

6.9.3 Potential impacts

Direct impacts

The construction and operational phases of the proposal have the potential to impact biodiversity values at the site. These cannot be entirely avoided, although BayWa r.e. is committed to minimising adverse impacts where practicable and enhancing retained habitat features for local wildlife.

Direct adverse impacts such as habitat clearance and installation and operational effects of installed infrastructure as detailed in Table 6-31.

Table 6-31 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	0.27 ha	Once	Construction Phase: Short Term	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Removal of paddock trees	Three trees	Once	Construction Phase: Short Term	• Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Direct Loss of native flora and fauna habitat
Displacement of resident fauna	Unknown	Regular	Construction & Operation Phase: Long Term	• Direct loss of native fauna • Decline in local fauna populations

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Injury or death of fauna	Unknown	Regular	Construction Phase: Short Term	• Direct loss of native fauna • Decline in local fauna populations
Shading by solar infrastructure	51 ha (70% of solar array)	Regular	Operational Phase: Long-term	• Modification of native fauna habitat • Potential loss of groundcover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure (Fencing, array infrastructure).	Total 76 ha (73 ha solar array)	Regular	Operational Phase: long-term	• Modification of habitat beneath array • Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats (fencing).

LOSS OF NATIVE VEGETATION

The changes in vegetation integrity scores as a result of clearing are documented for Zone 1 in Table 6-32. Due to limitations of scale and to aid in PCT/TEC determination, the plot data was collected includes wooded vegetation that would not be impacted by the proposal. To account for this, the future integrity score for Zone 1 has been calculated by assuming all wooded vegetation would remain and only understory species would be removed.

Table 6-32 Current and future vegetation integrity scores for each vegetation zone within the development site

Zone ID	PCT	TEC?	Area (ha)	Current vegetation integrity score	Future integrity score
1	98_Roadside	No	0.27	78.1	57.8

LOSS OF PADDOCK TREES

Three living paddock trees were recorded within the development site and would be removed for the proposal (Table 6-33). These paddock trees have been allocated a class (1, 2, or 3) in accordance with the BAM.

Table 6-33 Summary of paddock tree loss

PCT	Class 1	Class 2	Class 3
98 - Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	2	0	1
TOTAL:			**3**

LOSS OF SPECIES CREDIT SPECIES HABITAT OR INDIVIDUALS

The proposal is not considered to result in the loss of species credit species habitat.

LOSS OF HOLLOW-BEARING TREES (HBTS)

None of the paddock trees that would be removed for the proposal contain hollows. Only groundcover vegetation would require removal where access upgrades are proposed. Therefore, no hollow-bearing trees would be removed.

Indirect impacts

Indirect impacts can occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities or threatened species habitat beyond the development site. Table 6-34 below details the indirect impacts required to be assessed by the BAM.

Table 6-34 Potential indirect impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Consequence for bioregional persistence	
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	• Koala • Bristle-faced Free-tailed Bat • Superb Parrot • Shrub Sida	• Minor direct loss of native flora and fauna habitat • Low potential for injury and mortality of fauna during clearing of fauna habitat and habitat trees • Minor disturbance to stags, fallen timber, and bush rock • Increased edge effects • The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	• Koala • Bristle-faced Free-tailed Bat • Superb Parrot • Shrub Sida	• Minor loss of native flora and fauna habitat. • The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	• Koala • Bristle-faced Free-tailed Bat • Superb Parrot • Shrub Sida	• May alter fauna activities and/or movements • Minor loss of foraging or breeding habitat • The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	• Shrub Sida	• Minor loss of native flora and fauna habitat. • The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Increased risk of starvation,	Unknown	Rare	• Koala • Bristle-faced Free-tailed Bat	• Loss of foraging habitat

Nature of impact	Extent	Frequency	Consequence for bioregional persistence	
exposure and loss of shade or shelter			• Superb Parrot • Shrub Sida	
Loss of breeding habitats	One HBT adjacent to the development site that may be used for nesting/roosting	Constant	• Bristle-faced Free-tailed Bat • Superb Parrot	• Loss of potential breeding habitat including fallen and hollow logs at height • Loss of vegetation close to water • Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna.
Rubbish dumping	Unknown	Regular	• Shrub Sida	• Degradation of potential habitat
Earthworks and mobilisation of sediments	Unknown	Regular	• Shrub Sida	• Erosion and sedimentation and/or pollution of soils, dams and downstream habitats • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Increase risk of fire	Unknown	Regular	• Koala • Bristle-faced Free-tailed Bat • Superb Parrot • Shrub Sida	• Slight increase in the unlikely event componentry failure or damage results in a bushfire resulting in biodiversity impacts

Prescribed impacts

The following prescribed impacts are relevant to the proposal:

a) Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.
b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.
c) Impacts of development on movement of threatened species that maintains their lifecycle.
d) Impacts of development on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining).
e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

The unavoidable aspects of these impacts are discussed below.

IMPACTS OF DEVELOPMENT ON THE HABITAT OF THREATENED SPECIES OR ECOLOGICAL COMMUNITIES ASSOCIATED WITH NON-NATIVE VEGETATION

The vast majority of the development site contains Category 1 – Exempt Land where exotic vegetation in the form of crops and pasture would be present during growth periods. Such vegetation may provide some habitat value for the threatened species considered to have potential to utilise the development site for foraging purposes such as Superb Parrot. If insects are drawn to the cropped land, then this land may be considered a foraging resource for Bristle-faced Free-tailed Bat. However, these resources are unlikely to be primary to the persistence of either species in the bioregion.

92 ha would be developed upon, an impact unlikely effect to bioregional persistence of any threatened species.

IMPACTS OF THE DEVELOPMENT ON THE CONNECTIVITY OF DIFFERENT AREAS OF HABITAT OF THREATENED SPECIES THAT FACILITATE THE MOVEMENT OF THOSE SPECIES ACROSS THEIR RANGE

Connectivity within development site is limited to the portion present in the road reserve of Mitchell Highway. The proposal would have little, if any, detriment to this connectivity. Where three paddock trees would be removed, this would remove the ‘steppingstone’ effect that these trees have. However, this is unlikely to prevent any threatened species from moving across its range, as the gaps between remnant vegetation in the landscape would not increase.

It is an unavoidable impact that developments that require fencing generate an impediment to the movement of threatened species. However, given the siting of the proposal, any threatened species that presently may traverse through the development site to access habitat present in the surrounding landscape, would be able to make passage to the west and along the road reserve of Mitchell Highway as currently possible.

IMPACTS OF THE DEVELOPMENT ON MOVEMENT OF THREATENED SPECIES THAT MAINTAINS THEIR LIFECYCLE

As detailed above, the development site would present a minor impediment to the movement of ground traversing threatened species such as Koala. This is unavoidable impact of fenced developments. However, this impediment is very minor as no barrier to movement would be created. Koala would still be able to traverse their home ranges for the purposes of mating and raising young as they are now.

IMPACTS OF DEVELOPMENT ON WATER QUALITY, WATERBODIES AND HYDROLOGICAL PROCESSES THAT SUSTAIN THREATENED SPECIES AND THREATENED ECOLOGICAL COMMUNITIES

No waterbodies would be directly impacted by the proposal. Similarly, no waterways are adjacent that may be indirectly impacted. In a rare flood event, water may flow north from the development site into the

floodplain of the Bogan River. The proposal is unlikely to have substantive impact on this process, should it occur.

Given the above, the proposal has negligible potential to impact water quality, waterbodies and upon hydrological processes that sustain threatened ecological communities and species.

IMPACTS OF VEHICLE STRIKES ON THREATENED SPECIES OR ANIMALS THAT ARE PART OF A TEC

Despite the measures that would be in place to minimise this impact, it is an unavoidable that an increase in traffic volume would increases the risk of vehicle strike along the Mitchell Hwy. However, this would be largely confined to construction as operation would require minimal personnel. The development site would be fenced prior to construction commencing, minimising risk of vehicle strike, within the development site however, some small increase in risk would remain, particularly to avifauna.

The Mitchell Hwy poses the greatest risk of vehicle strike. Consideration must be given as to whether the siting of the proposal and fencing would direct or funnel animals traversing the development site and surrounds towards the Mitchell Hwy. As no bottlenecking or funnelling would occur, there is no perceivable increased risk of this process.

Impacts on Matters of National Environmental Significance

WETLANDS OF INTERNATIONAL IMPORTANCE

No wetlands of international importance would be impacted by the proposal.

THREATENED ECOLOGICAL COMMUNITIES

No federally listed communities would be impacted by the proposal as none are considered to occur.

THREATENED SPECIES

No federally listed threated species are considered likely to inhabit the development site on a regular basis or rely on the meagre resources present. For those likely to be present in the greater landscape that may intersect with the development site very rarely, such as Superb Parrot, impacts are limited to the removal of a small amount of foraging habitat. Therefore, further assessment is not deemed necessary

Koala

Habitat for Koalas within the development site is limited to areas of traversal and three Poplar Box which are a secondary feed tree. Two of these feed trees would be removed. Based on such limited habitat availability, is considered highly rare that Koala would utilise the development site.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 6-35 below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 6-35 resulted in a score of 2 and so habitat within the development site is not considered to be critical to the survival of the Koala, and an assessment of significant impact according to the EPBC Act significant impact criteria is not required.

Table 6-35 Koala habitat assessment tool for inland areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	
	+1	Evidence of one or more koalas within 2	

Attribute	Score	Inland	Applicable to the proposal?
	(medium)	km of the edge of the impact area within the last 10 years.	
	0 (low)	None of the above.	✓ No records of Koala within 10km of the development site. Koala not detected during site surveys.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	
	0 (low)	None of the above.	✓ Groundcover and paddock trees only.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	✓ Vegetation within the Mitchell Hwy road reserve extends out in places that covers >1000 ha.
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala	

Attribute	Score	Inland	Applicable to the proposal?
		occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	✓ High vehicle threat present: - Remnant Vegetation occurs along roadside corridor. High Dog threat present; - Highly fragmented landscape
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of EPBC Koala Referral	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓ Development site is not considered a habitat refuge, nor does it provide important connectivity to large areas surrounding a habitat refuge
Total	**2**	**Decision: Habitat not critical to the survival of the Koala— assessment of significance not required**	

MIGRATORY SPECIES

Based on habitat assessment (Appendix F), the development site is not considered to contain meaningful habitat that is likely to be utilised by federally listed migratory species. As such, none are considered likely to be impacted.

Impacts requiring offsets

ECOSYSTEM CREDITS

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

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

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 6-36.

Table 6-36 PCTs and vegetation zones that require offsets

Zone ID	PCT ID	Zone Name	Impact area (ha)	Vegetation Integrity Score	Future Vegetation Integrity Score	Ecosystem credits required
PCT 98: Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion						
1	98	Roadside	10.0	78.1	57.8	1
					TOTAL:	**1**

PADDOCK TREE CREDITS

Offsets are required for the clearing of Class 2 and Class 3 paddock trees. One Class 3 paddock tree would be removed by the proposal as shown in Table 6-37. This paddock tree forms part of PCT 98: Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion. Ecosystem credits are calculated as per the streamlined assessment defined in the BAM – Appendix 1 and Table 12.

One ecosystem credit is required for the clearing of the paddock trees.

Table 6-37 Paddock trees that require offsets

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Number of Credits Required	Ecosystem credits required
PCT 98: Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion				
Class 3 **>30cm DBH**	No	1	0.75	1
			TOTAL:	**1**

SPECIES CREDITS

No threatened species have been identified as having the potential to be significantly impacted by the development.

OFFSETS REQUIRED UNDER THE EPBC ACT

No entities listed on the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets under this Act.

Impacts not requiring offset

Impacts to PCTs that do not meet the thresholds identified in section 10.1.1 do not require offsets. As the one Zone of PCT 98 within the development site satisfies these thresholds, there are no Zones that do not require an offset.

Table 6-38 Impacts not requiring an offset

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Number of Credits Required	Ecosystem credits required
PCT 98: Poplar Box - White Cypress Pine - Wilga - Ironwood shrubby woodland on red sandy-loam soils in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion				
Class 1<20cm DBH	No	2	0	0
			TOTAL:	**0**

Areas not requiring assessment

Approximately 92 ha of land within the development site is considered to be Category 1 – Exempt Land, therefore, in accordance with the BAM, these areas do not require assessment, other than for prescribed impacts. Impacts to Category 1 – Exempt Land do not require offsetting.

6.9.4 Safeguards and mitigation measures

Safeguards and mitigation to protect biodiversity are listed in Table 6-39.

Table 6-39 Safeguards and mitigation measures for biodiversity impacts

No.	Safeguards and mitigation measures	C	O	D
BD1	Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing. A trained ecologist or licensed wildlife handler would be present during clearing events and complete: • Pre-clearing checklist. • Tree clearing procedure.	**C**		
BD2	Plain wire instead of barbed used on top of the perimeter fence.	**C**	**O**	
BD3	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance where partial clearing is proposed: • Approved clearing limits clearly delineated with temporary fencing prior to construction commencing. • No stockpiling or storage within dripline of retained trees. • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance. • Remove native vegetation by chainsaw rather than heavy machinery.	**C**		
BD4	Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	**C**		
BD5	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill: • Avoid night works. • Direct lights away from vegetation.	**C**	**O**	**D**
BD6	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operation activities. • Construction would cease if dust observed blown from site until control measures were implemented.	**C**		

No.	Safeguards and mitigation measures	C	O	D
	• All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.			
BD7	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas incorporated into the Pest and Weed Management Plan.	**C**	**O**	
BD8	All staff induction and regular communications to cover environmental features retained and protection measures to be implemented (including but not limited to): • Site speed limits to be enforced to minimise fauna strike. • Vehicle hygiene and biosecurity.	**C**	**O**	
BD9	Preparation of a Biodiversity Management Plan to implement biodiversity projection measures (including but not limited to): • Unexpected threatened species finds. • Rehabilitation and enhancement of disturbed areas.	**C**		
BD10	Screening and landscaping plantings to be comprised of local indigenous species representative of the vegetation in the development site.	**C**		

C: Construction; O: Operation; D: Decommissioning

6.10 ABORIGINAL HERITAGE

NGH (2020a), prepared an ACHAR to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The full report is provided in Appendix E and is summarised below.

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues.

Heritage –

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

BIODIVERSITY CONSERVATION DIVISION REQUIREMENTS

Aboriginal cultural heritage –

1. *The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010), and guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with DPIE regional branch officers.*
2. *Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.*
3. *Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any*

objects recorded as part of the assessment must be documented and notified to DPIE.

6.10.1 Existing environment

The proposal is within an area identified as part of the Wiradjuri language group. This is an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1904, Tindale 1974, MacDonald 1983, Horton 1994).

The Wiradjuri language group was the largest in NSW prior to European settlement. The borders were, however, not static, and were most likely fluid, expanding and contracting over time to the movements of smaller family or clan groups. Boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought and abundance.

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

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

The Cobar Peneplain Bioregion is a low undulating plain punctuated by stony ridges and ranges formed as a north western extension of the Lachlan Fold Belt. Rock outcrops form low ranges with those in the east of the peneplain being older (Ordovician) than those in the west (Devonian). Topography around Cobar is more subdued as residual hills, low rounded ridges and stony slopes formed on shales, phyllites and cherts (OEH 2020b). Wide short valleys connect to Lachlan floodplains.

The closest natural watercourse, the Bogan River, lies approximately 8.6 km east of the current assessment area. Three first-order ephemeral drainage lines are located approximately 5 to 9 km west of the proposed solar farm, but these have been truncated by historical developments.

There are no farm dams present in the proposal area; however, six exist in the wider lot boundary. Generally, surface water is scarce in the project area.

Database searches and consultation

On 17 December 2019 a search of the AHIMS database was undertaken over an area of approximately 20 km x 20 km centred over the project area (from latitude -31.5879, longitude 146.8862 to latitude -31.3267, longitude 147.2156 with a buffer of 200 m). The AHIMS Client Service Number was 473364. There were 28 Aboriginal sites recorded within this search area and no declared Aboriginal Places. Table 6-40 below shows the breakdown of the site the extent of the search area in relation to the proposed solar farm site. None of these registered sites will be impacted by the proposal. None of these registered sites would be impacted by the proposal (refer Figure 6-21).

Table 6-40 Breakdown of previously recorded Aboriginal sites within 20 km of the proposal area

Site Type	Number
Modified Tree (Carved or Scarred)	17
Artefact	10
Ceremonial Ring (Stone or Earth); Modified Tree (Carved or Scarred)	1
TOTAL	**28**

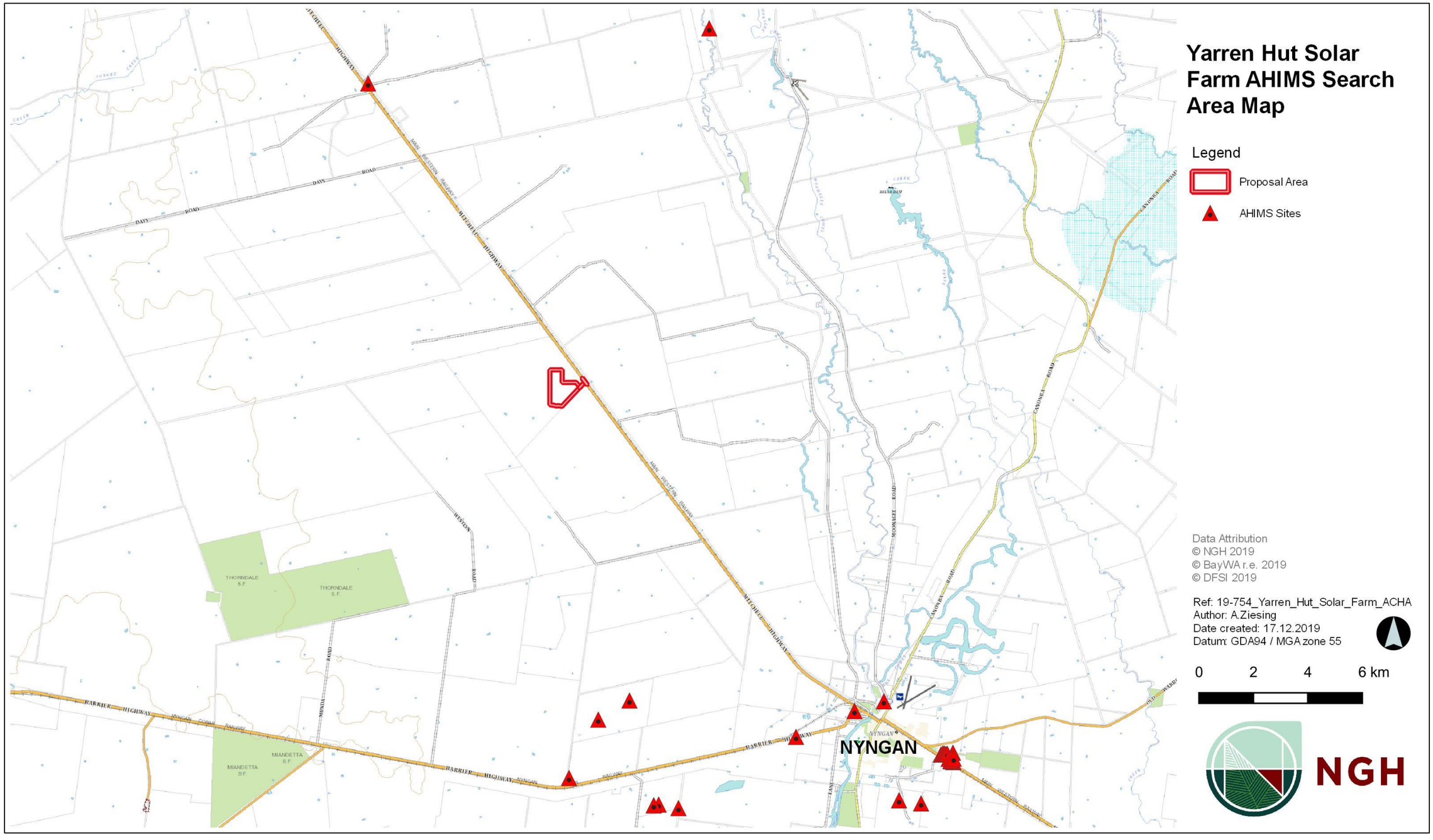

Figure 6-21 Location of AHIMS sites within 20 km of the subject land

6.10.2 Approach

Survey strategy

The survey strategy was to cover as much of the ground surface as possible within the development site. The survey undertaken for the purposes of this report was conducted on Thursday 27 February 2020 by NGH archaeologist Ali Byrne, RAP representatives Lesly Ryan and Brendon Weldon of Bogan Aboriginal Corporation and Mike Skinner of Corroboree Aboriginal Corporation. The survey involved walking in transects across the majority of the project area development footprint, with specific areas targeted where the potential for Aboriginal objects to be present was considered to be higher. Vehicle survey was undertaken in low sensitivity areas and outside the proposed footprint area for the development. Visibility within the project area was extremely high, generally between 80 and 90% as a result of the clearance of native vegetation historically, and current absence of crops within the ploughed field. Vegetation was limited to very sparsely scattered trees across the project area, with denser stands of trees along the road verge of Mitchell Highway. These include some mature box tree, as well as a number of smaller species such as tea tree.

The team were able to walk at a similar pace allowing for maximum survey coverage and maximum opportunity to identify any heritage features. Areas of remnant vegetation within the project area were also inspected for any evidence of Aboriginal scarring (Long 2005). NGH believes that the survey strategy was comprehensive and the most effective way to identify the presence of Aboriginal heritage sites and objects within the development site.

Survey coverage

Overall, visibility within the areas surveyed was very high and averaged more than 90%. Soils within the proposal area were generally heavily disturbed silty clay and exhibited significance disturbance as a result of ploughing and cropping, grazing of livestock and erosion by wind and water. A number of very shallow drainage depressions were identified in the western portion of the project area. One area measuring approximately 20 x 20 m in size also displayed evidence of recent fire, possibly related to farming practices. Effective coverage allowed for an effective view width of approximately five m for one person, a total of 15.85 ha was inspected during the archaeological survey, including both pedestrian and vehicle survey, primarily within the development footprint, with additional transects undertaken along the north eastern boundary of the property, next to the Mitchell Highway. Allowing for visibility restrictions, the effective coverage overall is calculated to have been 14.27 ha or 6.34% of the total project area, which has been calculated as 225 ha including the development site, north eastern boundary between power easement and fence line, and a buffer of up to 200 m around the development footprint within the property boundary. Coverage effort and survey area are further detailed in Table 6-41 and Figure 6-22.

Overall, it is considered that the archaeological survey programme achieved sufficient and effective coverage. The sites identified are considered to be a true reflection of the nature of the Aboriginal archaeological record present within the project area. The archaeological potential of the project area was assessed during the survey and it was determined that test excavation was not required.

Table 6-41 Summary of effective survey coverage for the proposal

Survey Section/ Topography	*Number of Survey Transects*	*Exposure type*	*Proposal Area ha*	*Surveyed area (length m x width m)*	*Survey Area m^2*	*Visibility*	*Effective coverage (area x visibility) m^2*	*Proposal Area surveyed (ha)*	*Percentage of Proposal area effectively surveyed*	*Survey Archaeological result*
Plain / flat	8	Vehicle tracks, ploughed land, erosion scours	225	2100 x 20, 2100 x 20, 1600 x 20, 1000 x 5, 300 x 5, 1500 x 5, 1500 x 5, 1200 x 5	158,500	90%	142,650	14.27	6.34	1 hearth with artefact 1 hearth 1 scarred tree
Total	8	-	-	-	-	-	142,650	14.27	6.34	1 hearth with artefact 1 hearth 1 scarred tree

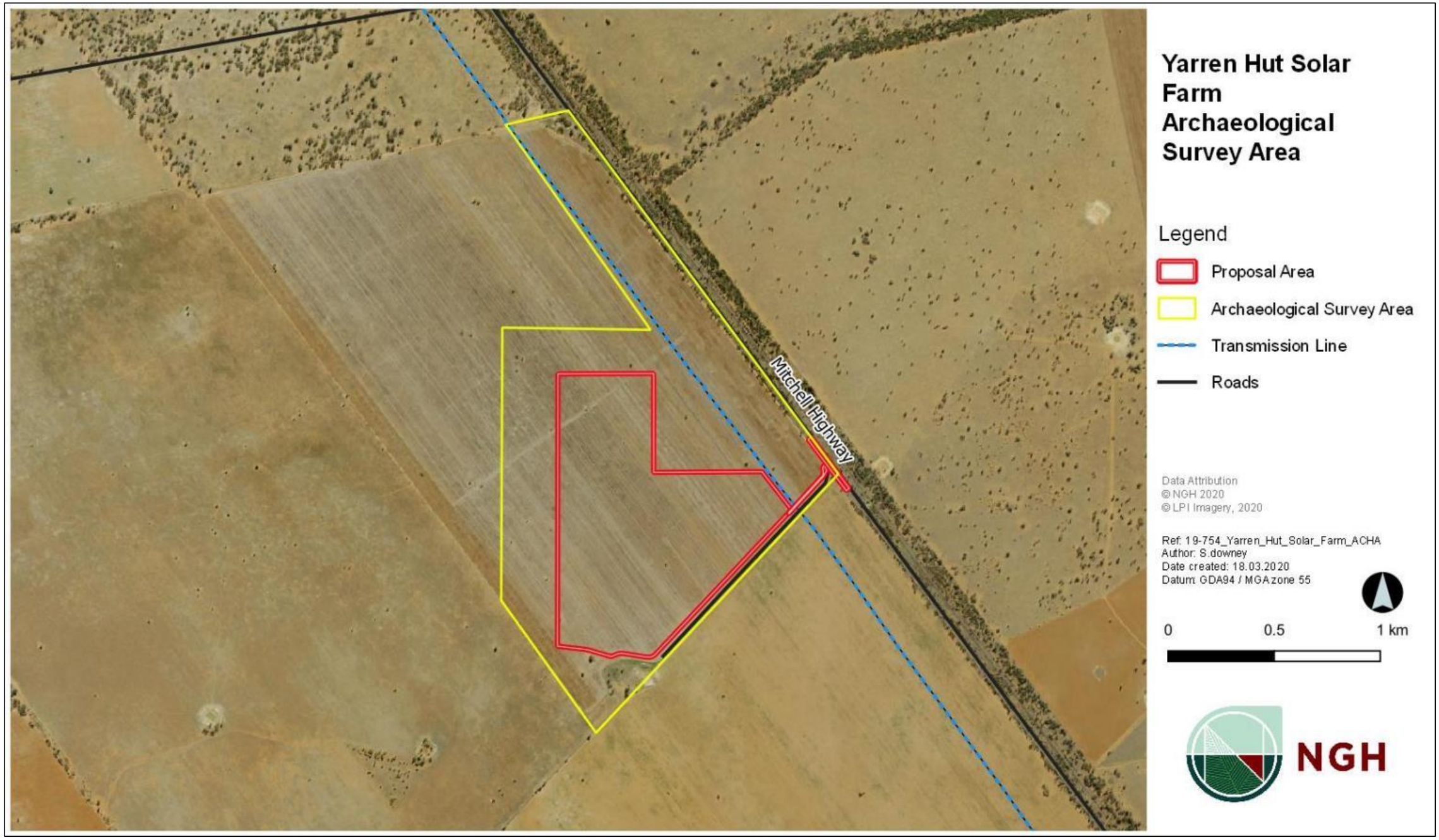

Figure 6-22 Aboriginal heritage survey area

6.10.3 Survey results

Three Aboriginal sites were identified and recorded during the completion of the survey, including two hearth and one scarred tree (Figure 6-23 and Figure 6-24). In addition to this, three additional "potential" scarred trees were also recorded, however the final assessment of these was that the scarring was not the result of cultural modification by past Aboriginal people. The locations of all the recorded trees are outside the proposed impact area of the development.

NGH Yarren Hut Hth1

NGH Yarren Hut Hth1 was located outside the proposed development footprint adjacent to the south western extent of the proposal. It comprised a cluster of burnt clay nodules and one artefact, a silcrete flake. The clay nodules are set in the silty clay B horizon soil, with loose pieces of other such nodules scattered within a one metre by 50 cm area. The artefact was located among the main nodules, on the surface. It is considered likely that erosion has exposed this site, of which only the base of the hearth remains embedded in the base clay. Information provided by the RAP representatives on site indicated that the burnt clay nodules were comparable to those they have recorded at other hearths sites within the region.

NGH Yarren Hut Hth2

NGH Yarren Hut Hth2 was identified inside the development footprint, adjacent to the western boundary. It showed evidence of extensive disturbance as a result of ploughing, and included scattered, crushed fragments of burnt clay, across an area of two metres by one metre. No artefacts were identified at this location, however compact burnt clay nodules were recorded scattered on the ground surface embedded in the exposed natural silty clay soils. The nodules differed significantly from unburnt clay clumps within other parts of the ploughed paddock, and also differed from other areas with evidence of burning which contained ash but no charcoal and were the result of recent burning associated with the farm. It was noted that a chain of shallow drainage depressions was present within 200 m of the hearth, and that these were likely to have been ephemeral sources of water prior to extensive disturbance from farming.

NGH Yarren Hut ST1

NGH Yarren Hut ST1 is a scarred tree with one small cultural scar considered to be Aboriginal in origin, located in the north eastern corner of the property, near a farm dam, in a sparsely populated grove of trees. The tree is alive, standing and appears to be a box species, in good condition with a circumference at its base of approximately three metres, and containing one scar assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The narrow oval scar and the large misshapen oval scar are both located on the trunk of the tree facing west. The narrow oval scar measures 45 cm length, by 27 cm width, by 10 cm depth. The base of the scar narrow oval scar is approximately 87 cm above the ground. The misshapen larger oval scar measures 40 cm in length and 10 cm in width. The base of the larger misshapen oval scar is 40 centimetres from the ground. No axe marks were noted. The registered Aboriginal parties present during the survey indicated that the narrow oval scar may reflect manufacture of coolamon or other sort of food or water receptacle.

Consideration of potential for subsurface material

The field survey of the development site, in conjunction with an assessment of environmental and topographical data, archaeological modelling and consideration of comments from the RAPs resulted in an assessment that there is no subsurface potential within the project area. This is due to two main factors, being heavy disturbance of the project area as a result of ploughing and harvesting of crops many times over a long period, and significant erosion as a result of extensive vegetation clearance, periodic extreme flooding events and windstorms. These factors have resulted in the removal of much

of the natural topsoil in the project area, exposing B horizon silty clays beneath scattered redeposited A horizon silts.

While two hearths were identified during the survey (NGH Yarren Hut Hth1 and NGH Yarren Hut Hth2), it is assessed that these comprise the last remnants of campsites, the majority of which have been weathered away or destroyed during agricultural activities, and there is unlikely to be further archaeological resources associated with these sites below the top 2 to 5 cm of clay where the nodules have been embedded.

As only one surface artefact was identified during the survey, it has been assessed to be unlikely that archaeological deposits are present.

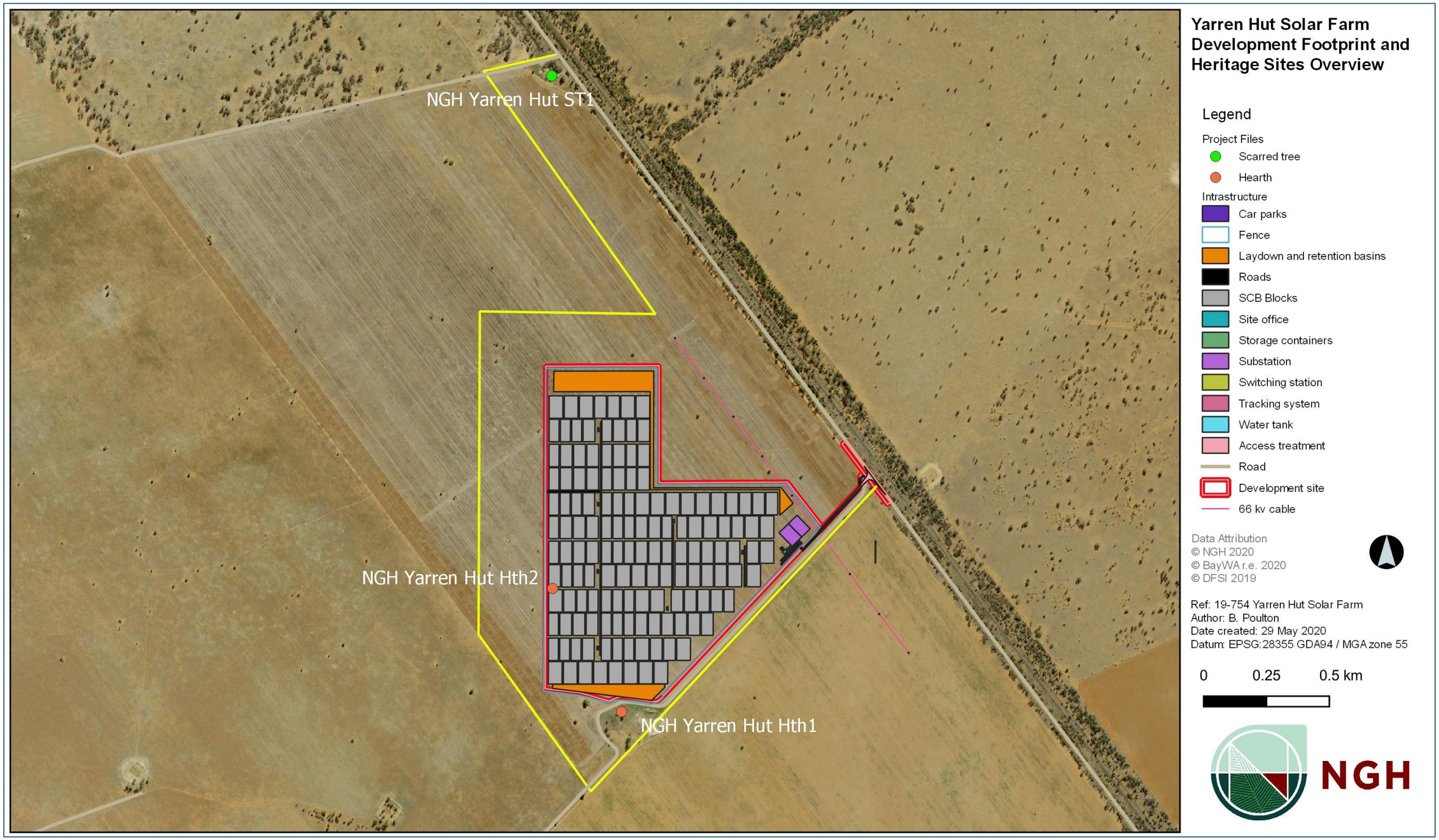

Figure 6-23 Proposed development footprint with Aboriginal heritage sites overlayed

Figure 6-24 Close up of hearth sites that would be avoided by the modified proposed development footprint

6.10.4 Potential impacts

Impacts to values

While the true cultural and social value of Aboriginal sites can only be determined by local Aboriginal people, in general, all sites hold cultural value to the local Aboriginal community. An opportunity to identify cultural and social value was provided to the Aboriginal representatives for this proposal through the consultation process which included providing comments on the methodology, participating in fieldwork and draft reporting process.

Construction

As described in this report, three archaeological sites were identified within the project area, one of which was within the proposed development footprint. However, the proposal has been amended to avoid this site and as such none of the three sites will be harmed as a result of the proposal.

Operation

During operation, it is unlikely the proposal would impact any further on Aboriginal cultural heritage. If unexpected objects of Aboriginal cultural heritage are encountered, the Unexpected Finds Management Procedure, outlined in Appendix A of the ACHAR (Appendix E of this EIS) would be followed.

6.10.5 Safeguards and mitigation measures

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

Table 6-42 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	The proponent should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The CHMP should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	**C**		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. BCD, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	**C**		
AH3	The location of NGH Yarren Hit Hth1 should be protected by the placement of barrier mesh fencing or similar delineating a 10 m buffer around the location of the recorded site.	**C**	**O**	**D**
AH4	The development must avoid NGH Yarren Hut Hth2. A minimum 5 m buffer around the site is required to protect it.	**C**	**O**	**D**
AH5	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	**C**		

C: Construction; O: Operation; D: Decommissioning

7 ASSESSMENT OF ADDITIONAL ISSUES

7.1 CLIMATE AND AIR QUALITY

Potential impacts on air quality in the form of vehicle emissions and dust are discussed below.

NSW ENVIRONMENT PROTECTION AUTHORITY REQUIREMENT

Dust –

1. *The EIS should identify the impacts from dust generated including during construction phase and appropriate mitigation measures defined and implemented.*

7.1.1 Existing environment

Climate

The Bogan LGA is part of the NSW Cobar Peneplain Bioregion, Lachlan Plains subregion. The Cobar Peneplain lies within Australia's hot, persistently dry semi-arid climatic zone. Patches of sub-humid climate exist on the south eastern boundary of the bioregion and, in the south, these areas are characterised by a hot summer and the absence of a proper dry season (OEH 2020b).

The BoM (2020b) climate records available from the nearest climate station at Nyngan Airport (station no. 051039, approximately 17 km southeast of the proposal) indicate a mean summer maximum of 34.4°C (January) and a mean winter minimum of 3.8°C (July) (Figure 7-1). Rainfall records from the same station show a mean annual rainfall of 445.6 mm, and that rainfall is generally greatest over summer, with the average monthly maximum occurring in January (51.2 mm).

Consideration of local climate is important in managing construction and operational impacts. For example, high rainfall periods and periods of drought will affect soil and water management actions particularly, as well as the establishment of groundcover.

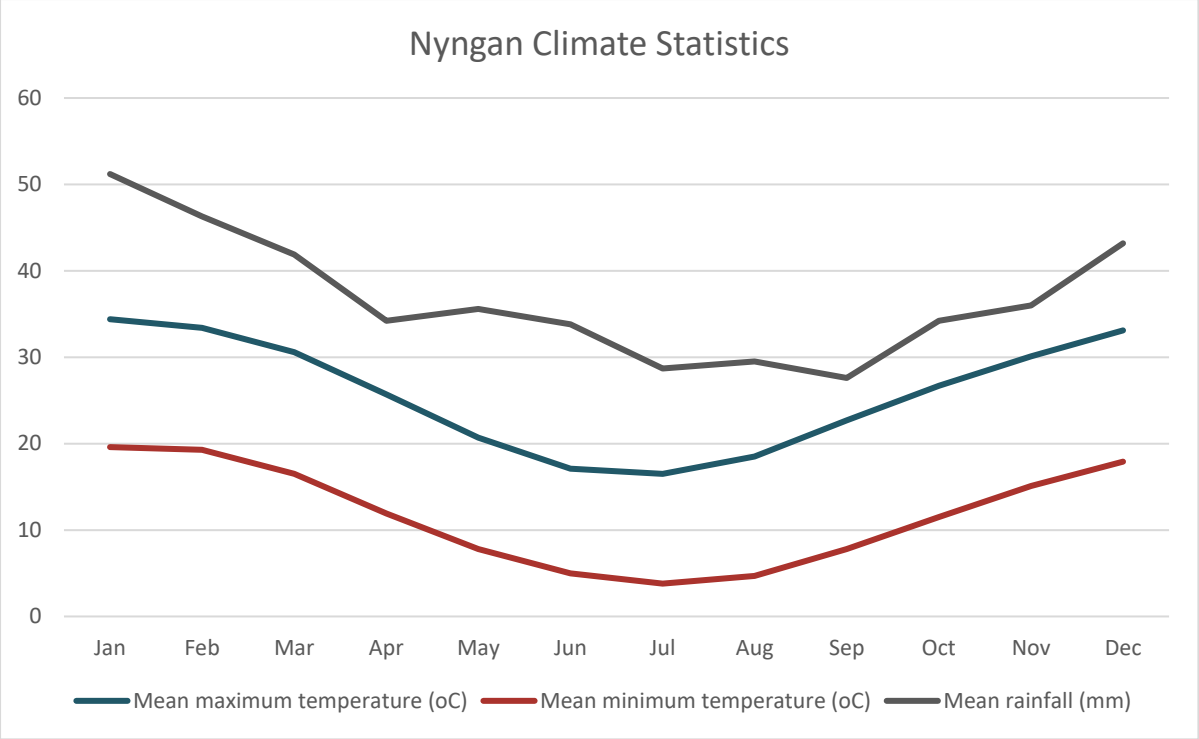

Figure 7-1 Climate statistics for weather station nearest to the proposal (Source: BoM 2020b)

Local air quality

The air quality around the development site is generally expected to be good and typical of that found in a rural setting in NSW. Existing sources of air pollution for the development site include:

- Vehicle emissions.
- Dust from nearby unsealed roads.
- Agricultural activities including sowing, lime application, burning of paddocks or earth moving.

A search of the National Pollutant Inventory (Australian Government, 2020) identified two substance emissions facilities located within the Bogan LGA, which include:

- Tritton Resources Limited, Girilambone (approximately 26 km)
- Tritton Resources Limited, Hermidale (approximately 30 km).

No residential dwellings are located within 5 km of the development site. Adjoining land uses include grazing and cropping for agriculture.

CRITERIA

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4 mg/m^2/month are also specified by the EPA.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of GHGs in the atmosphere. GHG's include carbon dioxide, methane and water vapour. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall decline in southern Australia and more extreme weather events including intense rainfall, more severe drought and harsher fires (CSIRO, 2015). The region is currently in a drought.

7.1.2 Potential impacts

Construction and decommissioning

Climate can act to influence the impacts of construction and decommissioning on the environment. For example, hot, dry or windy conditions can exacerbate adverse air quality impacts; prolonged rainfall can increase soil compaction impacts (Dean and Green, 2017). For these reasons, the specific climatic conditions of the site are considered in the assessment of impacts.

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along the unsealed access road during construction and decommissioning of the proposed solar farm. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving or lead to adverse health impacts when severe or prolonged (Dean and Green, 2017). Emission of GHGs are likely to contribute to climate change.

The construction phase is expected to last approximately 10 months, with a peak period lasting approximately five months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (shuttle bus) transport, (up to 40 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in section 6.6).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. The construction of the solar arrays uses a piling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be approximately 0.1% of the development site.

Additional disturbance and earthworks will be associated with trenching for cables, the construction of concrete footings for infrastructure and internal access tracks.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. However, construction would be responsive to local conditions to ensure impacts are managed. Haulage traffic and plant and equipment would generate emissions, however, the short duration of the work, the scale of the proposal and mitigation strategies in place suggest this contribution would be negligible in a local or regional context.

Operation

AIR QUALITY

The generation of solar energy during the operation of the proposal would generate negligible air quality impacts and emissions. The operation of the solar farm would produce minimal CO_2 emissions when compared to conventional coal and gas fired powered stations (Table 7-1). As discussed in section 2.2, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 76,000 MWh per annum, the proposal would power the equivalent of about 9,000 NSW homes.

Table 7-1 Comparison of CO_2 equivalent emissions produced per kilowatt hour for the lifecycle of the asset

Generation method	Emissions produced (grams CO2 equivalent per kWh)	Source
PV solar farm	19-59	Wright and Hearps (2010)
Coal-fired power station	800-1000	Wright and Hearps (2010)

Generation method	Emissions produced (grams CO2 equivalent per kWh)	Source
Combined cycle gas turbine	400	Alsema *et al*. (2006)

Maintenance activities during operation would result in some minor, localised vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads although strict speed limits would be enforced due to health and safety, which would assist as a mitigating factor. The impacts on local and regional air quality are expected to be negligible during operation. During major maintenance activities, this number could increase to 10 to 20 vehicles at any one time for a limited period.

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

Reduction of dust causing agricultural activities will also temporarily cease over the development area, with groundcover maintained to reduce erosion and dust. It is argued that overall dust creation on the subject land will decrease.

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is not expected to be significant. Cumulative impacts are discussed further in section 7.6.

7.1.3 Safeguards and mitigation measures

Air quality impacts would be addressed via the mitigation strategies in Table 7-2.

Table 7-2 Safeguards and mitigation measures for climate and air quality impacts

No.	Safeguards and mitigation measures	C	O	D
AQ1	Construction transport route to the development site to maximise use of sealed roads.	**C**		
AQ2	Primary construction access point located in north eastern corner of the development site away from residential buildings.	**C**		
AQ3	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	**C**	**O**	**D**
AQ4	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	**C**	**O**	**D**
AQ5	During construction, operation and decommissioning, dust would be monitored and managed to prevent dust leaving the development site. This includes dust from stockpiled materials.	**C**	**O**	**D**
AQ6	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		
AQ7	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.2 HISTORIC HERITAGE

A desktop search was completed for historical heritage in late 2019. Potential impacts on historical heritage are discussed below.

BIODIVERSITY CONSERVATION DIVISION REQUIREMENTS

Historic heritage -

1. *The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:*
    a. *outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996),*
    b. *b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),*
    c. *include a statement of heritage impact for all heritage items (including significance assessment),*
    d. *consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and*
    e. *where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.*

7.2.1 Approach

A search of listed items (under the Heritage Act, the Australian Heritage Database and those listed by local Councils and State Government agencies) was completed for the Bogan LGA on 25 November 2019.

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the development site. Bogan Shire LGA was used in the search as the development site is situated within the Bogan Shire. Heritage databases searched as part of this assessment included:

- The NSW State Heritage Inventory (SHI) (OEH, 2020c) (includes items on the State Heritage Register and items listed by state agencies and local government) to identify any items currently listed within or adjacent to the development site. The area searched was Bogan LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the development site.
- The Environmental Heritage (Schedule 5) of Bogan LEP for locally listed heritage items that are within or adjacent to the development site.

A general site inspection was also undertaken, with no items of historical heritage identified.

7.2.2 Existing environment

A summary of the results of the heritage searches are illustrated in Table 7-3. Details of listed items are provided below.

Table 7-3 Summary of heritage listings in the Bogan LGA

Name of register	Number of listings
World Heritage List	**0**
National Heritage List	**0**
Commonwealth Heritage List	**0**
NSW State Heritage Register	**2**
State Agency Heritage Register	**3**
Bogan LEP 2011	**4**

State Heritage Register

A search of the NSW heritage Register on 10 February 2020 for the Bogan LGA identified two items under the NSW Heritage Act and 11 items listed under the Bogan LEP and by state agencies. None of the items listed in the State Heritage Search were located within 10 km of the development site.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register for the Bogan LGA indicated 3 listings. These include:

- Gongolgon Weir, Bogan River, Nyngan,
- Nyngan Courthouse, Cobar Street, Nyngan
- Nyngan Railway Precinct, Pangee Street, Nyngan.

The above items are listed by State Agencies under s.170 of the Heritage Act. None of the above items are located within or in close proximity of the development site.

Local Heritage Schedule

A search of the Bogan LEP was completed on 10 February 2020, which found four items of local significance near the proposal area (Table 7-4). None of these items will be impacted by proposed solar farm with the closest site being over 17 km within the Nyngan township.

Table 7-4 Local Environmental Plan heritage listings

Scheme	Heritage Item	Status	Impact
Yarren Hut Solar Farm	Chinese graves and burner at Nyngan Cemetery	Registered - Local	None
	Nyngan Court House	Registered - Local	None
	Nyngan Railway Station	Registered - Local	None
	Railway overhead footbridge and goods shed	Registered - Local	None

No items of historic heritage significance will be impacted by proposal. The closest site is over 17 km south east from the proposal area. All the historic heritage places identified in these searches are shown in Figure 7-2 below.

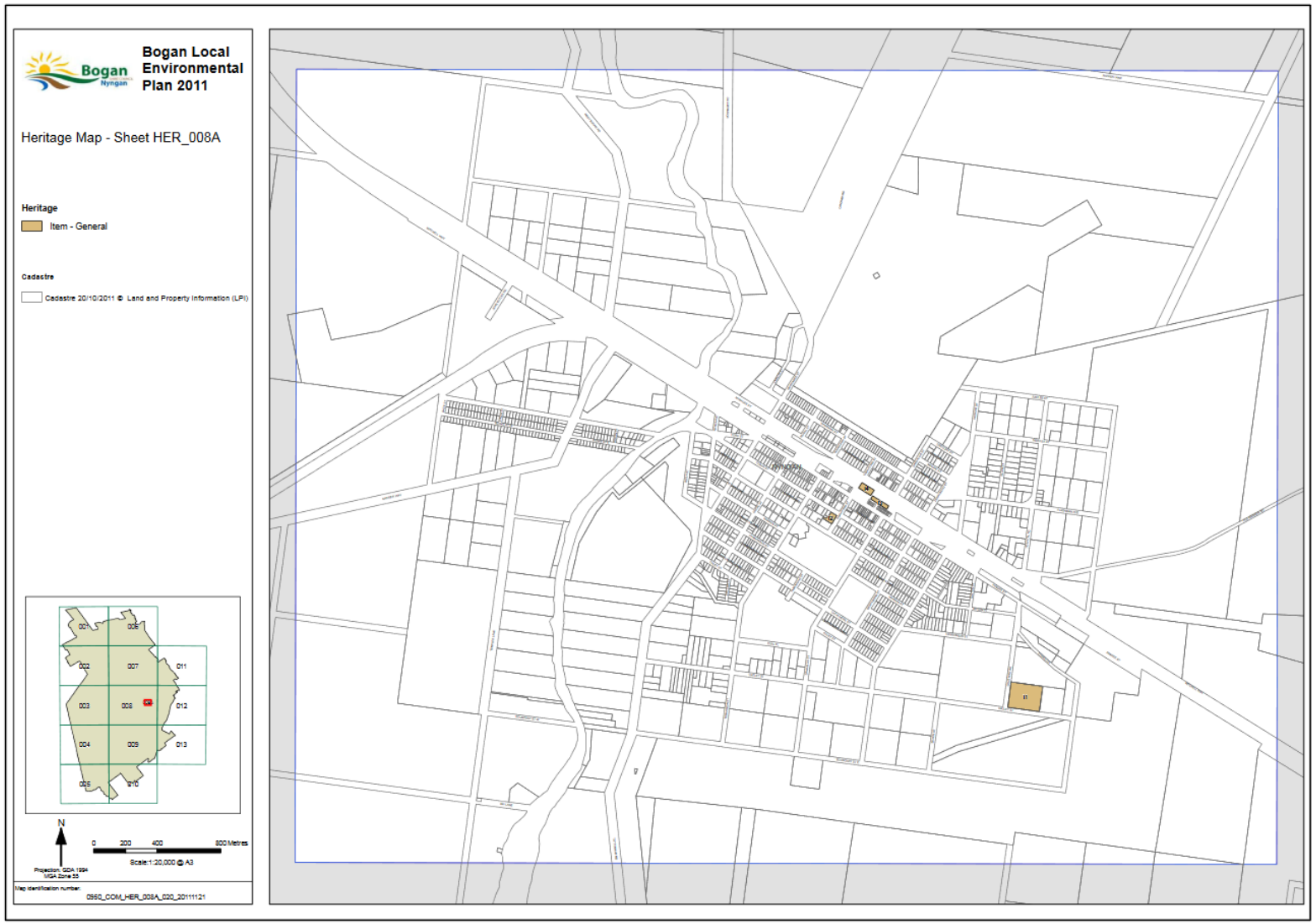

Figure 7-2 Bogan LEP (2012) Heritage Map results for the Bogan LGA (NSW Government 2012)

7.2.3 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. Most of these items are found in Nyngan and other towns and villages. None of these items are found within 10 km of the development site. The site inspection revealed no items of historical heritage at the development site.

The proposal is not considered likely to have a significant impact on heritage values in accordance with the Heritage Act, the EP&A Act, and the EPBC Act.

7.2.4 Safeguards and mitigation measures

Safeguards to protect historical heritage are listed in Table 7-5.

Table 7-5 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	In the unlikely event that an item of historic heritage is identified, the Heritage Division (DPIE) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.3 SOIL

A Soil Quality Assessment was undertaken by Barnson Pty Ltd in April 2020.

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

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Land – *Including:*

- *an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:*
  - *a soil survey to determine the soil characteristics and consider the potential for erosion to occur.*

7.3.1 Existing environment

Topography and geology

The site is located over the Canonba 1:50,000 Topographic Map (Sheet 8335S). The site has no clear areas of decreasing or increasing elevation greater than 4 m in any direction.

The development site lies on the border of two geological regions, the Great Artesian Basin and the Lachlan Fold Belt. The latter is characterised by deformed, Palaeozoic deep and shallow marine sedimentary rocks, cherts and mafic volcanic rocks. The soil is mapped as Summervale soil landscape. The Summervale landscape is part of the colluvial slopes and plains and flow lines associated with the Girilambone Beds to the northwest of Nyngan (DECC 2006).

Soil

A soil profile report from the NSW Soil and Land information system (OEH 2016) indicates the texture of surface soils (surface to 0.5 m) in the area as silty loam to sandy clay-loam, while sub-soil (>0.5 m) is described as medium to heavy clay.

No soil fauna activity, cracks or macropores were observed in the characterising samples.

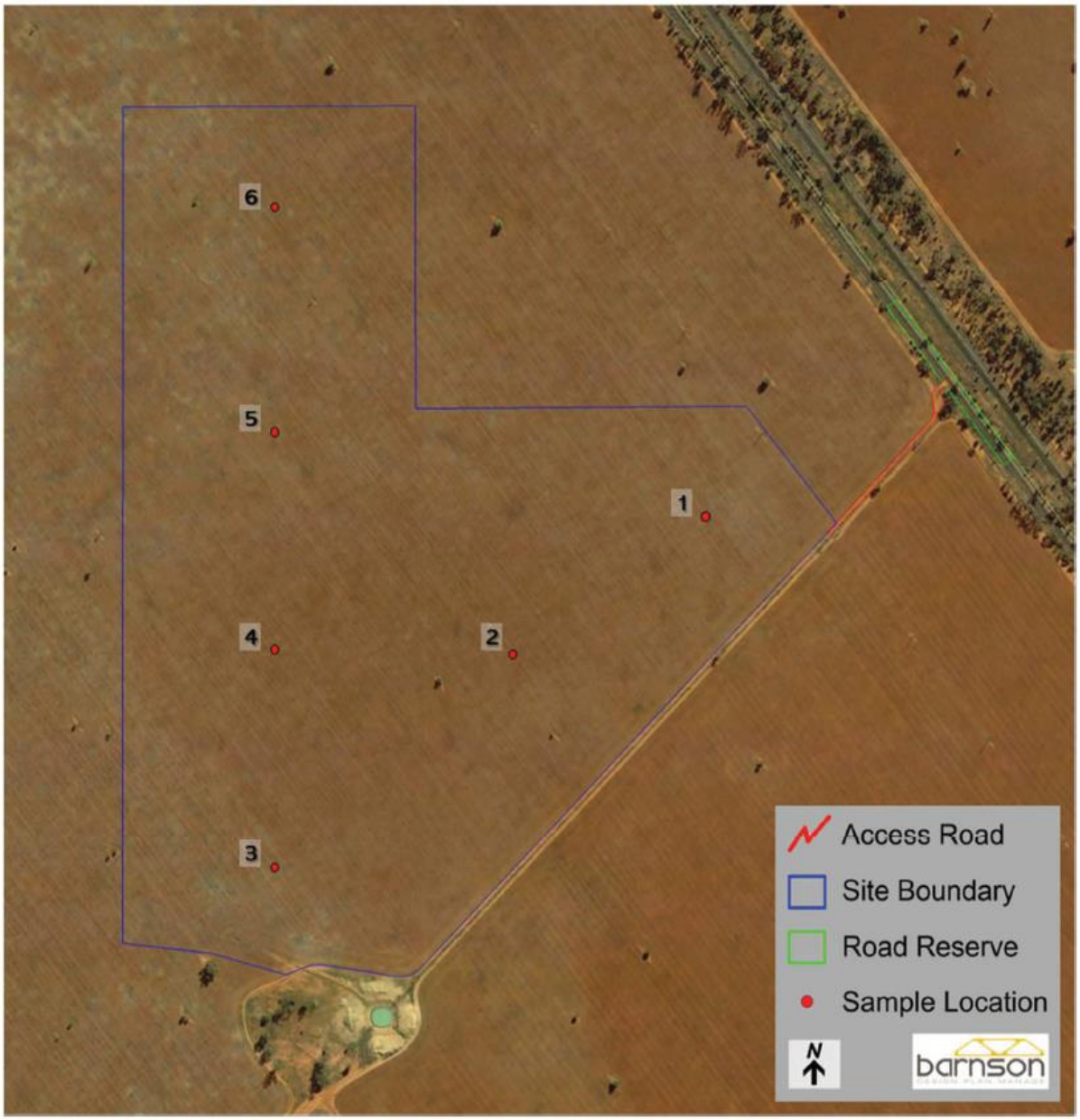

Figure 7-3 Soil survey investigation pit locations (source: Barnson Pty Ltd 2020)

Potential contamination

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

7.3.2 Approach

A Soil Quantity Assessment (Appendix I) was undertaken by Barnson Pty Ltd in April 2020. Site work for the soil quality assessment was undertaken on 26 March 2020 and involved the excavation of six auger holes across the development site. Samples of soil collected from the six auger holes were sent to an accredited laboratory for chemical analysis.

7.3.3 Results summary

Soil samples from the six auger holes were sent to an accredited laboratory for chemical analysis. The results of these tests is provided in Table 7-6 and Table 7-7 Discussion interpreting these results in regards to agricultural capability is provided below..

Table 7-6 Electrical conductivity measured in soil samples from the subject site.

Soil layer	Electrical Conductivity of Saturated Extract (ECe) dS/m					
	1	2	3	4	5	6
Surface soil	0.38	0.48	0.33	0.41	0.32	0.5
Sub-soil	0.78	0.64	0.62	0.62	0.68	0.83

Table 7-7 Measured chemical parameters for surface soil samples.

Surface Soil Sample Number	Soil PH	Exchange acidity (mq/100 g)	Exchangeable aluminium (mq/100 g)	Cation exchange capacity (mq/100 g)	Calcium/ magnesium ratio	Phosphate sorption capacity (mg P/kg)	Colwell extractable phosphorus (mg/kg)	Phosphorous buffering index
1	7.1	-	-	11.6	2.2	1,130	16	70.9
2	7.8	-	-	14.8	2.6	-	-	-
3	5.7	0.4	0.3	7	2.8	924	48	59.6
4	5.6	<0.1	<0.1	8.3	3.6	-	-	-
5	5.8	0.1	<0.1	8.6	2.2	-	-	-
6	6.6	-	-	12.3	2.5	726	23	45.5

Salinity and sodicity

Dryland salinity causes reduced plant growth, reduced water quality and damage to infrastructure. Soils are classified as saline when the measured electrical conductivity of saturate extract electrical conductivity value is greater than 2 dS/m. The results for both surface and sub-soils at the site indicate that the soils are non-saline (Table 7-6).

Soil sodicity can be an issue as it disperses when wetted. The results from the six surface soil samples and the three sub-soil samples analysed for exchangeable sodium percentage (ESP) (cation exchange capacity) indicate levels between 0.2% and 1.8% for surface soil and between 2% and 3.2% for sub-soil. The soils at the subject site are therefore non-sodic (see Table 7-7).

Erosivity

Soil erosion is influenced by vegetation cover, land management, soils, slope and climate. Erosion risk is determined by the interaction between these factors. Soil erodibility is the susceptibility of soil particles to detach and transport by rainfall and runoff. Run-off at the site is not an issue due to the very low slope. Results indicate the erosion rate for bare soil is estimated at 20 to 50 tonnes/ha/year, for covered soil it is 0.2 to 0.5 tonnes/ha/year. The erosion potential in bare conditions is unacceptable. However, with vegetation cover the rate of soil erosion can be reduced to well below tolerable rates.

The risk of erodibility of the surface soils at the site is medium to low site due to the low slope of the site, the non-saline and non-sodic nature of the surface soils and sub-soils.

There is a high potential for waterlogging on site following high rainfall. However, this can be ameliorated by vegetation cover which can utilise excess water. The growth of natural grass species present at the site should be encouraged to stabilise the surface soils and prevent soil erosion.

With the addition of suitable vegetation and the safeguards it is expected the site would be returned to its existing agricultural land capability after decommissioning.

Agricultural capability

Physical and chemical properties of the soil, including the soil infiltration rate, phosphorous buffering index, soil pH and the ratio of calcium and magnesium concentration in the soil were determined in the soil assessment. These are important as they influence the capability of the soil to sustain crops. Results are in Table 7-7.

Soil pH is important because it affects the biological, chemical, and physical processes of the soil and controls the availability of the essential nutrients. The optimal pH range for most plants is 6.0. If the pH is less than 5.4 the soil should be limed. In general, a soil pH between 5.4 and 7.0 is acceptable for plant growth. Soil sample pH results at the site were between 5.6 and 7.8.

Results for the extractable acidity and aluminium is very low (<1) which indicates low buffering capacity.

Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions and is very important as it influences soil structure stability, soil pH, nutrient availability and the soil's reaction to fertilisers and other ameliorants (e.g. lime). The results ranged between 7 and 14.8 mg/100 g which indicates a moderate capacity to hold exchangeable cations.

The phosphorous buffering index value is used to determine the rate at which phosphate fertiliser needs to be added to the soil to maximise crop yields. The index values calculated for the site are very low. A phosphorous addition rate of 5 to 20 kg/ha is indicated for optimum yield at the site.

Table 7-8 Landscape limitations (Barnson Pty Ltd 2020)

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulphate soils	Infrastructure risk
Chromosol	Whole site	Medium to Low	Low	Yes (4 samples)	High	No	Low

Existing limitations for ongoing agriculture use of the development site include erosion and waterlogging, while the physical and chemical properties of the soils indicate that the productive capacity is good so long as nutrients and soil conditioners are applied regularly. These same features create risks for the solar farm development. Maintaining perennial groundcover and carefully managing sheep stocking rates are essential for managing erosion and preventing changes to the microtopography of the site caused by hoof holes during waterlogging events.

7.3.4 Potential impacts

Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, cause soil erosion and subsequent sedimentation. Ground disturbance resulting from earthworks associated with the proposal would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of 1.5 m – 2.5 m.
- Construction of internal access tracks and access points and associated drainage.
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and office building.
- Cable trenches up to 1500 mm deep.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing and CCTV.

These activities would remove the existing groundcover and disturb soils, potentially decreasing their stability and increasing their susceptibility to erosion. Excavation of subsoils will be limited where possible, and excavated subsoils will be stockpiled and contained to avoid potential dispersion and sediment transfer. Topsoil salvaged from the construction of the access tracks and other works would be securely stored for use in site rehabilitation.

Ground disturbance resulting from the proposal would also be limited, given no major earthworks are required due to low relief of the landscape. Groundcover would be retained as far as practicable prior to and during construction.

The use of fuels and other chemicals onsite poses a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. Overall, these risks are low and considered readily manageable. Mitigation measures to prevent soil contamination are listed in section 7.3.5.

Operation

The primary risk of erosion during operation is from wind causing erosion. However, air movement would be reduced due to the installation of solar panels and the planting of suitable groundcover would ameliorate this risk.

Operational maintenance activities and vehicles would be largely confined to the formalised access tracks, minimising impacts to soils. Occasional vehicle access in between panel arrays would require traversing over undisturbed soils. This is expected to be infrequent and not likely to increase the erosion risk.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site.

In the grazed paddocks, native and exotic pasture across the development site could decline initially due to shading following PV array installation. A reduction in cover may lead to bare ground and susceptibility of the soil to erosion. The selection of suitable shade tolerant pasture species for planting would address this issue. Managing grazing levels will also be paramount to maintaining a protective perennial groundcover.

7.3.5 Safeguards and mitigation measures

Activities with potential for adverse soil impacts would be managed through the development and implementation of sediment control plans and spill controls, as detailed below (Table 7-9).

Table 7-9 Safeguards and mitigation measures for soil impacts.

	Safeguards and mitigation measures	C	O	D
SO1	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) would be prepared prior to construction, then implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. The SWMP and ESCP would include provisions such as: • Prior to the works, and progressively during construction, install erosion controls. • Maintain a register of inspection and maintenance of erosion control. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction, operation and decommissioning.	**C**		**D**
SO2	A Groundcover Management Plan developed in consultation with a soil scientist and an agronomist would take into account soil survey results to ensure perennial grasscover is established across the site as soon as practicable and maintained throughout the operation phase. The Groundcover Management Plan would cover: • Soil restoration and preparation requirements. • Species election. • Soil preparation. • Establishment techniques. • Maintenance requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements:		**O**	

	Safeguards and mitigation measures	C	O	D
	○ Live grasscover would be maintained at or above 70% to protect soils, landscape function and water quality. ○ Any grazing stock would be removed from the site when cover falls below this level. ○ Grasscover would be monitored using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. • Identification of baseline conditions for rehabilitation following decommissioning.			
SO3	A Decommissioning and Rehabilitation Plan developed in consultation with a soil scientist, an agronomist and the landowner would consider soil survey results to ensure soil and groundcover is established in preparation for the development site's future land use. The Decommissioning and Rehabilitation Plan would cover: • Determine future land use in consultation with the landowner. • Soil restoration and preparation requirements. • Species selection. • Soil preparation. • Establishment techniques. • Maintenance requirements. • Land capability criteria. • A period of monitoring to determine that land capability requirements are met prior to relinquishment.			**D**
SO4	The array would be designed to allow sufficient space between panels to establish and maintain groundcover beneath the panels and facilitate weed control.	**Design**		
SO5	All chemicals and fuels used on-site must be stored and handled in accordance with: • The requirements of all relevant Australian Standards. • The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook* if the chemicals are liquids. • In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.4 HAZARDS

Hazards relevant to the proposal and proposal site include risks associated with hazardous goods, electromagnetic fields, fire and flooding. These potential impacts are discussed below.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

***Hazards –** Including:*

- *an assessment of potential hazards and risks associated with bushfires.*

- *an assessment of the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.*

NSW RURAL FIRE SERVICE REQUIREMENTS

The subject land is mapped bushfire prone land by Bogan Shire Council and can include unmanaged grassland vegetation. The NSW RFS is also the primary response agency for fighting structural fires within the site and surrounding locality.

The NSW RFS has no objection to the draft SEARs and recommends the Environment Assessment specifically addressed the following, having regard to the requirements of 'Planning for Bushfire Protection 2019':

- *potential bushfire threats to the facility.*
- *potential hazards to firefighters.*
- *management of bushfire (including grass fire) impacting on and structural fire emanating from the proposed solar farm and its associated infrastructure.*
- *firefighting water supplies.*
- *vehicle access and defendable space around the solar array.*
- *land and vegetation management opportunities.*
- *proposed emergency management procedures.*

Ultimately, as part of any consent issued for the project, the NSW RFS will require the proponent to develop a Fire Management Plan, in consultation with the local NSW RFS District Fire Control Centre.

NSW ENVIRONMENT PROTECTION AUTHORITY REQUIREMENT

Storage of chemicals and fuels –

The EIS should describe the control measures that are to be implemented to minimise the risk of spills polluting land or water, such as appropriate storage and bunding of chemicals and fuels.

7.4.1 Hazardous materials and development

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 Guideline lists industries that may fall within SEPP 33, which does not include solar farms. Appendix 2 of the Applying SEPP 33 Guideline provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. The Applying SEPP 33 Guideline is, however, a guide only and final determination is made based on considerations if the development would fall under the definition of potentially hazardous in the actual SEPP 33.

Risk screening

SEPP 33 screening procedure considers the quantity of dangerous goods stored or transported, the frequency of transportation movements, and in some cases the distance of the materials from the site boundary. The Applying SEPP 33 Guideline require goods to be classified according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

A development which exceeds the screening thresholds in the SEPP 33 Guideline would be considered potentially hazardous and a PHA would be required. For quantities that fall below the stated thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage for the proposal are detailed in Table 7-10, with the location of the proposed storage sites shown on Figure 3-3.

Transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, therefore would not be considered potentially hazardous. The proposal does not require a PHA.

Table 7-10 SEPP 33 transport thresholds

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
Class 3 - Flammable Liquids (PG II)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	1 tonne	Stored in a bunded area, 20 m from boundary	No
Class 6.1 Toxic Substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1 tonne	Secure operations storage building	No

Other risk factors

The proposal would not involve the storage or transport of incompatible materials, generation of hazardous wastes, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, or storage or processing operations involving high (or extremely low) temperatures.

Potentially offensive industry

The proposal would result in relatively minor vehicle and machinery exhaust emissions during the construction phase. The emissions occur outside, in a rural locality, and would be readily dispersed. The emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would largely be confined to standard working hours during the construction phase and have been demonstrated to fully comply with construction, operation and traffic criteria (section 6.5); noise emissions would not be hazardous are there are no residences within 5 km of the development site. Water pollution risks have been assessed as low (section 7.2), subject to identified mitigation measures, with longer term benefits following cessation of cultivation and maintenance of groundcover across the site. Based on these factors, the proposal is not considered a potentially offensive industry.

7.4.2 Fire

Bushfire presents a threat to human and animal life, homesteads and infrastructural assets, and can adversely impact ecological values. A bushfire risk can be considered in terms of environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines and other electrical components).

Existing environment

The development site is flat and generally devoid of groundcover. Local native vegetation remains along Mitchell highway and on private property west of the subject land as native remnant patches and scattered paddock trees. The development site is surrounded largely by land with little groundcover (Figure 6-19).

Although the site is identified as bushfire prone land (NSW RFS, 2019), discussions with the local community highlight that the area has experienced significant fires over the past few years; the risk of which is higher in the hot, dry summer months.

The existing natural bushfire hazards within the development site are as follows:

- A narrow corridor of remnant eucalypt woodland along Mitchell Highway.

- Remnant patches of vegetation located east of the subject land.

Groundcover within the subject land has largely been removed or maintained at low levels due to cultivation practices and grazing and is so not considered a fire risk. Where areas are enhanced, crash grazing may be used to ensure understorey growth does not accumulate to unacceptable levels.

The local bushfire danger period occurs between October and March, where conditions are most conducive to bushfire ignition - being hot and dry. The harvest period of November to mid-December is considered a prime risk period due to the use of machinery (ignition source) in crops (fuel) and the generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas.

Prevailing wind direction is from west to east, for most of the year (BoM 2020b).

There are 17 Rural Fire Services (RFS) listed for the Bogan LG, with the nearest located within 30 km of the development site. The closest RFS is about 17 km away in Nyngan, on Lawler Street.

In the event of a bushfire originating on a property outside of the solar farm, the RFS (Incident Controllers) would be expected to undertake defensive operations and not enter a perimeter around electricity infrastructure – i.e. they would protect the facility from an encroaching bush or grass fire, or if the solar farm is on fire, attempt to prevent the spread of fire from the solar farm. This approach is the same as currently followed for electrical substations in the path of a fire, or one that was alight. However, RFS crews could access any structure on fire, such as offices, buildings, carparks, etc. that are not actual electricity generation/storage infrastructure.

In terms of resources to fight fire, one farm dam is located directly south the development site as well as multiple water troughs for livestock. Additional dams are scattered on properties surrounding the proposal. In addition, following consultation with local FRS members, BayWa r.e. would install a 20,000 L water tank near the solar farm entrance.

Planning for Bushfire Protection Guidelines (2019)

According to the *Planning for Bushfire Protection (PBP) Guidelines* (NSW RFS 2019), six key Bushfire Protection Measures for developments should be adhered to:

a) the provision of clear separation of buildings and bush fire hazards in the form of fuel reduced APZ (comprising inner and outer protection areas and defendable space).
b) construction standards and design.
c) appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation.
d) adequate water supply and pressure.
e) suitable landscaping to limit fire spreading to a building.
f) emergency management arrangements for fire protection and/or evacuation.

The PBP Guidelines provides the following bushfire management objectives for National Construction Code Class 5 to 8 buildings (including commercial and industrial facilities) and Class 10 non-habitable buildings and structures (such as garages and fences):

- *to provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress with evacuation.*
- *to provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*
- *to provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development.*
- *consideration of storage of hazardous materials away from the hazard wherever possible.*

In addition, the PBP Guidelines provides requirements for the Asset Protection Zone (APZ), which include the following design parameters:

- A minimum carriageway width of 4 m for rural/residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint).
- In forest, woodland and heath situations, rural property access roads have passing bays every 200 m that are 20 m long by 2 m wide, making a minimum trafficable width of 6 m at the passing bay.
- A minimum vertical clearance of 4 m to any overhanging obstructions, including tree branches.
- Internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum 12 m outer radius.
- Curves have a minimum inner radius of 6 m and are minimal in number to allow for rapid access and egress.
- The minimum distance between inner and outer curves is 6 m.
- The crossfall is not more than 10 degrees.
- Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads.

The PBP Guidelines provide for a 10 m APZ from structures, associated buildings, infrastructure and adequate firefighting access. This has routinely been incorporated for NSW utility scale solar farms, following RFS advice. BayWa r.e have incorporated a 10 m APZ for this solar farm proposal. The APZ must be maintained to the standard of an inner protection area for the life of the development to provide adequate access for firefighting purposes.

The PBP Guidelines require a bushfire emergency management and operation plan detailing the suspension of work involving risk of ignition during total fire bans, the availability of fire-suppression equipment, storage and maintenance of flammable materials, notification of the local NSW RFS Fire Control Centre for any works during the fire danger period that have the potential to ignite surrounding vegetation, and bush fire emergency management planning.

Potential fire impacts

CONSTRUCTION AND DECOMMISSIONING

Specific activities that would be associated with the construction of the proposal that may cause or increase the risk of bushfire include:

- Site maintenance activities such as mowing, slashing and using other petrol-powered tools.
- Hot works, including welding and soldering activities.
- Operating a petrol, LPG or diesel-powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.
- Smoking and careless disposal of cigarettes on site.

Considering the low vegetation cover as a fuel source over the development site and other factors discussed above, it is considered unlikely that construction of the solar farm would pose a significant uncontainable bushfire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

A 10 m APZ would be established inside the perimeter security fence.

The bushfire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bushfire mitigation measures outlined in section 7.4.4.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction, any bushfire risk associated with decommissioning of the project would be highly manageable.

OPERATION

Maintenance activities

Repairs and maintenance activities during operation could increase bushfire risk. All electrical components would be designed to minimise potential for ignition. Groundcover beneath panels would be maintained and not permitted to accumulate to high fuel loads (access and solar input requirements are in line with this activity). Strategic grazing is one potential method for keeping fuel loads to a minimum around the solar farm infrastructure.

An APZ would be maintained around individual buildings and the entire development site including inverters, delivery station and solar substation. Internal access tracks are 3.5 m to 5 m wide allowing adequate access for emergency vehicles including fire trucks.

Bushfire risks during operation of the solar farm and connection infrastructure would be manageable.

Bushfire and compliance with PBP Guidelines

Asset Protection Zones

Appendix 4 of the PBP Guidelines provides minimum APZ requirements for habitable buildings in residential developments designated as bushfire prone. While the proposal is not residential, these APZ prescriptions would be applied to the solar farm infrastructure to provide defendable space and to manage heat intensities at the infrastructure interface.

The PBP Guidelines indicates a minimum APZ width of 10 m for grassy woodlands (total fuel load 15 tonnes/hectare) and semi-arid woodlands (total fuel load 18 tonnes/hectare) on flat ground in the Southern Riverina with a Fire Danger Rating of 80. This setback is based on the need to conform to Level 3 construction (AS3959 – 1999) for a building of Class 1 or 2 under the BCA.

The 2019 *Planning for Bush Fire Protection* (NSW RFS, 2019) specifies the following minimum APZ widths for residential subdivisions on flat ground in FDI 80 areas:

Grassy woodlands	11 m
Semi-arid woodlands (grassy)	6 m.

An APZ of minimum width of 10 m would be provided around the solar farm buildings and substation, and around the outside perimeter of the solar array. The 10 m APZ setback requirement would also be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm. The APZ would be managed as an Inner Protection Area. The APZ surrounding the proposed substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

Fuel hazard management

According to the PBP Guidelines, the APZ should provide a tree canopy cover of less than 15% located greater than 2 m from any part of the roofline of a dwelling and should not overhang any building. Trees should have lower limbs removed up to a height of 2 m above the ground. The understorey should be managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season.

There would be no trees or shrubs within the APZ established for the solar farm, or within the solar array area. Grassland Fuel Hazard is a function of grass height and cover, with variation according to curing and species fuel characteristics. Grass fuel would be monitored and managed using stock

grazing or mowing to maintain safe fuel levels. Grass height within the APZ would be maintained at or below 5 cm throughout the October-April fire season. Grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 cm throughout the fire season.

The overhead powerlines at the development site would be managed by maintaining appropriate vegetation clearances to minimise potential ignition risks, in accordance with the Industrial Safety Steering Committee (ISSC) (2016) 3 Guideline for Managing Vegetation Near Power Lines.

Access

Safe and efficient access (suitable for firefighting appliances) would be established and maintained over the solar farm site. The APZ around the perimeter of the site may incorporate a 4 m - 5 m wide gravel access track. The perimeter track would comply with the requirements for fire trails in section 4.1.3 of the
PBP Guidelines, including:

- A minimum carriageway width of 4 m with an additional 1 m wide strip on each side of the trail clear of bushes or long grass.
- Minimum vertical clearance of 4 m.
- Capacity for passing using the 10 m APZ.

The turn radius and swept path clearance on access roads would be suitable for Category 1 Tankers (Medium Rigid Vehicle).

Firefighting resources and preparedness

One 20,000 L steel or concrete water storage tank would be installed near the site office and main access point, dedicated emergency fire access points and adjoining the main internal access road for firefighting and other non-potable water uses. A 65 mm Storz outlet, a metal valve and a minimum of 20,000 L reserve is proposed for fire-fighting purposes (see Figure 7-4). Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity. Suitable fire extinguishers and PPE would be maintained at site buildings.

A Bush Fire Management Plan would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the solar farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through site orientation and information events and the facilitation of training. An Emergency Response Plan, including an Evacuation Plan, Emergency Fire Response Plan and SCRP would also be developed to enable rapid, safe and effective incident response.

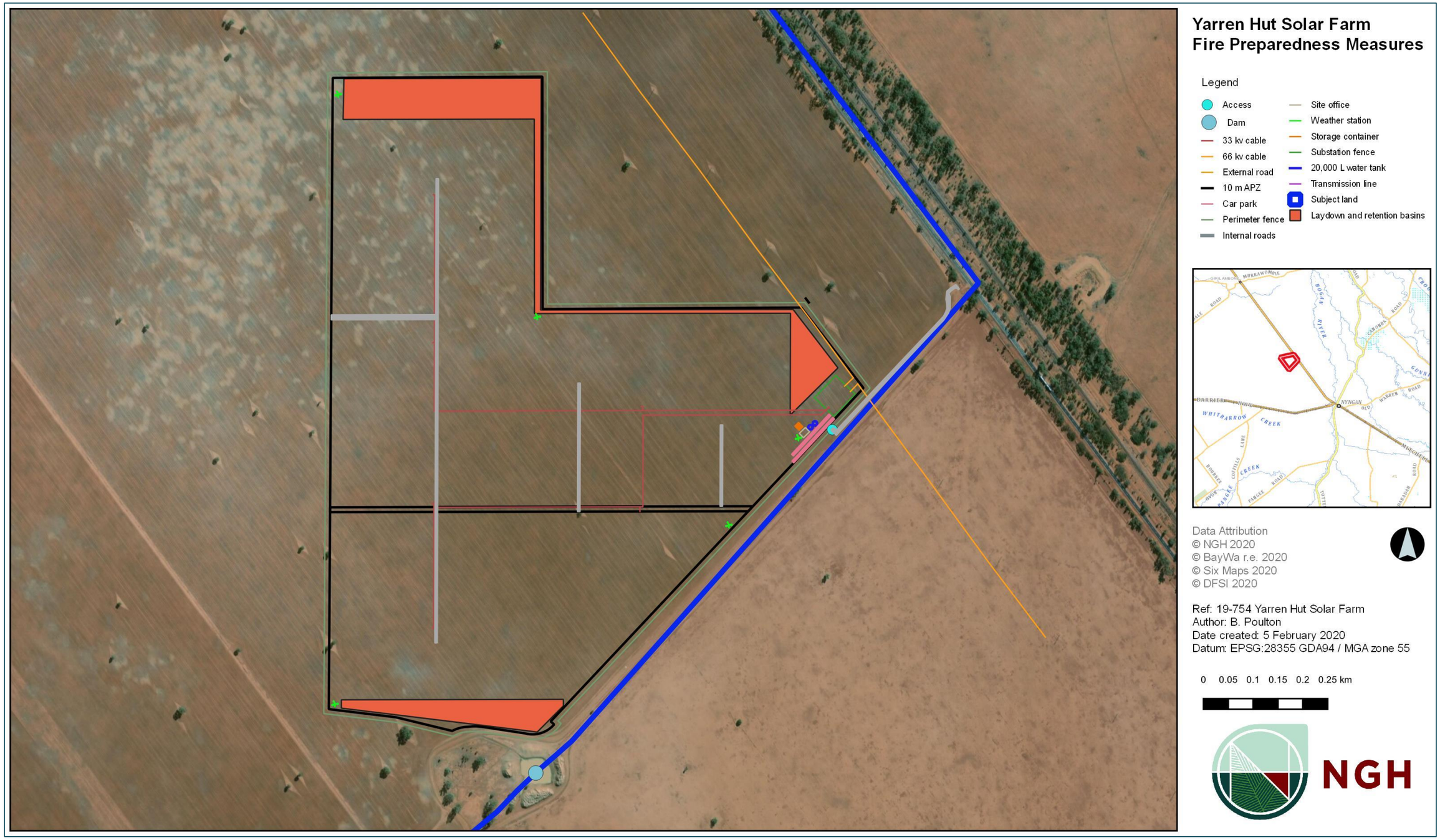

Figure 7-4 Fire preparation measures

7.4.3 Electric and magnetic fields

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs). While a low risk to the public, in terms of the levels produced by the proposal, it is an issue that has sometimes been a concern for local residents, as evidenced by solar farm feedback collected by NGH over the last several years.

About EMFs

EMFs consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO, 2012).

Electric fields are produced by voltage. Magnetic fields are produced by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances while operational (WHO, 2007). Electric and magnetic field strengths reduce rapidly with distance from the source and, while electric fields are shielded to some extent by building materials, magnetic fields are not.

In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50 hertz (Hz). This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

Research into photovoltaic solar arrays in California by Chang and Jennings (1994) indicated that magnetic fields (the EMF type of greatest public concern) were significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, 2007). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF electric fields at the low levels generally encountered by the public (WHO, 2007), such as those that would be produced by electricity generation at the proposed solar farm and along the transmission line.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that would provide protection against known adverse health effects.

To prevent health-relevant interactions with ELF fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached. The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions would also be met (in the body). These are not the actual limits, they are simply guidance figures for when it is necessary to investigate the basic restriction (ICNIRP, 2010). Reference levels for occupational and general public exposure are shown in Table 7-11.

Table 7-11 ICNIRP reference levels for electric and magnetic fields. Values are for 50 Hz

Electric fields	Magnetic fields
Occupational	
ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
field actually required: 24.2 kV/m	field actually required: 3.03 mT
General public	
ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 µT
field actually required: 9.9 kV/m	field actually required: 606 µT

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

1. Solar Panels and inverters.
2. Underground cables.
3. Overhead 66 kV transmission line (connecting to existing Essential Energy transmission line).
4. Substation.

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

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however, magnetic fields still occur. They are expected to be minimal.

The substation would be classified as a high voltage substation (rated high capacity of 66 kV). The highest electromagnetic field is usually produced by the lines and cables supplying the substation and not by the equipment inside the substation itself. If the substation itself produces a field outside its perimeter, it usually falls away over the first few metres (EMFs info, 2019).

Potential EMF impacts

CONSTRUCTION AND DECOMMISSIONING

There is low potential for EMF impacts during the construction and decommissioning phases of the project. The maximum magnetic field of the proposed transmission line is well under the 200 µT and 1000 µT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing 66 kV overhead transmission line. Exposure to EMFs during the construction of the substation and its connection to the existing transmission line would be short term, therefore the effects are likely to be negligible.

The construction site would be fenced to protect the public from construction health and safety risks.

OPERATION

During operation, EMF sources would include underground cabling, and the solar array incorporating inverters.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts minimised also.

The site is surrounded by agricultural land. Public access would be restricted by fencing around the site including substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

Using the Principle of Prudent Avoidance to design and site infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs would not result from the proposal.

7.4.4 Safeguards and mitigation measures

ICNIRP sets out protective measures to reduce personal harm from EMFs if the basic restrictions are expected to be exceeded. These include engineering design, administrative controls and personal protective clothing. The works undertaken for the proposed solar farm are not expected to exceed the basic restriction levels. The following safeguard and mitigation measures would be implemented to reduce any further risks associated with EMF exposure and bushfire management (Table 7-12).

Table 7-12 Safeguards and mitigation measures for health and safety (EMFs and bushfire management)

No.	Safeguards and mitigation measures	C	O	D
HA1	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids,* and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and bunded.	**C**	**O**	**D**
HA2	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA3	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA4	Design of electrical infrastructure to minimise EMFs through the solar array (underground).	**C**		

No.	Safeguards and mitigation measures	C	O	D
HA5	Bushfire preparedness (construction) • All workers, subcontractors and visitors will be inducted to ensure they are aware of their responsibilities relating to fire safety. • Designated emergency management personnel will be trained according to their level of responsibility (First Aiders, Fire Wardens). • Contractors will comply with the restrictions applied during Fire Danger Period and Total Fire Bans. No hot works such as grinding or welding will be performed during Total Fire Bans without the appropriate permit. • Adequate firefighting equipment (e.g. extinguishers) would be available across the site to quickly manage any fire. • All firefighting equipment will be in accordance with relevant fire safety standards and will be inspected on a regular basis and replaced after use or where faulty. • Handle and store dangerous and flammable goods in accordance with the measures outlined in the Code of Practice for the Storage and Handling of Workplace Dangerous Goods (2013). • As far as practicable, vehicles will move around site using designated roads and tracks and must not park on or drive in long grass or off road. • Diesel vehicles are to be used where practicable. The use of petrol-powered vehicles should be restricted, unless inspected and risk assessed by the Head Contractor. Petrol vehicles should not be used off road or be parked off road with the engine running. • No burning of waste or construction materials on site. • Smoking will only be permitted in designated smoking areas.	**C**		
HA6	A Fire Management and Emergency Response Plan (FMERP) would be developed and implemented during construction, operation and decommissioning, with input from the local RFS centre, and include but not be limited to: • Operational procedures relating to mitigation and suppression of bushfire relevant to the solar farm. • Addressing foreseeable on-site and off-site fire events or other emergency incidents. • Detailing appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. • Such measures will include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures to be instigated, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. • Management of activities with a risk of fire ignition. • Management of fuel loads onsite.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bushfire suppression. • 24-hour emergency contact details including alternative telephone contact. • Site infrastructure plan. • Firefighting water supply plan. • Site access and internal road plan. • Construction of asset protection zones, fire trails, access for firefighting and on-site suppression equipment and their continued maintenance. • Location of hazards (physical, chemical and electrical) that will impact on the firefighting operations and procedures to manage identified hazards during the firefighting operations. • Such additional matters as required by the NSW RFS District Office. • The below requirements of Planning for Bush Fire Protection 2019: o Identifying asset protection zones. o Providing adequate egress/access to the site. o Emergency evacuation measures. Two copies of the FMERP will be stored in a prominent location in a position directly adjacent to the main entry point.			
HA7	To allow for emergency service personnel to undertake property protection activities, a 10 m defendable space managed as an APZ shall be provided around the buildings, substation, outside perimeter of the solar array, and all areas of unmanaged vegetation being retained within the site.	**C**	**O**	**D**
HA8	A 20,000 L water supply (tank) fitted with 65 mm Stortz fittings shall be located at the main access point.	**C**	**O**	**D**
HA9	Once constructed and prior to operation, the operator of the facility will contact the relevant local emergency management committee (LEMC).	**C**	**O**	
HA10	All chemicals and fuels used on-site must be stored and handled in accordance with: • The requirements of all relevant Australian Standards. • The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook if the chemicals are liquids*. In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.5 RESOURCE USE AND WASTE GENERATION

Waste generated during construction, its minimisation and disposal are discussed below.

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENT

The EIS must also address the following specific issues:

Waste –

- *Identify, quantify and classify the likely waste stream to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.*

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENT

Waste management –

The EIS should incorporate options and strategies for waste minimisation, reuse and recycling. Waste management should be a high priority given the issues that other solar developments in the region have experienced in managing the large volume of waste generated during construction.

BOGAN SHIRE COUNCIL REQUIREMENT

Provide a detailed Waste Management Plan that includes the types and quantities of waste to be disposed of, including details of the licensed facilities that are proposed to accept the waste.

7.5.1 Approach

Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar farm include those listed in Table 3-1.

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Water requirements during operation are estimated to be 60 kL / year based on the estimate of 0.8 L per panel.

Waste generation

POLICY POSITION

Legal requirements for the management of waste are established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under section 143 of the POEO Act. Littering is an offence under section 145 of the POEO Act.

The WARR Act includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. BayWa r.e. is committed to adopting environmental best practice and would follow the waste hierarchy throughout all stages of the proposal, with priority given to minimising waste generation. Resource management options would be considered against a hierarchy shown in Figure 7-5.

Figure 7-5 Waste hierarchy (source: wastelessfuture.com)

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

CONSTRUCTION

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

- Unpackaging materials.
- Excess building materials.
- Scrap metal and cabling materials.
- Plastic and masonry products, including concrete wash.
- Excavation of topsoils and vegetation clearing (expected to be minimal).
- Liquid bio wastes from onsite septic systems.

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

BayWa r.e. is committed to environmental best practice and would ensure that panels are supplied in biodegradable packaging, where practicable. BayWa r.e would also work with Bogan Shire and commercial services to recycle as much packaging as practicable.

OPERATION

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

DECOMMISSIONING

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

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

The vast majority of solar panel materials can be recycled. Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All infrastructure above ground and to a depth of 2500 mm would be removed from the site during decommissioning.

7.5.2 Potential impacts

Construction and decommissioning

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the proposal are not currently limited or restricted. In the volumes required, the proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

Water would be required during construction for activities including watering of roads, topsoil stockpiles and in the site office and amenities compound. Water use is considered in section 6.8.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. The proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. The majority of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

Operation

LIFECYCLE ANALYSIS

Lifecycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total lifecycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A lifecycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 30-year lifetime of the panels, it is expected that 28 g of GHG emissions would be produced per kWh of energy generated (Fthenakis *et al.* 2011). The 'energy payback time' for multicrystalline PV panels is dependent on the geographical location, however on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer ISE, 2015), which is considered comparable to the development site.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis *et al*. 2011). The waste produced during production of the panels which can be recycled include graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis *et al*. 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it is referred to as the system's. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer ISE, 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems' lifecycle (GA and ABARE, 2010).

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO_2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

RESOURCES AND WASTE STREAMS

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintaining vehicles during operation of the solar farm.

Operational waste streams would be very low given the low maintenance requirements of the solar farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation. However, these activities would occur very infrequently and there would be a high potential for recycling or reuse of the waste.

7.5.3 Safeguards and mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Impacts are proposed to be addressed via the mitigation measures in Table 7-13.

Table 7-13 Safeguards and mitigation measures for resource use and waste generation

No.	Safeguards and mitigation measures	C	O	D
WM1	A Waste Management Plan (WMP) would be developed and implemented prior to construction, operation and decommissioning to minimise waste. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sewage would be disposed of. • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.6 CUMULATIVE IMPACTS

Cumulative impacts relate to the combined effect of similar or different impacts on a particular value or residence and may occur concurrently or sequentially. The incremental effects of the proposal on existing background conditions in the study area have been taken into account in the following assessment sections.

7.6.1 Existing environment

The proposal will contribute to overall infrastructure development in the region.

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

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

There are four other Major Projects listed on the Major Projects Register within the Bogan LGA including two other large-scale solar farms:

- The Nyngan Scandium mine project has been approved. This project is located approximately 20 km west of Nyngan, with access proposed via Gilgai Road and Barrier Highway. The development is expected to generate approximately 70 vehicle movements per day once constructed.
- Western Slopes Pipeline had been issues SEARs but has yet submitted an EIS. The proposed infrastructure involves the construction and operation of approximately 450 km of buried steel gas transmission pipeline between Narrabri Gas Project and the existing Moomba Sydney Pipeline.
- Nyngan Solar Farm has been constructed and is located approximately 10 km west of the Nyngan township. The development is expected to generate approximately six light vehicle movements per day.
- Bogan River Solar Farm was located 2 km south of Nyngan, between the junction of Tottenham Road and Mitchell Highway. The development application was withdrawn in December 2018.

7.6.2 Potential impacts

Potential cumulative impacts are primarily associated with the following:

- Biodiversity impacts.
- Visual and landscape character impacts.
- Noise impacts
- Traffic impacts.
- Pressure on local facilities, goods and services.
- Local agricultural impacts.

Cumulative impacts may have varying impacts to SSD proposals occurring within the LGA. Of four Major Projects listed above, the Nyngan Solar Farm is located approximately 9.5 km from the proposal and as it has already been constructed would not contribute noticeably to cumulative visual, noise and traffic impacts in conjunction to the proposal.

The identified cumulative impacts in this EIS are considered manageable. Each component should be assessed individually and using the most up-to-date information available at the time of pre-construction.

Biodiversity impacts

The clearing of native vegetation, which is a key threatening process at both the State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 % of native vegetation in NSW has been removed since European settlement (NSW Scientific Committee, 2011) and the removal of vegetation at the proposal is contributing to this process. The cumulative impact of similar renewable energy projects, particularly where EEC is involved, can be considerable given that many poorly-conserved vegetation communities have a substantial portion of their extent represented on private land where most renewable energy projects are proposed. Small losses of vegetative communities may be insignificant at a local level but may accumulate over time to cause a significant reduction in the extent of remnant patches.

Cumulative impacts are considered best addressed by avoiding and minimising. Where avoidance is not possible the impact of each contributing project is assessed on a case by case basis. Long term mechanisms like offsetting through the BAM are structured to address the ongoing impacts of multiple

projects in a cohesive manner. For the proposal, credits were generated using the biobanking credit calculator (BCC) and offsetting of biodiversity impacts considered. However, the overall proposal has been designed to avoid and minimise impacts to biodiversity.

Visual and landscape character impacts

As no residential receivers are located within 5 km of the development site, no cumulative visual impacts are anticipated.

Noise impacts

As no residential receivers are located within 5 km of the development site, no cumulative impacts for noise are anticipated.

Traffic impacts

Cumulative traffic impacts may occur on the construction access and freight transport route, primarily on Mitchell Highway. Mitchell Highway is a high capacity road designed for heavy vehicle traffic and is likely to absorb any cumulative impacts. Any impact to Mitchell Highway is expected to be noticeable; however, any impact from increased traffic would be predominately limited to the 10-month construction period.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, only a small maintenance team using light vehicles would be required.

Accommodation impacts

Bogan and surrounding areas provide many visitor accommodations. It is possible that, in conjunction with other major projects, shortages of accommodation could occur during the construction stage. The proponent would engage with local accommodation providers and Bogan Shire Council if necessary, to provide additional short term and temporary accommodation at these businesses. The proponent would also consult with Bogan Shire Council to coordinate construction schedules to minimise conflict with any local festivals or activities. Scheduling staff 'rostered days off' could help alleviate accommodation pressures by allowing itinerant workers to go back home.

It is considered that the demand for health care and other services would also be dispersed throughout the surrounding towns to coincide with where workers are staying.

Pressure on local facilities, goods and services

There is potential that the possible concurrent construction of the proposal with other SSD or local development would increase pressures on local community services including accommodation. However, there is also a potential for positive cumulative economic effects from the construction of multiple developments in the area. Socio-economic benefit in relation to developments in the region will be a continuous ongoing benefit for the community with increased jobs and economic input into local business.

It is unlikely that there would be negative cumulative impacts to local facilities, goods and services.

Local agriculture impacts

Approximately 92 ha of cropping and grazing land would be converted to solar farm development. The proposal would not permanently fragment primary production land, with the exception of the 0.4 ha permanent Essential Energy switching station. Upon decommissioning, the solar farm would require limited rehabilitation to restore it to its pre-existing capability for agriculture land use including the removal of all infrastructure above ground and below ground to a depth of 2500 mm. The soil structure and chemical composition would not be directly altered by the proposal, although the carbon content and general fertility is expected to improve as result of an extended rest from cropping over the operational phase.

Continued use of this land for livestock grazing would be maintained within the development footprint for the life of the proposal. Therefore, the development of a solar farm would potentially result in the following agricultural impacts:

PRODUCTIVE LAND PRESERVED FOR FUTURE GENERATIONS

An estimated 12 million ha of arable land are lost to land degradation globally each year (UNCCD, 2009). Solar farms constitute a temporary and reversable primary land use, allow sheep grazing to persist over the life of the project and can function as an 'arable land savings account,' securing productive land for future generations.

Solar farm development sites can be returned to agricultural use following decommissioning. The benefits of resting land from cropping include:

- Increased groundcover and diversity of groundcover with biosecurity management.
- Increase in soil moisture and nutrients.
- Increases in soil organic matter means less evaporation, less impact of runoff and less erosion.
- Perennial grasses can be encouraged to increase soil stability of grassland around the panels.
- Microorganism populations responsible for nutrient cycling, improving soil structure and controlling disease are able to recover.

7.6.3 Safeguards and mitigation measures

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

8 ENVIRONMENTAL MANAGEMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS.*

8.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposal would be managed by implementing a project-specific suite of mitigation measures detailed in sections 6 and 7 and summarised below.

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

These plans would detail the environmental management responsibilities of specific staff roles, reporting requirements, monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training, complaint response procedures and adaptive management mechanisms to encourage continuous improvement.

8.2 MITIGATION MEASURES

8.2.1 Safeguards and mitigations

A summary of the safeguards and mitigation measures contained within this EIS are listed collectively in Table 8-1 below.

Table 8-1 Safeguards and mitigation measures summary

No.	Safeguards and mitigation measures	C	O	D
Visual				
VA1	Screening vegetation would be planted along the eastern border of the development site facing Mitchell Highway in accordance with a Landscape Plan (LP)	**C**	**O**	**D**
VA2	Prior to the commencement of construction, a detailed LP will be prepared including: • Screening location. • Species type. • Planting density and spacing. • Method for planting. • Management measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method, replacing dead plants). • A program to manage, monitor and report on the effectiveness of implemented measures.	**Design**		
VA3	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	**Design**		

No.	Safeguards and mitigation measures	C	O	D
VA4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	**C**		
VA5	Construction night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).	**C**	**O**	**D**
Land use				
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	**C**	**O**	**D**
LU2	Consultation would be undertaken with Essential Energy regarding connection to the existing overhead powerline.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with DPIE and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above and below ground infrastructure. • Removal of gravel from internal access tracks where required in consultation with landowners. • Reverse any compaction by mechanical ripping. • Targets and standards to indicate successful rehabilitation of disturbed areas. These targets and standards should be applied to rehabilitation activities once the proposal is decommissioned.			**D**
LU4	A Pest and Weed Management Plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The Pest and Weed Management Plan must be prepared in accordance with Bogan Shire and DPIE requirements. Where possible integrate weed and pest management as a part of district-wide control measures.	**C**	**O**	
LU5	The proponent would consult with GSNSW and tenement holders in relation to mineral exploration, or potential for sterilisation of mineral resources.	**C**		
LU6	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	**C**	**O**	**D**
LU7	Underground cabling and all underground infrastructure would be removed on decommissioning.	**C**		
LU8	Grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		**O**	
Socio-economic				
SE1	A Community and Stakeholder Engagement Plan (CSEP) would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	**C**	**O**	

No.	Safeguards and mitigation measures	C	O	D
SE2	Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**	**O**	
SE3	Liaise with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaise with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**
Noise and vibrations				
NS1	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**
Traffic				
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure and residential dwellings. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).	**C**		**D**
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The Traffic Management Plan would include but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network, to be undertaken in consultation with TfNSW. • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads (including internal roads) to minimise dust generation through increased traffic use. Following construction, a post condition survey of the relevant sections of the existing road network would be undertaken to ensure it is of similar condition as prior to construction.	**C**		**D**
TT3	Obtain a section 138 Consent from the relevant council/agency to perform works within the road reserve.	**C**		
TT4	Any upgrades would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	**Design**		

No.	Safeguards and mitigation measures	C	O	D
TT5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	**C**		**D**
Hydrology and flooding				

F1	To mitigate the risk of flood sensitive components of the development being subject to flood damage, the following mitigation measures are proposed:
	• Inverter stations:
	  ○ Floor level of the inverter stations are to be elevated a minimum of 0.5 m above the surrounding ground surface level.
	  ○ Inverter stations are to be aligned such that their longer side is positioned in the north-south direction to minimise the potential for them to obstruct flow.
	• Substation and site office:
	  ○ The floor level of any flood sensitive facility buildings is to be elevated a minimum of 0.5 m above the surrounding ground surface level.
	• Solar array fields:
	  ○ The solar panels should be designed such that the whole of the panels are able to be elevated a minimum of 0.5 m above the ground surface level below (i.e. minimum height difference between the ground surface and the lowest part of the solar panel).
		Design		

F2	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal. The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	**C**	**O**	**D**
F3	A Business Floodsafe Plan would be prepared prior to construction in general accordance with the NSW SES Business Floodsafe Toolkit and Plan.	**C**	**O**	**D**
Water use, quality (surface and groundwater) and hydrology				
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental chemical (e.g. fuel) spills.	**C**	**O**	**D**
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
WA3	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 POEO Act).	**C**	**O**	**D**
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	**C**	**O**	**D**
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	**C**		**D**
WA6	Erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	**C**	**O**	**D**
WA7	Ensure appropriate drainage controls are incorporated into the design.	**Design**		
Biodiversity				
BD1	Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing. A trained ecologist or licensed wildlife handler would be present during clearing events and complete: • Pre-clearing checklist. • Tree clearing procedure.	**C**		
BD2	Plain wire instead of barbed used on top of the perimeter fence.	**C**	**O**	
BD3	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance where partial clearing is proposed: • Approved clearing limits clearly delineated with temporary fencing prior to construction commencing. • No stockpiling or storage within dripline of retained trees. • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance. • Remove native vegetation by chainsaw rather than heavy machinery.	**C**		
BD4	Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	**C**	**O**	
BD5	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill: • Avoid night works. • Direct lights away from vegetation.	**C**	**O**	**D**
BD6	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operation activities. • Construction would cease if dust observed blown from site until control measures were implemented. • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	**C**		

No.	Safeguards and mitigation measures	C	O	D
BD7	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas incorporated into the Pest and Weed Management Plan.	**C**	**O**	
BD8	All staff induction and regular communications to cover environmental features retained and protection measures to be implemented (including but not limited to): • Site speed limits to be enforced to minimise fauna strike. • Vehicle hygiene and biosecurity.	**C**	**O**	
BD9	Preparation of a Biodiversity Management Plan to implement biodiversity protection measures (including but not limited to): • Unexpected threatened species finds. • Rehabilitation and enhancement of disturbed areas.	**C**		
BD10	Screening and landscaping plantings to be comprised of local indigenous species representative of the vegetation in the development site.	**C**		
Aboriginal heritage				
AH1	The proponent should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The CHMP should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	**C**		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. BCD, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	**C**		
AH3	The location of NGH Yarren Hit Hth1 should be protected by the placement of barrier mesh fencing or similar delineating a 10 m buffer around the location of the recorded site.	**C**	**O**	**D**
AH4	The development must avoid NGH Yarren Hut Hth2. A minimum 5 m buffer around the site is required to protect it.	**C**	**O**	**D**
AH5	Further archaeological assessment would be required if the proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	**C**		
Air quality				
AQ1	Construction transport route to the development site to maximise use of sealed roads.	**C**		
AQ2	Primary construction access point located in north eastern corner of the development site away from residential buildings.	**C**		
AQ3	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	**C**	**O**	**D**
AQ4	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
AQ5	During construction, operation and decommissioning, dust would be monitored and managed to prevent dust leaving the development site. This includes dust from stockpiled materials.	**C**	**O**	**D**
AQ6	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		
AQ7	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**
Historic heritage				
HH1	In the unlikely event that an item of historic heritage is identified, the Heritage Division (DPIE) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**
Soil				
SO1	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) would be prepared prior to construction, then implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. The SWMP and ESCP would include provisions such as: • Prior to the works, and progressively during construction, install erosion controls. • Maintain a register of inspection and maintenance of erosion control. • Ensure that machinery arrives on site in a clean condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction, operation and decommissioning.	**C**		**D**

SO2	A Groundcover Management Plan developed in consultation with a soil scientist and an agronomist would take into account soil survey results to ensure perennial grasscover is established across the site as soon as practicable and maintained throughout the operation phase. The Groundcover Management Plan would cover:
	• Soil restoration and preparation requirements.
	• Species election.
	• Soil preparation.
	• Establishment techniques.
	• Maintenance requirements.
	• Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements:
	  ○ Live grass cover would be maintained at or above 70% to protect soils, landscape function and water quality.
	  ○ Any grazing stock would be removed from the site when cover falls below this level.
	  ○ Grasscover would be monitored using an accepted methodology.
			O	

No.	Safeguards and mitigation measures	C	O	D
	• Contingency measures to respond to declining soil or groundcover condition. • Identification of baseline conditions for rehabilitation following decommissioning.			
SO3	A Decommissioning and Rehabilitation Plan developed in consultation with a soil scientist, an agronomist and the landowner would consider soil survey results to ensure soil and groundcover is established in preparation for the development site's future land use. The Decommissioning and Rehabilitation Plan would cover: • Determine future land use in consultation with the landowner. • Soil restoration and preparation requirements. • Species selection. • Soil preparation. • Establishment techniques. • Maintenance requirements. • Land capability criteria. • A period of monitoring to determine that land capability requirements are met prior to relinquishment.			**D**
SO4	The array would be designed to allow sufficient space between panels to establish and maintain groundcover beneath the panels and facilitate weed control.	**Design**		
SO5	All chemicals and fuels used on-site must be stored and handled in accordance with: • The requirements of all relevant Australian Standards. • The NSW EPA's *Storing and Handling of Liquids: Environmental Protection – Participants Handbook* if the chemicals are liquids. • In the event of an inconsistency, the most stringent requirement must prevail to the extent of the inconsistency.	**C**	**O**	**D**
Hazards (EMFs, fire)				
HA1	Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids,* and the ADG Code where relevant. All potential pollutants kept on-site would be stored in accordance with relevant HAZMAT requirements and bunded.	**C**	**O**	**D**
HA2	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA3	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA4	Design of electrical infrastructure to minimise EMFs through the solar array.	**C**		
Waste management				
WM1	A Waste Management Plan (WMP) would be developed and implemented prior to construction, operation and decommissioning to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• Provision of toilet facilities for onsite workers and how sewage would be disposed of. • 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 (C), Operation, (O), Decommissioning (D)

9 CONCLUSION

9.1 NEED AND BENEFITS

The proposed Yarren Hut Solar Farm would involve the construction and operation of a proposed 28 MW AC solar farm near Nyngan, NSW. The 1205 ha development site is located on freehold rural land, approximately 17 km northwest of Nyngan in the Bogan LGA. The development footprint of the proposal is approximately 92 ha.

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

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 40 employees at the peak of construction (five months) and one or two FTE operational staff for the life of the project. Maintenance contracts for panel cleaning, fence repair, road grading, etc. would also be required and would likely be met by local contractors.
- Direct business volume benefits for local services, materials, and contracting.

It is estimated that the solar farm would require around $1.1 million per year of operational spending to maintain. A large portion of this would be spent on local wages, local contractors, and material.

9.2 ENVIRONMENTAL ASSESSMENT AND MITIGATION OF IMPACTS

NGH with input from specialists including ecologists, environmental scientists, archaeologists and financial planners, has prepared this EIS on behalf of the proponent, BayWa r.e. This EIS has assessed the broader proposal and development site where infrastructure may be located. Overall, the proposal would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered highly compatible with existing land uses and highly reversible upon decommissioning; returning the site to its previous agricultural capacity is a commitment of the proposal.

The key environmental risks have been investigated through detailed specialist investigations. These included:

- Biodiversity impacts – the BDAR concluded that no significant impacts to threatened species and ecological communities would result. No referrals under the EPBC Act are considered to be required. An offset requirement has been calculated for the proposal and would ensure an in-perpetuity commitment to account for the small area of native vegetation that the proposal cannot avoid.
- Aboriginal heritage impacts – the Aboriginal heritage survey and assessment found that no operational impact to Aboriginal cultural heritage would occur from the proposal. The two hearths and scarred tree identified during the survey would be avoided during all phases of the proposal. A mitigation strategy has been developed for each site recorded and forms a commitment of the project.
- Visual impact - the VIA concluded that the operational solar farm would not impact any residential dwelling with none located within 5 km of the proposal. Specific native vegetation plantings would be implemented to limit views by passing traffic on Mitchell Highway.
- Noise impacts – the noise assessment concluded that generally noise impacts during construction, operation and decommissioning would be within the accepted noise

criteria. No NML exceedances would occur during construction or operation of the proposal.

- Land use - While the agricultural output from the existing farmland would be slightly reduced by the operation of the solar farm, the land can still be utilised for sheep grazing. The proposal is reversible and would not result in the permanent loss of agricultural land.

A suite of management measures has been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. Key management strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks. The management measures account for uncertainty and are precautionary where required. The impacts and risks identified are considered highly manageable with the effective implementation of the measures stipulated in this EIS.

9.3 ABILITY TO BE APPROVED

- The development site is highly appropriate to solar energy generation.
- The proposal is consistent with local, State and Federal planning provisions.
- The development site has been selected to avoid or minimise environmental impacts where possible through an iterative constraint investigation/design process.
- The development footprint has been designed/reduced to avoid or minimise impacts to vegetation, habitat, neighbours and Aboriginal heritage sites.
- Visual impacts would be negligible as no residences are located within 5 km of the proposal.
- Land use conflicts and hazard risks are considered manageable and acceptable.

The residual impacts are considered justifiable and acceptable in the context of the proposal's benefits.

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