ENVIRONMENTAL IMPACT STATEMENT

CULCAIRN SOLAR FARM

JANUARY 2020

Project Number: 18-441

DOCUMENT VERIFICATION

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Final V1.3	19/01/2020	Address DPIE comments	Nicola Smith / Sarah Hillis	Michial Sutherland	Erwin Budde
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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: Neoen Australia Pty Ltd

Proposed development:

The Culcairn Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce up to 400 Megawatts of electricity. Associated infrastructure includes a substation, inverters, battery storage, staff amenities, control room, internal access tracks and fencing.

Land to be developed:

- Lots 70-73, 86 DP 753764
- Lots 9-11, 45-47, 53, 54 DP 753735
- Lot 1 DP 179854
- Lot 114 DP 664997
- Lot 1 DP 575478
- Lot 1 DP 171815
- Lot 1 DP 945904
- Lot B DP 972054

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:	29th November 2019	19 January 2020

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Terms and definitions

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AGO	Australian Greenhouse Office
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AHD	Australian Height Datum
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AWS	Automatic weather station
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
BCC	Biobanking Credit Calculator
BCD	Biodiversity Conservation Division (formally the Office of Environment and Heritage (OEH))
BESS	Battery Energy Storage System
BOM	Australian Bureau of Meteorology
BLM	Bureau of Land Management
BREE	Bureau of Resources and Energy Economics
BSF	Battery Storage Facility
BFRMP	Bush Fire Management Plan
°C	degrees Celsius
CEMP	Construction environmental management plan
CRP	Community Relation Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
dB(A)	A measure of A-weighted *(c.f.)* sound levels.
DOEE	Department of the Environment and Energy (Commonwealth)
DPE	Department of Planning and Environment
DPIE	Department of Planning, Industry and Environment (formally DPE)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)

EPA	(NSW) Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environment Protection Licence issued under the POEO Act *(c.f.)*
ESD	Ecologically sustainable development
GA	Geoscience Australia
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
HVAC	Heating, Ventilating and Air Conditioning
Hz	hertz
ICNG	Interim Construction Noise Guideline
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
km	kilometres
kV	kilovolts
L_{A90} (15 minutes)	The A-weighted sound pressure level that is exceeded for 90% of a 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.
L_{Aeq} (15 minutes)	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period that excludes other noise sources such as from industry, road, rail and the community.
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LCU	Landscape Character Unit
LEP	Local Environment Plan
LGA	Local Government Area
LMZ	Landscape Management Zone
LRET	Large-scale Renewable Energy Target
m	metres
mm	millimetres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory Renewable Energy Target
MVA	Megavolt-ampere
MW	Megawatt
MWh	Megawatt hours
NHMRC	National Health and Medical Research Council
NPI	*NSW Noise Policy for Industry*
NPW Act	*National Parks and Wildlife Act 1974*

NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage (BCD)
PCT	Plant Community Type
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PMF	Probable Maximum Flood
PV	Photovoltaic
RBL	Rating Background Level - the level of background noise
RDA	Regional Development Australia
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
REAP	Renewable Energy Action Plan (NSW)
RFS	NSW Rural Fire Service
RNP	NSW *Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
RMS	(NSW) Roads and Maritime Services
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
Sensitive Receptor	A place or object that is sensitive to a particular environmental impact. e.g. school, place of worship, residence, heritage building/structure, pipeline (for vibration/blasting).
SEPP	State Environmental Planning Policy (NSW)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
Sound pressure level	The noise at a given distance from plant or equipment
sp/spp	Species/multiple species
SPRAT	EPBC Act Species Profiles and Threats Database
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State significant development
TMP	Traffic Management Plan
µT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	volts
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WMP	Waste Management Plan
WSP	Water Sharing Plan
ZVI	Zone of Visual Influence
The proposal	The construction and operation of the proposed Solar Farm
The Proponent	Neoen Australia Pty Ltd

Subject land	All land within the affected lot boundaries. Lots 70-73, 86 DP 753764, Lots 9-11, 45-47, 53, 54 DP 753735, Lot 1 DP 179854, Lot 114 DP 664997, Lot 1 DP 575478, Lot 1 DP 17181, Lot 1 DP 945904, Lot B DP 972054, approximately 1351 ha.
Development site	The area of land that is subject to the proposal. The development site is made up of 1317 ha and includes the development footprint along Weeamera Road. 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 1126 ha.
Study area	The study area refers to the area that was covered in site surveys.

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 350 megawatt (MW) Alternating Current (AC) / 402.5 MW Direct Current (DC) photovoltaic (PV) solar farm approximately 4 km from Culcairn, southern NSW. The 1,317 hectare (ha) development site is located on freehold rural land.

NGH has prepared the EIS on behalf of the Proponent, Neoen Australia Pty Ltd (Neoen). 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) (formerly the Department of Planning and Environment (DPE)) on 3 May 2019.

PROPOSAL DESCRIPTION

The proposed Culcairn Solar Farm would have a total installed capacity of up to 350 MW (AC) / 402.5 MW (DC), and would include:

- Single axis tracker PV solar panels mounted on steel frames over most of the site (up to approximately 1,100,000 PV solar panels).
- Climate Controlled Battery Energy Storage System to house the battery units that store energy produced onsite (maximum 100 MW / 200 MWh storage capacity).
- Electrical conduits and transformers.
- On site substation.
- Site office, maintenance building ablution block, parking access tracks, material laydown area, parking area, waste storage area and perimeter fencing.
- Electrical transmission infrastructure and overhead transmission line to connect to the existing 330 kilovolt (kV) TransGrid transmission line.
- Internal access roads.
- Upgrade to existing public roads.
- On-site vegetative screening to soften views of proposed infrastructure from residences and at the intersection of public roads.

TransGrid's Jindera to Wagga Wagga 330 kV transmission line enters the development site from the south-west and continues through the site, running north along the eastern boundary. The transmission line forms part of the existing electricity distribution network that originates at TransGrid's North Wagga Wagga Substation. The proposed solar farm will connect directly to the transmission line where it crosses the site, with a new substation required near this location. The substation would be operated by TransGrid.

The development site would be accessed from Weeamera Road, via Benambra Road and the Olympic Highway. Benambra Road and the southern section of Weeamera Road is the heavy vehicle route used by the Boral Quarry, located to the south-east of the proposal. The Olympic Highway provides access to the region's transport network. Access to the northern section of the proposal would be established across Cummings Road.

The proposal would require the subdivision of Lot 70 DP753764 as only part of this property will be leased for the life of the proposal. A subdivision of Lot 54 DP753735 would be required for the land for the substation.

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

The proposal is expected to operate for 30 years. The construction phase of the proposal is expected to take 16 to 18 months and will commence in mid to late 2020. After the operating phase, the proposal would either be decommissioned, removing all above ground infrastructure and below ground infrastructure to a depth of 500 mm, or removed as necessary to allow restoration of land capability to pre-existing agriculture. The site would be returned to its existing land capability or upgraded with new photovoltaic equipment.

PROJECT NEED

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and 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 2017). Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE 2017). Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia (DEE 2017). Once constructed, the proposal would provide a major contribution to Australia's greenhouse gas emissions reduction, generating more than 800,000 MWh of clean, renewable electricity into the national power grid each year. This reduction will be the equivalent of taking either 245,000 cars off the road or planting 1.28 million trees, producing enough electricity to power approximately 140,000 homes with renewable energy.

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

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013a). The Government's vision is for a secure, affordable and clean energy future for NSW. The Plan positions the state to increase energy from renewable sources by attracting investment, building community support and growing expertise in renewable energy at the least cost to the energy customer and with the maximum benefits to NSW. Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors.

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

The proposal would contribute to the NSW Renewable Energy Action Plan (NSW Government 2013), which supports the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013a). The proposal would also further the three goals of the Action Plan:

- Attract renewable energy investment and projects.
- Build community support for renewable energy.
- Attract and grow expertise in renewable energy.

The proposal would also contribute to the Australian Government's objective to achieve an additional 33 GW of energy from renewable sources by 2020 under the LRET.

PROJECT BENEFIT

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 500 employees for the 8 to 12 month peak of construction and five to ten 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.
- Dispatchable renewable electricity allowing generation (via the battery) during peak demand periods to place maximum downward pressure on prices, for example during evening times post-sunset
- Direct business volume benefits for local services, materials and contracting (e.g. accommodation, food and other retail).
- Significant wage spending would be directed at local and regional businesses and service providers during the construction period. Spending would include housing, retail and recreational spending, and personal, medical and other services.
- Increased economic security to rural economies through diversification of employment opportunities and income streams.

It is estimated that the solar farm would require around $12,000 per MW DC per year of operational spending to maintain, or about $4.8 million per year. This would mostly be spent on local wages, local contractors, and materials. Over the life of the project, this could provide around $144 million of additional economic activity in the local community.

Further project benefits are provided in the Economic Impact Assessment of the proposal by Ethos Urban (Appendix O) with the total Economic Benefits over construction and operation of around $84.3 million.

To minimise the environmental costs of achieving the above benefits, the proposal would respond appropriately to the environmental constraints of the site. It would be designed to:

- Preserve biodiversity features through minimising native vegetation removal.
- Minimise impacts on items of Aboriginal significance.
- Minimise impacts on soil and water resources through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Retain existing site topography where possible with no major earthworks proposed.
- Minimise visual impacts to neighbours, incorporating vegetation screenings located in consultation with any highly impacted neighbours.
- Retain some agricultural production value through managed stock grazing during operation.
- Preserve future agricultural production values, being highly reversible at the end of the project's life.

SITE SUITABILITY

The proposal would assist in reducing Australia's greenhouse gas emissions (GHG) and in meeting 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 Culcairn and the surrounding region.

Key considerations for site selection are detailed within the *NSW Large-scale Solar Energy Guideline for State Significant Development* (DPIE 2019), including:

- The proposal is not highly visible, not located on high ground or within a valley. Natural screening occurs along Cummings Road. Screening is proposed for sensitive receivers adjacent to the proposal where there are views of the proposal.
- Minimal impacts to biodiversity are expected due to the historical disturbance and agricultural activities. Patches of remnant vegetation throughout the site would be retained.
- There would be no land use conflicts due to zoning.
- The proposal is not located on Strategic Agricultural Land and 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 may be used within the development site. Grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.
- Although the site is not identified in the Culcairn Flood Planning Area (GHS 2017) the site is shown to comprise flood prone land in modelling of the existing environment (WSP 2019). Minor flooding occurs adjacent to channels with an existing flood depth of less than 0.25 m.
- The proposal is not located on prospective resource developments.
- The proposal is located on Crown land, with Crown Roads (CADID 105500159 and 105271469) traversing the centre of the subject land in an east-west direction. It is intended that this Crown Road will be purchased by Landowner 2 and thereafter will not form part of the proposal.

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 aspects as key risks, and detailed investigations were subsequently undertaken in these areas:

- Visual impacts.
- Noise and vibration impacts.

- Socioeconomic and community.
- Land use and resources.
- Traffic, transport and road safety.
- Water use and quality, including groundwater.
- Biodiversity.
- Aboriginal heritage.

Visual impact

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

Three involved and 34 uninvolved residences are located within 3 km of the subject land. Four Landscape Character Units (LCU) were identified within Culcairn and surrounding areas:

- Rural (including agricultural lands).
- Residential (viewpoints near rural residents/homes).
- Industrial (major roads, electrical and other built infrastructure).
- Commercial (viewpoints from retail and administration buildings located primarily in central business districts).

An assessment of the extent of visual impact was undertaken at each residence within a 1 km radius of the subject land with landowner permission. Three public viewpoints were also assessed and included Weeamera Road, Cummings Road and Morgan's Lookout. The form of the infrastructure is not incongruous with the existing low-lying rectangular forms in this agricultural area.

The operational visual impact assessment was undertaken considering:

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

Three receivers were assessed to have a high visual impact from their residences, which are located directly adjacent to the south-eastern boundary of the proposal. On-site screening as a mitigation strategy would occur where there is a view of the proposal from the respective dwelling. Off-site screening as a mitigation strategy would be discussed in consultation with the landholders where required. The mitigated impact would be low to moderate with the implementation of vegetative screening from a respective dwelling.

Two residential viewpoints and the public viewpoints from Weeamera and Cummings Road were assessed to have a medium visual impact. The Weeamera and Cummings Road viewpoints are representative locations for motorists using these two roads. On-site screening as a mitigation strategy for the intersection of these roads has been considered. Vegetative screening barriers of appropriate widths would be provided to screen proposed infrastructure from dwellings.

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited.

Some of the other onsite infrastructure may cause glare or reflections depending on the sun's angle. This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to motorists or aircraft.

The operational view of the solar farm may generate visual impact being in direct contrast with the surrounding agricultural views. The array site requires security fencing and steel dominated infrastructure. Generally, adverse visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

Noise impacts

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

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

Daytime construction noise levels were assessed for 14 neighbouring receivers. The highest predicted noise level is within the range for the Noise Management Levels (NMLs) within standard hours and complies at nine receivers for scenario 1, 11 receivers for scenario 2 and 13 receivers for scenario 3. Exceedance of the NMLs would be expected to occur for 5 receivers under scenario 1, 3 receivers under scenario 2 and 1 receivers under scenario 3. Those effects would be temporary and intermittent during the construction of the solar farm. Of those five sensitive receivers none are predicted to be Highly Noise Affected at any time.

The predicted construction road traffic noise levels satisfy the road noise policy (RNP) criteria for assessed receivers.

The predicted operational noise levels were assessed for the 14 neighbouring receivers and have been demonstrated to comply with the Project Intrusive Noise Levels (PINLs) at all residential receivers for daily operation of the solar farm and the operation of the BESS during evening and night-time hours. Exceedances occur for one receivers for operational scenario 3, maintenance vehicle activity. Exceedance of the PINLs at 8 receivers would occur during operational scenario 4, panel cleaning and grass slashing with a tractor. The effects would be temporary and intermittent as vehicles move around the site. Of the impacted receivers, none are predicted to be Highly Noise Affected at any time.

Predicted exceedances occurred at three receivers for operational scenario 5. The replacement of broken, faulty or worn equipment would occur infrequently. No sensitive receivers are considered to be ‘highly noise affected’ given that the work would occur during normal working hours and would be short-term.

A detailed maximum noise level assessment is not required as the predicted noise levels for night-time operations do not exceed the maximum noise level screening criterion of 40 dB $L_{Aeq,15min}$ and/or 52 dB L_{Amax}.

The results of the noise assessment demonstrate that construction noise levels satisfy relevant regulatory construction and operational noise levels for the majority of nearby receivers. No specific mitigation is required to comply. However, several opportunities to further minimise the noise impacts of the proposal form commitments of the proposal.

Socioeconomic and community

The Greater Hume Community Strategic Plan 2030 (Greater Hume 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 was conducted during the development of the project. Four dedicated Community Liaison Officers (two Neoen staff and two external consultants) were appointed for the project who directly engaged with members of the community, local groups, local businesses and adjacent property owners. A communications log has been maintained throughout the preparation of this EIS.

Community feedback has been sought through one community open day and direct engagement through letters, emails, phone calls and face to face meetings. A dedicated website and email address were created for the provision of information and for seeking feedback from the general public. The community open day was advertised in Greater Hume newspapers, and advertised in the Culcairn and Walla Walla newsletter. Around 70 people provided feedback forms. Concerns have been raised about the visual impact, the use of agricultural land and the impact on land value of near neighbours of the proposed development. These matters are addressed in specific sections of the EIS.

Positive socio-economic impacts from the proposal include a boost to the local and regional economy through the employment of around 500 staff during peak construction and through increased demand for accommodation, goods and services.

Potential adverse impacts include those associated with increased traffic on the roads, a change in the rural landscape and visual amenity of the area. These potential impacts are likely to be reduced during the operation and decommissioning stages of the project, with less staff and reduced traffic numbers required during these stages. As a result of ongoing consultation between the Proponent and the proposal's near neighbours, residents would be offered a one-off 'construction disruption' payment where there is potential for direct negative impacts during the construction phase, detailed further in the Neoen Community Relations Plan (Appendix C).

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

Land use impacts (including mineral resources)

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

The land is classified as Class 4 under the Land and Soil Capability Assessment Scheme (OEH 2012), which is moderate capability land with moderate to high limitations for high impact land uses. This restricts management options for regular high-impact land uses such as cropping, high intensity grazing and horticulture. Limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investments and technology. The land is used for a range of crops and pastures. It is noted that land capability in the Greater Hume LGA is currently under review with new mapping being produced. This mapping was not available at the time of the preparation of this EIS.

The development site is zoned RU1 land for primary production. The land surrounding the development site is also RU1 (Primary Production). Surrounding agricultural land consists of cropping and grazing activities. Benambra National Park is within 17 km of the site.

There are no mineral titles and no mineral applications relevant to the development site indicated in the Minview database (DPE 2018). This was confirmed by a letter from the NSW Division of Resources and Geoscience, stating there are no current mineral, coal or petroleum titles over the site or adjacent lands (Appendix C.1). It was however noted that the Boral Quarry is located approximately 1.5 km from the proposal.

A land use conflict risk assessment was undertaken to consider potential conflicts between the solar farm and surrounding land uses. Potential construction conflicts such as the impacts of contaminated surface water runoff, fire/bush fire, traffic generation, dust and visual amenity had moderate to high risk rankings.

These potential conflicts have been addressed with appropriate management strategies 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.

Traffic, transport and road safety

Construction vehicle access to the site would be located on Weeamera Road via the Olympic Highway and Benambra Roads. Benambra Road and the southern section of Weeamera Road are sealed and capable of carrying additional heavy vehicles, as they currently service the Boral Quarry. The 1.4 km section of Weeamera Road, between the Boral Quarry turn and the access location, would be upgraded to a 6 m sealed width to allow capacity for heavy vehicle use. Access to the northern section of the site would be via two directly opposite access points across Cummings Road.

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

Internal access tracks would remain unsealed but would be re-sheeted with gravel or crushed and compacted soil, to maintain their condition during the construction phase.

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby receivers.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by ‘platooning’ of construction traffic.

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 (about 30-year period). Up to ten traffic movements per day would be expected during normal operation of the proposal. 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.

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

Water use and water quality (surface and groundwater) and hydrology

Two watercourses run along the boundary of the development site, Billabong Creek to the north and Back Creek to the west. One ephemeral drainage line flows east-west through the northern section of the development site and is a tributary of Billabong Creek. Two unnamed ephemeral drainage lines run east-west through the centre and south of the development site and are tributaries of Back Creek. Billabong Creek holds water and/or is generally flowing all year round. Back Creek and the small unnamed drainages are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted and remnant native vegetation. There are 20 farm dams within the subject land.

The 20 farm dams all contained water at the time of the site survey. Six of these dams are in close proximity to remnant native vegetation including tall hollow bearing trees. These six dams are outside the development footprint. The remaining 14 dams located in the development footprint would be retained.

The development site is not identified as flood prone land under the Greater Hume LEP. However, the Billabong Creek system has recorded major floods, with the largest recorded flood in July 1931. The system is subject to the Billabong Creek Floodplain Management Plan 2006 (DNR 2006). The development site is outside of the critical flow distribution areas detailed within the management plan.

There are nine groundwater bores located within the development footprint, which access the Billabong Creek Alluvial Groundwater Source.

Moderate potential for aquatic Groundwater Dependant Ecosystems (GDE) is shown along Billabong Creek north of the proposal, with low to high potential for terrestrial GDE across the site. Most of these areas are located within proposed retained vegetation. As such, there is a low potential for groundwater to be encountered during excavations and earthwork for the construction. This is likely to be highly localised and no inception of groundwater is considered.

It is intended that water during construction would be sourced from standpipes operated by Greater Hume Shire Council and/or the Boral Quarry located near the proposed site (the Proponent is in discussions with both the Council and Boral). The anticipated amount of non-potable water required during construction is around 62 ML. This water is predominantly used for dust control. Around 2.5 ML of potable water would be required during construction.

During operation, around 1 ML of water annually for panel washing and other maintenance activities would similarly be sourced from the available standpipes. It is expected 54 kL of potable water would be required each year.

Increases in impervious areas and cessation of grazing during the operation of the proposal would result in small reductions in peak discharge at most site discharge locations. The decrease in peak discharge would be accompanied by increased flood depth in the order of 5 cm. A maximum increase in flood height of 13 cm could occur in the southern section of the development site during the probable maximum flood (PMF).

The proposal would not directly affect the surface water quality. Indirectly, the proposed works would involve a range of activities that could disturb soils. This could potentially lead to erosion and sediment laden runoff. This could impact surface water quality in local waterways during rainfall events. The impacts are considered low for this project.

No construction or operational activities would affect the groundwater. It is considered that this project would have negligible impact on groundwater.

Biodiversity (flora and fauna)

NGH prepared a Biodiversity Development Assessment Report (BDAR) to investigate and assess the potential impacts of the proposal on biodiversity. The development site is located in the Lower Slopes subregion of the NSW South West Slopes Bioregion. Cleared and highly modified agricultural land occupies about 72% of the development site. Five Plant Community Types (PCTs) were identified in the development site:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.
- PCT 74 – Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 249 –River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.
- PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.
- Patches of derived grassland communities associated with the above PCTs were also identified in low condition throughout the site.

Twenty candidate threatened species required survey. Two were excluded based on habitat and geographic restrictions (Large-eared Pied Bat and Pink-tailed Legless Lizard). Two threatened species were detected within the development site during the survey periods, Superb Parrot and Brown Treecreeper. Three species were unable to be surveyed during the recommended survey window and these species were assumed to be present on site:

- Small Scurf-pea.
- Silky Swainson-pea.
- Small Purple-pea.

Two threatened species listed under the EPBC Act were considered likely to occur in the development site, although none were recorded during the field surveys. Assessments of significance were completed for these species. These concluded that a significant impact was unlikely. No referral is considered necessary to the Australian Government's Department of Environment.

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

- Ecosystem credits – 104 Ecosystem credits were generated from the removal of 0.61 ha of native vegetation and 99 paddock trees.
- Species credits – 30 species credits were generated from impacts to 3 threatened species.

Potential direct and indirect impacts to biodiversity values of the site could result from the proposal and have been considered. A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction phase are avoided where possible and minimised where they cannot be avoided.

Aboriginal heritage

NGH prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The assessment was undertaken in consultation with Aboriginal stakeholders.

The Culcairn region is in an area identified as part of the Wiradjuri language group. The proposal area is within the NSW portion of the Murray-Darling Basin. The topography of the Culcairn region is comprised of extensive flat alluvial plains with floodplains along Back Creek and Billabong Creek. Billabong Creek runs along the northern boundary of the proposal area and Back Creek runs along the western boundary. The Culcairn Solar Farm proposal area is bordered to the north by Billabong Creek and to the west by Back Creek, which also runs through the southern-most paddock within the proposal area. Three unnamed ephemeral drainage lines also run east-west through the centre of the proposal area.

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

A series of pedestrian survey transects were undertaken across the proposal area. The survey was undertaken by three archaeologists from NGH with representatives of the Aboriginal community. Following the initial site survey, subsurface testing was undertaken of the potential archaeological deposit (PAD) areas identified within the development site.

Despite the variable visibility encountered during the survey a total of 26 isolated finds, 16 artefact scatters, 5 cultural tree sites, 3 modified trees and a single cultural stone site were recorded. Several areas of PAD were also identified adjacent to Back Creek, Billabong Creek and a paleochannel. Of the 68 test pits excavated only 13 contained stone artefacts.

It has been noted above that historically the Culcairn Solar Farm proposal area has been impacted through land use practices and in particular clearing, ploughing and grazing. The implications for this activity are that the archaeological record has been compromised in terms of the potential for scarred trees to remain outside the areas of remnant vegetation. The implication for stone artefacts is that they may have been damaged or moved but they are likely to be present and remain in the general area they were discarded by Aboriginal people. Despite these impacts, Aboriginal artefacts and cultural material remain in the area, indicating the presence of past Aboriginal people and providing indications of their use of this landscape.

The assessment concluded that it is possible that additional *in situ* stone artefacts could occur within the proposed development footprint.

Direct impacts are likely to be most extensive where earthworks occur such as the installation of cabling and the transmission line poles, which may involve the removal, breakage or displacement of artefacts. This is considered a direct impact on the sites and the Aboriginal objects by the development in its present form. However, the modified trees would not be impacted by the development.

Overall the impact to Aboriginal cultural heritage has been assessed to be low. An Unexpected Finds Protocol (UFP) would be prepared and followed should there be an inadvertent 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 at the development site is generally expected to be good. Existing sources of air pollution at the site include vehicle emissions, dust from surrounding unsealed roads, and agricultural activities.

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

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

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

Historical heritage

In the Greater Hume Local Government Area there are no listed items on the Commonwealth Heritage List, four listed items on the NSW State Heritage Register and 15 listed items/places on the NSW State Agency Heritage Register. There are 172 listed items/places in the *Greater Hume Local Environment Plan (LEP) 2012*. The closest listed heritage items are in the township of Culcairn at least 3 km north-east of the proposal.

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

Soil

DM McMahon Pty Ltd prepared a soil report to provide an assessment of the existing landforms, and the soil types and characteristics of the proposed development site. This was intended to confirm land capability and characteristics that may affect design, construction or rehabilitation of disturbed soils. It included a desktop and field study for the development site.

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

Three eSPADE soil profiles (eSpade v.02) occur within the subject land. These record Mottled Brown and Red Dermosols, and Yellow Sodosols with no salting evident.

The proposed activities for the construction, operation and decommissioning stages of the solar farm have the potential to increase soil erosion during rainfall events. Proposed activities could lead to the removal of vegetation and groundcover, increased compacted surfaces and decreased permeability.

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

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

These potential impacts have been addressed with specific mitigation measures. Overall, the risk of erosion impacts resulting in soil loss are considered low during construction, operation and decommissioning.

Hazards

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. The guidelines require goods to be classified according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). A development which exceeds the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. The proposed battery storage on site would exceed the screening threshold of 30 MW, therefore a PHA has been prepared.

The PHA assessed the risks associated with the BESS using a literature review of similar BESS systems, design advice from Neoen and a review of solar battery equipment failures and outcomes. Consequence events considered included: bush or scrub fire, battery leakage, battery failure / fire and potential acid gas release and transformer failure. Risk events from the BESS would pose onsite impacts only and are assessed as low – medium and manageable. Of the eight key risks associated with the BESS infrastructure, seven are considered medium risks and would require monitoring, and one was a low risk event. The PHA concluded that the proposal meets the NSW DPIE land use planning criteria.

The development site is undulating to flat. Limited native vegetation remains in and around the site as native remnant patches and scattered paddock trees. Remnant roadside native vegetation is minimal to the south of the site along Cummings Road, which runs east-west through the development site. The paddocks adjacent to the riparian vegetation along Back Creek and Billabong Creek are generally classified as bushfire prone land.

Specific construction and operational activities can cause or increase the risk of bush fire. Considering the low vegetation cover as a fuel source over the development site, mitigation measures and other factors, it is considered unlikely that construction of the solar farm would pose a significant uncontainable bush fire risk. The bush fire hazard associated with the activities listed above is considered highly manageable.

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

Resource use and waste generation

The Proponent is a committed project custodian and will establish circular procurement initiatives with its supply partners to ensure that best practices in recycling and waste management are followed throughout the life of the project. This is particularly the case for solar PV and battery modules, done in partnership with the original manufacturers and where possible, local recycling agencies.

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

Recyclable materials are expected to constitute a large proportion of the waste generated, including timber pallets used to transport the solar panel modules. Components such as batteries and solar panels will be recycled (typically by the manufacturer) when they reach the end of their operational life.

Waste would be produced during the construction and decommissioning stages. During operation, waste materials would be fuels, lubricants and metals. Items that cannot be reused or recycled would be disposed of in accordance with the POEO Act.

All waste will be disposed of at appropriately licensed facilities, in accordance with legislative requirements. Unused or excess chemicals and material will be removed and disposed of correctly, in accordance with safety data sheets (SDS) and waste disposal guidelines.

Licensed waste transporters will be used to collect and dispose of waste, and waste tracking forms and receipts will be used in accordance with legislative requirements. No substantive impact for any of these aspects is expected from the project. 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.

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 six Major Projects listed on the Major Projects Register within the Greater Hume LGA including:

- Glenellen Solar Farm – Prepare EIS.
- Jindera Solar Farm – Prepare EIS.
- Culcairn Solar Farm – Prepare EIS.
- Culcairn Solar Farm – Withdrawn.
- Walla Walla Solar Farm – Prepare EIS.
- Rockley Falls Quarry – Determination.

Cumulative impacts may have a minor impact to SSD proposals occurring within the LGA. Mechanisms to consult with local industry would assist to manage cumulative impacts should additional developments become relevant to the proposal. Of the SSD project list above, one project is in proximity to the proposal. The proposed Walla Walla Solar Farm is approximately 2 km south of the proposal and if both were approved, construction periods could be concurrent.

Cumulative impacts with the proposed Walla Walla Solar Farm have been assessed in this EIS, particularly for construction and operation noise, visual impacts and traffic impacts. For noise impacts, there is one sensitive receiver within 1 km of both proposed solar farms. There are no exceedances for cumulative construction or operation noise impacts at this receiver. For visual impact, there is one sensitive receiver where broken views of solar farm infrastructure of both proposals would be visible. Traffic impacts are considered unlikely and would be short-term if both proposals are approved and construction times are concurrent. Ongoing consultation with the developers and Boral Quarry staff would ensure traffic impacts along Benambra Road are minimal.

The cumulative impacts identified for the proposal are considered to be best managed by dealing with each component individually, noting that the probability of all potential projects proceeding is considered unlikely.

MANAGEMENT OF IMPACTS

The solar farm has been designed to avoid environmental impacts, including:

- Avoidance of the majority of native vegetation, including threatened biota.
- Avoidance of known Aboriginal heritage items where possible.
- Incorporation of screening and landscaping elements to reduce visual impact.
- Selection of technologies that minimise noise and vibration outputs.

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

- A range of management measures to minimise risk of potential bushfire events.

- Traffic management measures during construction.
- A range of standard construction mitigation measures to minimise dust, soil erosion, waste and noise impacts.
- Protocols in place for managing Aboriginal heritage and biodiversity.
- All stages of the development would be designed and operated in accordance with Australian Standards to minimise any risks to the health and safety of the public and employees.

CONCLUSION

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

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

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

1 INTRODUCTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

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

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; and_
- _certification that the information provided is accurate at the date of preparation._

The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The EIS should fully describe the proposal, the existing environment and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data. The assessment must include all ancillary infrastructure associated with the project and Rural Fire Service requirements for asset protection.

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed 350 MW AC / 402.5 MW DC Culcairn Solar Farm SSD-10288 ('the proposal'). NGH Pty Ltd has prepared this EIS on behalf of Neoen Australia Pty Ltd (the 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 79C of the EP&A Act. It is considered State Significant Development (SSD). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPIE on 3 May 2019 (Appendix A).

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

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

1.2 PROJECT OVERVIEW

1.2.1 The Proponent

Neoen (the Proponent) is a French company specialising in renewable energy production, with more than 2.8 gigawatt (GW) of renewable energy already operating or under construction. They have developed renewable energy projects, including solar farms, wind farms and Battery Energy Storage Systems, in thirteen countries including France, Australia, El Salvador, Zambia, Portugal, Argentina, Jamaica, and Finland. The company has many years of experience in developing, building and operating solar power projects. Solar projects that the company has developed and built in Australia include:

- Coleambally Solar Farm.
- Griffith Solar farm.
- Parkes Solar Farm.
- Numurkah Solar Farm.
- Dubbo Solar farm.

1.2.2 Development site location

The proposal is located within the Greater Hume Local Government Area (LGA), approximately 4 km south-west of the township of Culcairn. The subject land comprises of the following lots (Figure 1-2):

- Lots 70-73, 86 DP 753764.
- Lots 9-11, 45-47, 53, 54 DP 753735.
- Lot 1 DP 179854.
- Lot 114 DP 664997.
- Lot 1 DP 575478.
- Lot 1 DP 171815.
- Lot 1 DP 945904.
- Lot B DP 972054.

The development site is agricultural land comprising several large paddocks that are generally flat and largely cleared and cultivated primarily for cropping. Native vegetation remains in the form of scattered paddock trees, roadside vegetation, riparian vegetation, and small isolated patches of remnant woodland. Five watercourses run through or along the boundary of the development site, Billabong Creek to the north, Back Creek to the west, and three unnamed ephemeral drainage lines flowing east-west through the development site. Billabong Creek holds water and/or is generally flowing all year round. Back Creek and the small unnamed drainage lines are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by planted and remnant native vegetation.

The proposal is bound by Walbundrie Road (north), Weeamera Road (east), Cummings Road (west), and Benambra Road (south). The site is intersected by Cummings Road, Schoff's Lane, and an unnamed lane (north / south) through the centre of the site.

The Locality

The proposal is located within the Greater Hume LGA, located in southern New South Wales between the major regional centres of Albury and Wagga Wagga. The shire has several small towns including Culcairn, Henty, Holbrook, Jindera and Walla Walla, and the smaller villages of Brocklesby, Burrumbuttock, Gerogery, Gerogery West, Morven, Walbundrie, and Woomargama. The LGA is 5 746 km^2 with a population of 10 351 as at the 2016 Census (ABS 2019).

Major centres and/or towns in the area (horizontal distance from development site) that provide services include:

- Walla Walla – 3.7 km south-west.
- Culcairn – 4 km north-east.
- Henty – 17.2 km north.
- Jindera – 25.9 km south.
- Holbrook – 29.2 km east.
- Albury – 38.3 km south.
- Lockhart – 54.8 km north-west.
- Wagga Wagga – 68.5 km north-east.

1.2.3 Key components of the proposal

The development footprint would occupy around 1125 hectares (ha) of the 1351 ha subject land. One hectare (1 ha) of the development footprint is located outside the subject land, along the section of Weeamera Road that requires upgrade. The development site is around 1317 ha inclusive of the road upgrade along Weeamera Road. This will be refined during detailed design, when the location of solar panels, site infrastructure and access tracks will be optimised. The proposal would involve the construction of a ground-mounted photovoltaic (PV) solar array generating around 350 MW AC / 402.5 MW DC of renewable energy and would connect into an existing 330 kV TransGrid transmission line that traverses the proposal. The power generated would be exported to the national electricity grid.

Key development and infrastructure components would include:

- Single axis tracker PV solar panels mounted on steel frames over most of the site (maximum tilt 4.2m in height).
- Battery storage to store energy produced on site (up to 100 MW / 200 MWh capacity).
- Underground and overground electrical conduits and cabling to connect the arrays to the inverters and transformers.
- Systems of invertor units and voltage step-up throughout the arrays.
- NEM compliant metering arrangements for all energy exported to the grid as well as internal metering to measure battery and solar output.
- On site substation, connecting to the existing 330 kV TransGrid transmission line.
- Site office and maintenance building, vehicle parking areas, material laydown area, internal access tracks and perimeter security fencing.
- Site access track off Weeamera Road.
- Road crossing and easement electrical crossing through underground and/or overhead lines, of Cummings Road and Schoff's Lane.
- Vegetative screening at impacted visual receivers and at the intersection of public roads.

The proposed infrastructure map (Figure 1-3) illustrates the indicative layout, including a concept development footprint for the solar arrays noting that not all the area will contain infrastructure). Detailed design would allow for avoidance of sensitive features on the site. Within this envelope, there are several areas that have been prioritised for avoidance from blocks of solar panels, due to areas that represent higher quality fauna habitats. A native vegetation buffer would be established post-construction to minimise visual impacts in specific locations.

In total, the construction phase of the proposal is expected to take 16 to 18 months, and the facility would be expected to operate for around 30 years. Five to ten full time equivalent staff would operate the facility and include operations and maintenance staff, and up to six service contractors. At the end of its operational life, the facility would be decommissioned. All above ground infrastructure and below ground infrastructure would be removed in consultation with the landowner, and the site returned to its existing land capability.

1.2.4 Capital investment

The proposal would have a capital investment of approximately $636.6 million (Appendix N).

1.2.5 Land ownership

The subject land is owned by three title holders:

Table 1-1 Land ownership

Property Description	Landowner
Lot 9 – 11 DP 753735, Lot 1 DP 179854, Lot 114 DP 664997	1
Lot 45 – 47, 53, 54, 73, 86 DP 753735, Lot 1 DP 171815, Lot 1 DP 575478, Lot B DP 972054, Lot 1 DP 945940	2
Lot 70 – 72 DP 753735	3

The use of the site would be based on a lease agreement between the Proponent and the landowners. The Proponent has signed an Option Deed with the landowners 2 and 3 to lease the land for the purpose of a solar farm. The land of landowner 1 would be purchased for the purpose of a solar farm.

Schoff's Lane, a Crown Road, (CADID 105500159 and 105271469) is in the process of being purchased by Landowner 2. The purchase and transfer of the Crown Roads has not been finalised, with no Lot or Deposited Plan (DP) number assigned yet.

Landowner consents for the proposal are provided in Appendix D.

In order to link the different freehold properties that comprise the proposed development site, the Proponent will need to have the agreement to lay-down underground Medium Voltage cables across an unused Crown Road (Schoff's Lane). The Proponent has been advised by Crown Land that consent can be granted once a copy of the final EIS has been provided.

1.2.6 Development history

An Informal Access Application under the *Government Information Public Access Act 2009* was submitted to Greater Hume Shire Council on 15 October 2019. It was determined that no development applications are recorded or have been approved within the proposal area since the creation of the Greater Hume Shire in 2004 (Appendix C.1).

A search for State Significant Development on the Major Projects website (accessed 15 October 2019) of Greater Hume LGA did not indicate any Development Applications on the affected lots (subject land).

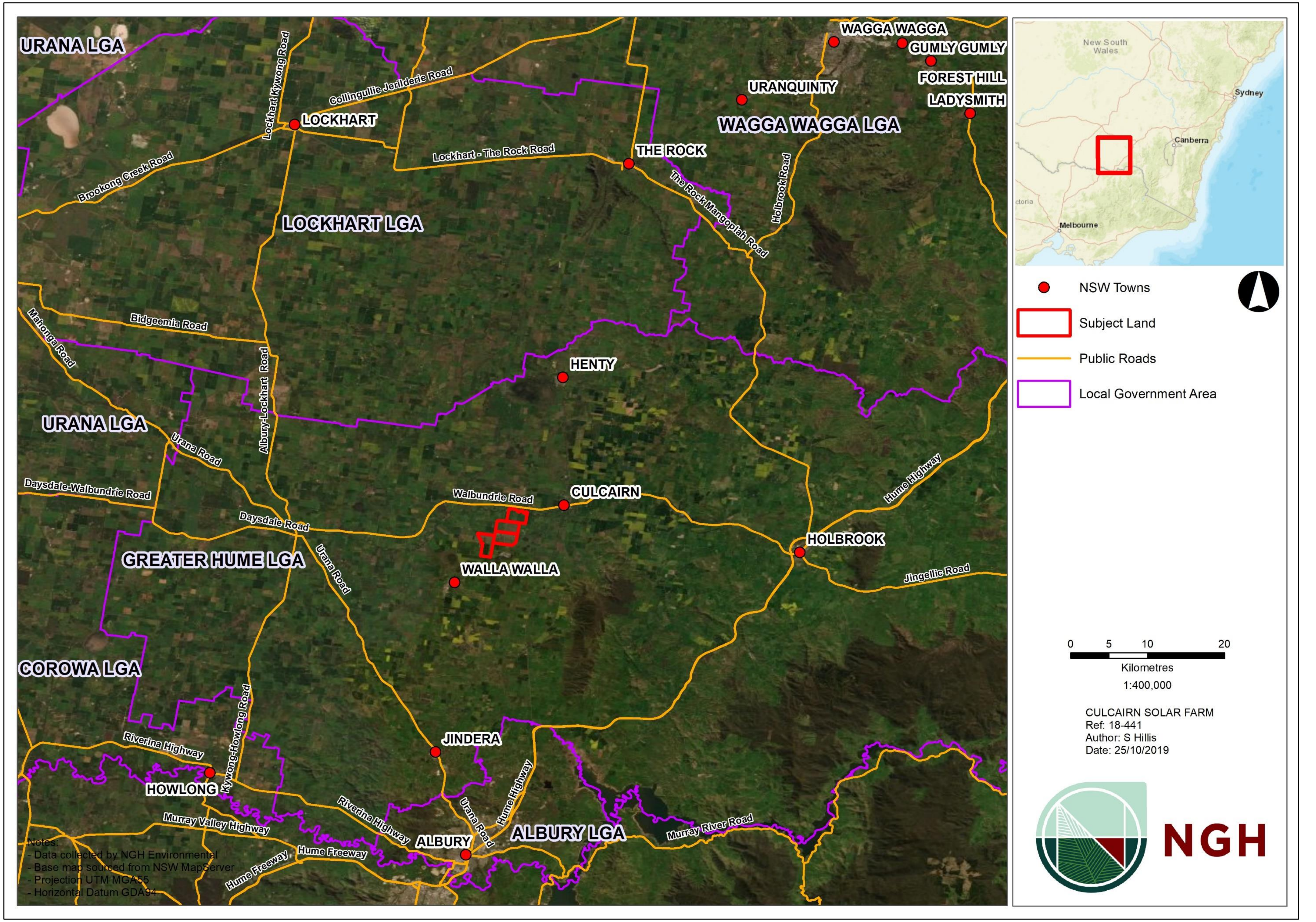

Figure 1-1 General location of the subject land

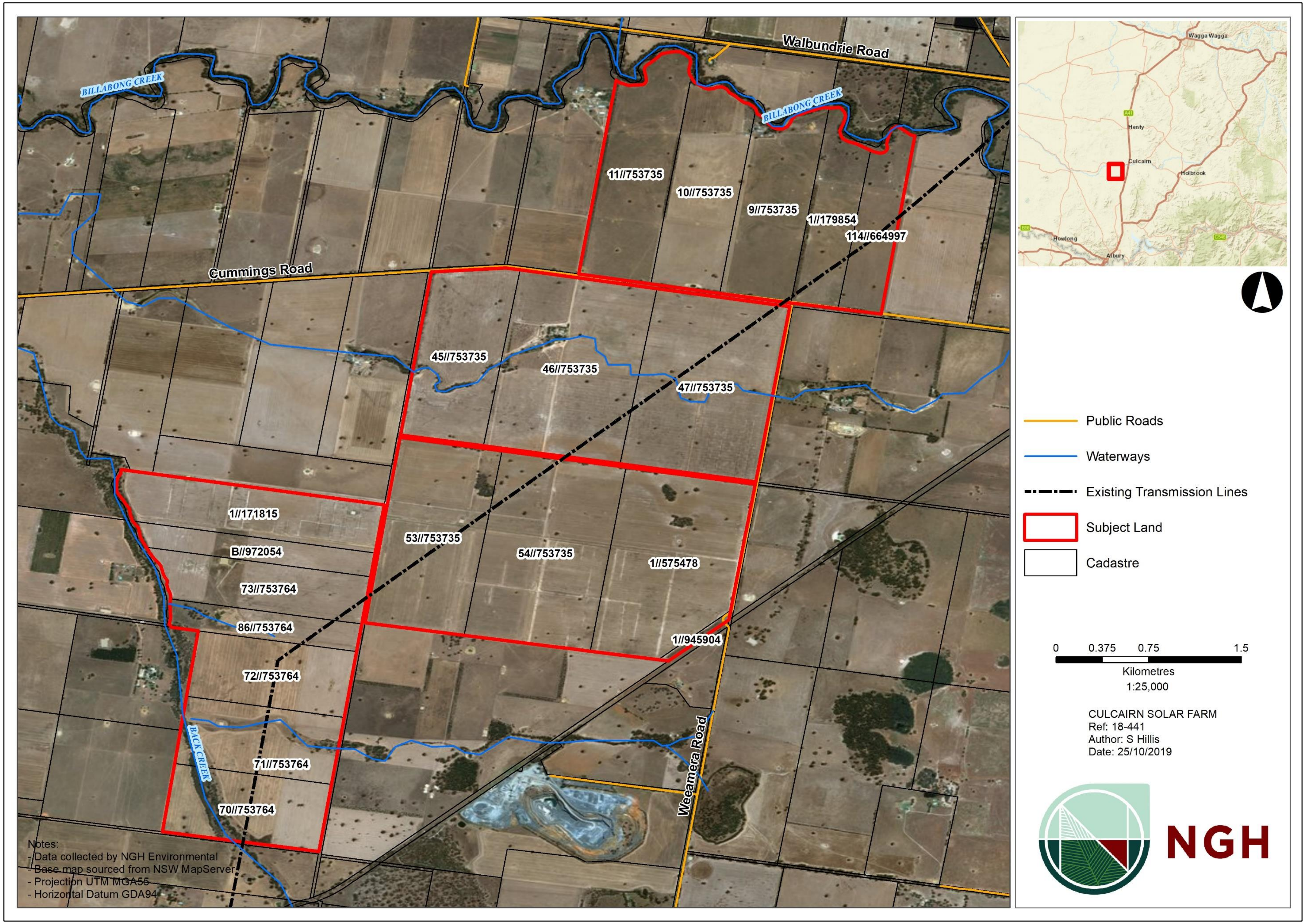

Figure 1-2 Subject land

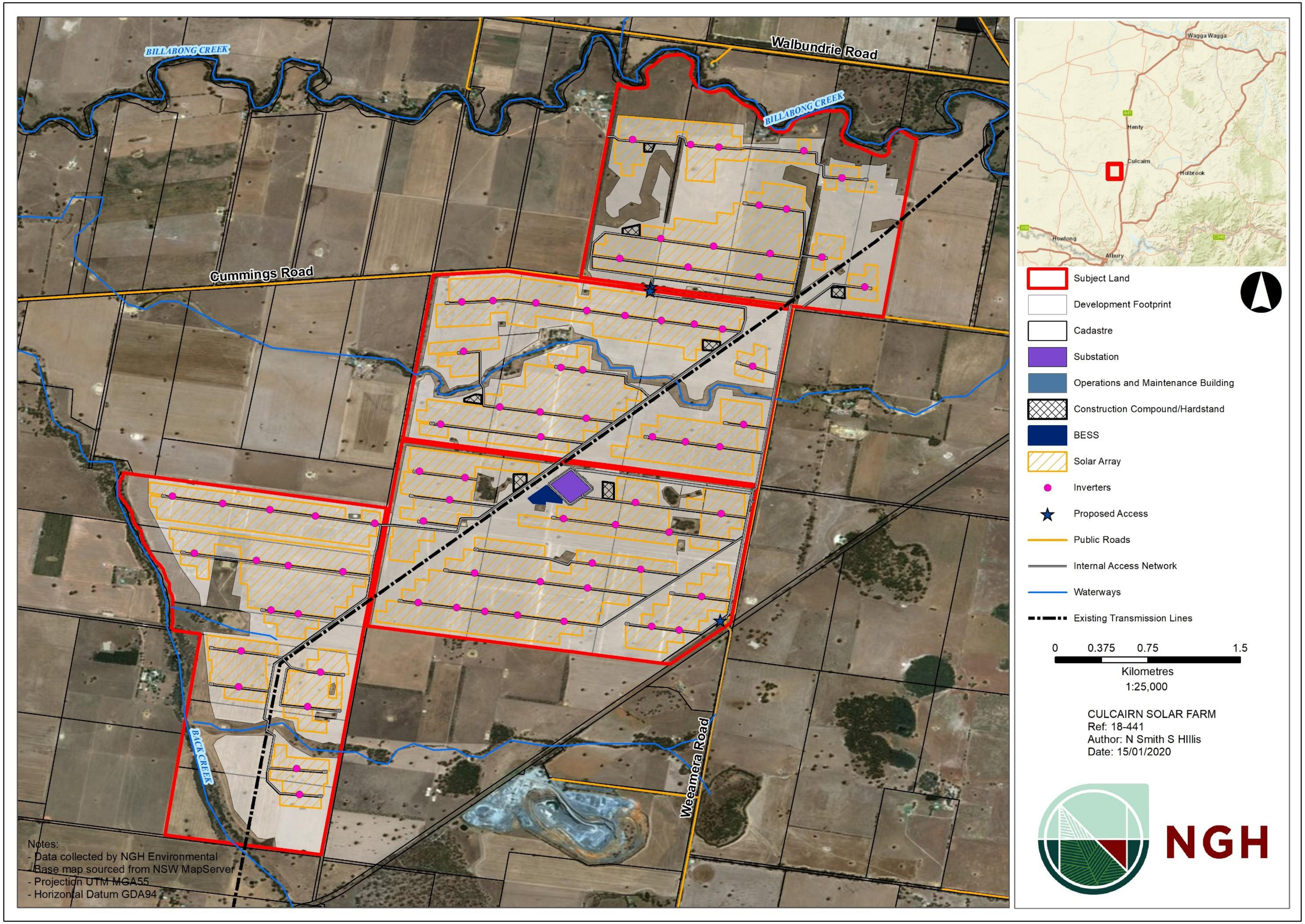

Figure 1-3 Proposed layout.

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 contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter.*
- *The reasons why the development should be approved having regard to:*
  - *The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and*
  - *Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.*

2.1 STRATEGIC NEED

2.1.1 Global warming

Human activity is resulting in the release of large amounts of greenhouse gases (GHGs) which trap the sun's heat in our atmosphere and alter the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the United Nations Paris Agreement on Climate Change (DEE 2017). Federally, Australia has committed to reducing its emissions to 5% below 2000 levels by 2020, and 26-28% below 2005 levels by 2030 (DEE 2017).

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia, representing 35 per cent of emissions (DoEE 2018). The transition to low carbon renewable energy sources would be critical to enable Australia to meet its Paris commitments.

In terms of renewable energy technologies, solar projects have the capacity to provide faster results in reducing greenhouse gas emissions than other options because of shorter potential construction and commissioning times (CER 2017). Rapidly improving technology in this sector is also seeing the improved performance of solar energy projects.

2.1.2 National renewable energy targets

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

There have been a number of government policies in place in Australia influencing the development of renewable energy. In 2001, the Commonwealth Government introduced the Mandatory Renewable Energy Target (MRET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The initial MRET was for Australian to provide 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 Large-scale Renewable Energy Target (LRET) components to ensure that adequate incentives were provided for large scale grid connected renewable energy. The LRET aims to create a financial incentive for the establishment and growth of renewable energy power stations, such as wind and solar farms, or hydro-electric power stations through the creation of large-scale generation certificates.

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

2.1.3 Finkel Report

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

2.1.4 NSW Renewable Energy Action Plan

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

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

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

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

Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors. Storage allows renewable energy investors to increase revenue by selling power at times of peak market prices as opposed to when the electricity is generated. This in turn places downward pressure on electricity prices by encouraging more supply at times of peak demand and reducing the need for additional distribution and transmission infrastructure.

Storage technology (including rechargeable batteries and thermal energy storage) is a global market, with many other countries currently grappling with ways to integrate increasing amounts of renewable energy into their networks. NSW can leverage off the work being done overseas as well as develop storage expertise within NSW to create a long-term export industry.

2.1.5 State and Federal support for renewable energy

At present, Australia has one of the world's highest GHG emissions per unit of electricity produced 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 level by grant programs from the Australian Renewable Energy Agency (ARENA), and financing programs from the Clean Energy Finance Corporation.

2.1.6 Climate Change Fund Draft Strategic Plan 2017 to 2022

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

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

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

The advanced energy priority 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

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

A commitment is made to:

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

Specific initiatives under this target that directly support building solar power plants 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 - life cycle analysis and benefits of solar technology

Lifecycle analysis can be used to consider the emissions produced during the manufacture, construction, operation and decommissioning of, in this case, electricity generation technologies. When compared with existing conventional fossil-fuel based electricity generation, solar PV technology generates far less lifecycle GHG emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al* 2008, 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 photovoltaic modules emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources.

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

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

2.1.9 Electricity supply

The Australian Energy Market Operator (AEMO 2016) forecasts that grid-supplied electricity consumption will remain flat for the next 20 years, despite projected 30% growth in population. Although not required to meet projected electricity demand, the proposal would benefit the network by shifting electricity production closer to local consumption and regulating inputs to the grid using an Energy Storage Facility.

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

2.2 PROPOSAL BENEFITS

2.2.1 Broad benefits

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

- Reduced GHG emissions, assisting the transition towards cleaner electricity generation.
- Provision of a renewable energy supply that would assist the Australian and NSW Governments to reach Australia's LRET and other energy and carbon mitigation goals.
- Embed electricity generation supply into the Australian grid closer to identified consumption centres.
- Diversification of land use and economic activity in regional NSW.

Specifically, the proposal would:

- Generate approximately 800,000 MWh of renewable electricity per year.
- Establish regional leadership capabilities and expertise in a new high skilled industry
- Create significant employment opportunities for tradespeople and apprenticeships
- Supply enough power each year to service approximately 189,800 households (assuming average household consumption of 4,215 kWh p.a.).
- Save around 267,000 tonnes of carbon dioxide (CO_2) per year, assuming generation would otherwise use brown coal with a carbon factor of 0.33372 tonnes per MWh (DOEE 2017).
- A solar energy facility that displaces 267,000 tonnes of CO_2 per annum is the equivalent of taking about 117,700 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 2.268 tonnes of CO_2 emissions per car per year) (DIT 2011).

2.2.2 Electricity reliability and security benefits

The Proposal would enhance electricity reliability and security.

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life. Nine coal-fired power stations have closed since 2011-2012, representing around 3,600 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 strong transmission network in the region and the declining cost of solar power over the last decade, the proposal is an important source of new power generation.

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

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

2.2.3 Downward pressure on electricity prices

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

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

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

2.2.4 Local benefits

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

- Direct and indirect employment opportunities during construction and operation of the solar farm. This includes up to 500 employees at the peak of construction (up to 12 months) and five to ten operational staff for the life of the project.
- The proposal would provide significant participation opportunities for businesses and workers located in the area.
- Direct business volume benefits for local services, materials, and contracting (e.g. accommodation, food and other retail).
- Assistance in meeting the future national electricity demands.
- Council rates revenue associated with the solar farm would be subject to negotiations between Greater Hume Shire Council and the Proponent.
- Introduce additional sources of employment and income to the region.
- Increase tourism opportunities, with visitors accessing the observation platform and information facility at site.

Additionally, the proposal would address the environmental constraints of the site appropriately. It would be designed to:

- Preserve biodiversity features through minimising tree and vegetation community removal.
- Preserve Aboriginal cultural heritage through maintaining important features.
- Minimise impacts to soil and water, through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Minimise visual impacts to neighbours, incorporating vegetation screens located in consultation with neighbours, where required.
- Preserve agricultural production values, being highly reversible at the end of the project's life and utilising the area for grazing for the lifetime of the project (Appendix P).

2.3 PROPOSAL OBJECTIVES

The objectives of the proposal are to:

- Select and develop a site which is suitable for commercial scale solar electricity generation.
- Assist the NSW and Australian Governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals.
- Develop the project in a manner which is acceptable to the local community.
- Provide local and regional employment opportunities and other social benefits during all stages of the project.
- Provide a clean and renewable energy source to assist in reducing GHG emissions.
- Avoid and minimise environmental and cultural impacts wherever practicable through careful design and best practice environmental protection and impact mitigation.
- Provide electricity generation close to an identified consumption centre.

2.4 ALTERNATIVES CONSIDERED

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

2.4.1 The 'do nothing' option

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

- Opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- A renewable energy supply that would assist in reaching the LRET.
- Additional electricity generation and supply into the Australian grid.
- Social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.

Doing nothing would avoid the environmental impacts associated with the development of the proposed solar farm, which include vegetation impacts, construction noise, traffic and dust, visual impacts and a temporary reduction in agricultural production at the site.

These impacts are considered to be manageable, however and would not result in a significant impact to the environment. Given the benefits of the proposal, the do-nothing option is not considered to be a preferred option. Considering the benefits of the proposal and the low level of environmental impact (assessed within this EIS), the proposal is considered to be ecologically sustainable and justifiable.

2.4.2 Technology alternatives

Generation technology

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

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site.

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

Energy storage technology

There are several alternative technologies that could be used for the proposed battery storage unit (BSU). Battery technology was selected over mechanical or physical storage methods (flywheel, pumped hydro, liquid air, compressed air) or thermal storage (such as hot water or molten salt) because it enables modular installation without major infrastructure or specialised landform features. Batteries generally have lower weight and physical volume and better scalability compared to other technologies. Disadvantages of batteries include their relatively limited life, some batteries are made from hazardous materials, and their sensitivity to climatic conditions (Finkel *et al.,* 2016). In the project design, the Proponent will integrate the battery cells within a climate-controlled energy storage system that is designed to maintain conditions that are optimal to the cell’s performance and thus mitigate the risk of climatic conditions.

The sealed lithium-ion battery (LIB) is currently the preferred technology for storing energy generated from wind and solar sources (Nova, Academy of Science 2017), and is likely to dominate battery chemistry for the next 20 years (Randell Environmental Consulting 2016). The shift to LIB is because of their greater energy density (which means they are smaller and lighter), expected longer life spans and ability to undergo deeper discharges, reducing the capacity required (Helen Lewis Research 2016). LIB have a very long lifetime compared to other battery technologies, with 5,000 or more charge cycles (Finkel *et al.* 2016).

Alternative battery technologies include lead acid and relatively new technologies such as hydrogen, molten-state, sodium-ion, flow (vanadium redox, hydrogen bromide or zinc bromide) and saltwater batteries. Many of the competing technologies are either still in technical or commercial development, environmentally unfriendly or offer low energy and power density compared to LIB.

LIB technology is established and proven, compact, lightweight, highly efficient, very high energy density, economically attractive, commercially available and easily installed with low maintenance requirements.

2.4.3 Alternative site locations

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

- Low environmental constraints (predominantly cleared cropping and grazing land).
- Level terrain for cost effective construction.
- High quality solar resource.

- Compatible land use zoning (on the development site and considering adjacent land holdings).
- Existing road access.
- Onsite connection to the transmission network.
- High levels of available capacity on the grid transmission system.
- Land availability and support from the landowner.

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

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

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

Available grid capacity at a suitable voltage on the existing TransGrid Jindera to Wagga Wagga 330 kV transmission line west of the site was also instrumental in making Culcairn an ideal choice for a renewable energy development.

2.4.4 Alternative site access

Initial site access was proposed via the Olympic Highway and Cummings Road. However, consultation between Amber Traffic and Transport Direction and NSW Roads and Maritime Services (RMS) was ongoing and provided justification in changing the initial access route to the current proposed access via Olympic Highway, Benambra Road and Weeamera Road. RMS suggested that the angle of turning movements from the Olympic Highway to Cummings Road was unsuitable and that the recent upgrades to the intersection of the Olympic Highway and Benambra Roads was the preferred option. The proposed access was confirmed with Greater Hume Council through ongoing consultation. Consultation regarding the proposed access routes in described in section 5.1.

Benambra Road, and the first 2 km of Weeamera Road from the intersection with Benambra Road, are sealed and capable of carrying heavy vehicle traffic as a result of heavy vehicle access required for Hurricane Hill, the Boral Quarry located approximately 1 km south of the proposal. The remaining 1.4 km of Weeamera Road from the intersection with the turn off for Hurricane Hill to the proposed access would require upgrading from an unsealed section of road to a sealed and slighter wider section of road. Requirements for the upgrade are provided in section 6.6.

2.4.5 Scale of the proposal

The scale of the proposal has been influenced by:

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

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

2.4.6 Grid connection and capacity

As part of the site selection process, the Proponent has consulted with TransGrid and has lodged a Connection Enquiry to confirm the feasibility for a 350 MW AC project. On-going modelling from TransGrid, AEMO and the Proponent is done to make sure the proposal respects the Grid code / requirements. The Proponent has a Connection Process Agreement in place with TransGrid. The agreement drives the relationship in the connection study phase and connection package review phase. This would lead to a connection agreement.

2.5 SITE SUITABILITY AND JUSTIFICATION

The proposal would meet the proposal objectives, principally the development of a utility scale solar electricity power station. It is justified in terms of reducing Australia's GHG emissions and meeting future energy demands. It would contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. Finally, it would contribute to economic development in Culcairn, Walla Walla and the surrounding region.

Key considerations for site selection are detailed within the *NSW Large-scale Solar Energy Guideline for State Significant Development* (DPE 2018). The key site constraints with justification as to why the site is suitable are detailed in Table 2-1 below:

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

Areas of constraint	Site justification
Visibility and topography - Sites with high visibility, such as those on prominent or high ground positions, or sites which are located in a valley with residences with elevated views looking towards the site. This is particularly important in the context of significant scenic, historic or cultural landscapes.	The site does not have high visibility, is not in a prominent location or on high ground, or within a valley with residences with an elevated view. One resident to the south-west has a broken elevated view of the proposed infrastructure in the southern section of the site. The area is generally flat, with little to no variation in height. It is also proposed to screen the proposal with a mixture of native vegetation.
Biodiversity - Areas of native vegetation or habitat of threatened species or ecological communities within and adjacent to the site, including native forests, rainforests, woodlands, wetlands, heathlands, shrublands, grasslands and geological features.	The design of the proposal is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the proposal have become available. The land has been heavily disturbed from past and current agricultural activities. Given the location, site attributes and the heavy disturbance of the land, the proposal would have low impacts on the environment. Based on biodiversity, heritage and other investigations carried out for the EIS, the proposed layout achieves the objective of efficient electricity production while minimising environmental impacts overall. The final design avoids the majority of native vegetation, habitat of threatened species and ecological communities. The proposed site does not include any native forests, rainforests, wetlands, heathlands, shrublands or geological features.
Residences - Residential zones or urbanised areas.	The proposal is not likely to generate land use conflicts with surrounding land uses and is compatible with land use zoning. The proposed development site is within land zoned RU1, with up to 34 residences within 3 km of the development site. It is proposed to

Areas of constraint	Site justification
	screen views of the proposal with a barrier using a mixture of native vegetation to shield dwellings, and other specific mitigation measures. This will minimise impacts to residential receivers.
Agriculture - Important agricultural lands, including Biophysical Strategic Agricultural Land (BSAL), irrigated cropping land, and land and soil capability classes 1, 2 and 3. Consideration should also be given to any significant fragmentation or displacement of existing agricultural industries and any 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. As the land capability classification system is under review, adjacent land use has also been used to guide agricultural capability. The site has suitable soil type to sustain the level and type of infrastructure proposed and not considered Biophysical Strategic Agricultural Land (BSAL). The development site is located within 2 km of the proposed Walla Walla Solar Farm and one of four solar farm proposals for the Greater Hume Shire. The cumulative impact of agricultural loss of land due to solar farms would be temporary. The four proposed solar farms would result in the temporary loss of 0.61% of agricultural land within the Greater Hume Shire if all were approved.
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. Back Creek runs west-east and south-east through the subject land that eventually confluences with Billabong Creek and drains into the Murray River. The creek bed running west-east contains remnant riparian vegetation and will not be impacted by the proposal, whereas the south-east overland ephemeral flow path is currently cultivated as a crop and is not immediately apparent on the ground. The waterway is not key fish habitat. Flood modelling for the site was done for the following events - 5% AEP, 1% AEP and PMF. Substation, transformers and ancillary infrastructure would be located in a compound outside flood depths greater than 0.25 m during the PMF, while solar panels would be located largely outside the 5% AEP.
Resources - Prospective resources developments, including areas covered by exploration licences and mining and petroleum production leases. Solar development applicants should seek advice from the Department of Planning, Division of Resources and Geoscience (GSNSW) about the coverage of resources-related licences.	Email correspondence DPE, Resource and Geoscience Division detail that there are no current operating mines or quarries over the proposal or adjacent lands (Appendix C.1). The Division has identified that the 'Hurricane Hill' hard rock quarry operated by Boral Resources Pty Ltd is located approximately <1.5 km to the southeast of the project site. Consideration should be given to the impacts the project may have on the quarry's operations. Consultation with Boral during preparation of the EIS is also provided in Appendix C.2.
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 either be leased or purchased for the life of the proposal. It also comprises Greater Hume Council Weeamera Road, where a 1.4 km section would require upgrade. It also comprises Crown Roads, the crossing of Schoff's Lane for cable lay-downs, easements and internal access tracks.

3 PROJECT DESCRIPTION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must include:

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

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The assessment must include all ancillary infrastructure, such as transmission lines, parking facilities, equipment sheds and new vehicle tracks. The EIS should also include Rural Fire Service requirements for asset protection.

3.1 PROPOSAL AREA DESCRIPTION

The subject land comprises about 1351 ha of freehold land, identified as Lots 70-73, 86 DP 753764; Lots 9-11, 45-47, 53, 54 DP 753735; Lot 1 DP 179854; Lot 114 DP 664997; Lot 1 DP 575478; Lot 1 DP 171815; Lot 1 DP 945904; Lot B DP 972054 with the transmission line passing through multiple lots of the subject land.

Cummings Road traverses the subject land, with Weeamera Road running along the eastern boundary (Figure 1-2).

The development area comprises several large paddocks that are generally flat, largely cleared of native vegetation, and cultivated for cropping, pastures and grazing, which is the dominant land use in the area. Figure 3-1 and Figure 3-2 show the cleared and heavily modified agriculture nature of the land. The subject land and most adjoining land are used for agriculture, including grazing and cropping.

Most of the development site has been largely cleared of native vegetation through past agricultural practices. The vegetation within the development site is predominately exotic and comprises crops of Wheat (**Triticum* sp.), Canola *(*Brassica napus*) and Oats *(*Avena sativa*). Exotic pastures occur more frequently in the north and are comprised of Lucerne (**Medicago sativa*), Chicory (**Cichorium intybus*) or clover (**Trifolium*) mixes.

Native vegetation predominantly occurs as scattered paddock trees over exotic crops or pasture or small isolated patches of remnant woodland. The understorey of these woodland patches has undergone frequent disturbance by grazing and agricultural practices and is dominated by exotic species such as Barley Grass (**Hordeum leporinum*) and Rye Grass (**Lolium perenne*), Paspalum *(*Paspalum dilatatum*) and Bromes (**Bromus sp*). Yellow Box (*Eucalyptus melliodora*), Blakely's Red Gum (*Eucalyptus blakelyi*) and White box (*Eucalyptus albens*) are the dominant trees remaining in the development site. Further south, Grey Box (*Eucalyptus microcarpa*) transitions as the dominant paddock tree. The higher quality vegetation of Yellow Box, Blakely's Red Gum and White Box remains along the creek lines, roadsides and central Crown Land paper roads. These higher quality areas have a mix of native groundcovers, shrubs and overstorey canopy.

Areas of linear planted native vegetation occur in the north along fence lines. Planted native vegetation is comprised of a mix of Eucalypt and Acacia species.

There are 20 farm dams within the development site. The majority of these dams are devoid of native vegetation and are surrounded by exotic vegetation such as Phalaris, Rye Grass, Wire weed and Barley Grass or no vegetation at all. A number of drainage channels are also scattered throughout the development site.

Two ephemeral wetlands occur in the south, one including a swampy depression about 200 m east of Back Creek, and the other a drainage line connecting further south to Back Creek. The swampy wetland has previously been modified through the creation of a dam and connecting drainage lines.

A 330 kV TransGrid owned transmission line runs northeast to southwest across the development site which is part of the electricity distribution network that originates at TransGrid's North Wagga Substation.

There are approximately 34 potentially affected sensitive receivers and 4 industries within 3 km of the subject land (Figure 3-7). The closest sensitive receivers to the subject land are located 120 m north (R31) and 120 m (R33) south. The flat terrain and intermittent tree cover limits long range views in the locality. Overall 9 sensitive receivers within 1 km would have views of the proposal.

All construction traffic would access the proposal from Weeamera Road via Benambra Road from the Olympic Highway. Access to all sections of the site would be internally. Construction access points between the central and northern sections of the proposal would occur opposite each other in order to cross Cummings Road. Both Cummings Road and Weeamera Road are under the management of Greater Hume Shire Council. Both roads currently experience a low level of traffic, predominantly local traffic and agricultural machinery.

Figure 3-1 Example of cleared, highly modified agricultural paddock with farm dam.

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

Figure 3-3 Example of farm dam.

Figure 3-4 Example of stands of native vegetation.

Figure 3-5 Billabong Creek.

Figure 3-6 Example of cropped paddocks with few paddock trees.

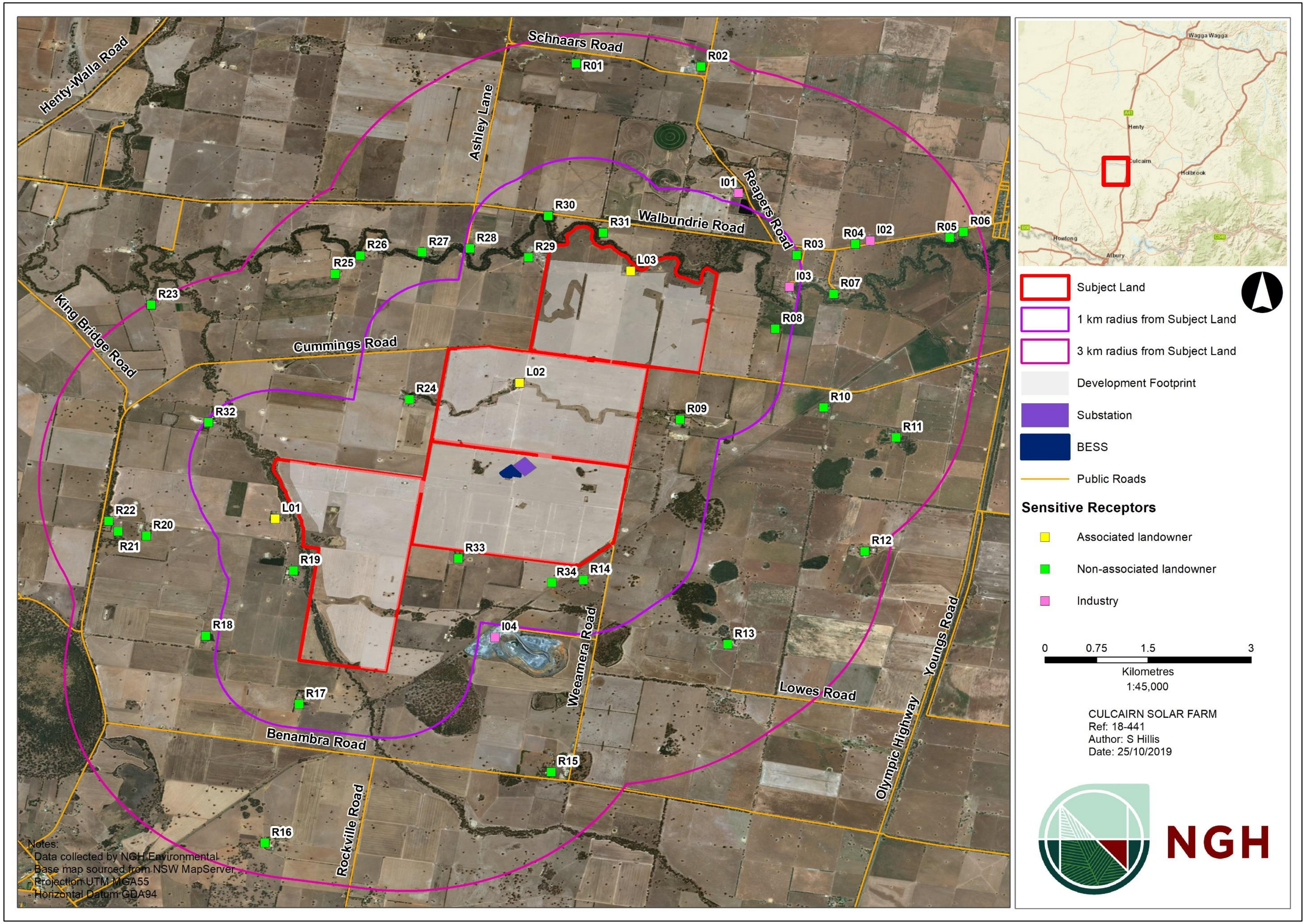

Figure 3-7 Sensitive residence within 3 km of the subject land.

3.2 PROPOSED CULCAIRN 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 Culcairn Solar Farm.

Proposal element	Description
Proposal	Culcairn Solar Farm
Proponent	Neoen Australia Pty Ltd
Capacity	350 MW AC / 402.5 MW DC Note: the approximate capacity is based on the proposed technology available at the time of the EIS but may change through the life of the solar farm as advances in technology occur.
Subject Land	1351 ha
Development site	1317 ha
Development footprint	1126 ha
Site description	Lots 70-73, 86 DP 753764; Lots 9-11, 45-47, 53, 54 DP 753735; Lot 1 DP 179854; Lot 114 DP 664997; Lot 1 DP 575478; Lot 1 DP 171815; Lot 1 DP 945904; Lot B DP 972054. Freehold agricultural land zoned RU1 (Primary Production) under the Greater Hume Local Environmental Plan.
Local Government Area	Greater Hume
Subdivision	Part (35 ha) of Lot 70 DP 753764 will be subdivided from the proposal as it is not ideal for the proposal layout, and so the landowner can continue their farming practices. A 4 ha subdivision for the proposed substation will also be required of Lot 54 DP753735.
Solar array	Up to 1,100,000 solar panels mounted in arrays, with 5 – 10 m row spacing. The 2 m x 1 m solar panels would be arranged in rows of one or two mounted 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 small pile driver.
Inverters/transformers	The proposal would include between 67 and 75 containerised inverter/transformer units across the site. The height of the inverters is approximately 2.5 m and mounted on piers 0.3 m above the ground, not considering flood levels.
Substation	An on-site substation occupying around 4 ha with gravelled hardstand and security fencing. The maximum height of infrastructure within the substation would be 15 m for the lightning rods.
Battery Energy Storage System (BESS)	Approximately 100 MW / 200 MWh storage housed in approximately 50 containerised battery storages for Lithium-ion batteries.
Internal access tracks	Internal access tracks would be constructed of engineered fill topped with crushed stone pavement. Internal access roads to material storage compounds and the substation would be approximately 4–6 m width (including shoulders and any required drainage), whilst general internal roads would be approximately 4–5 m wide. The main access to the substation would be approximately 8 m wide.
Operations and maintenance buildings	Buildings would be constructed to provide a control room, switch room and storage facilities for the solar farm. The approximate height of the operations and maintenance building is 4 m.

Proposal element	Description
Switch Room	A single storey building approximately 15 m long, 12 m wide and 4 m high (including timber-decked verandah) would be constructed on concrete footings to house control facilities.
Storage Shed	A gable roofed storage shed measuring approximately 20 m long, 15 m wide and 6 m high would be constructed at the proposal site.
Viewing Platform	The Project is expected to attract tourism interest to the Culcairn region. The Project will include a viewing platform in proximity to existing public access routes, allowing visitors and tourists the opportunity to explore the project expanse. The elevated, covered platform shall also provide information about the renewable energy infrastructure, educating visitors on the asset and its surroundings.
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 1.8-2.1 m high.
Construction hours	Standard daytime construction hours would be 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. In general, no construction activities would occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. Greater Hume Shire Council and surrounding landholders would be notified of any exceptions.
Construction timing	16 to 18 months commencing mid to late 2020
Workforce	Construction – peak of around 500 workers. Operation – 5 to 10 full time equivalent staff and up to 6 service contractors
Operation period	Up to 30 years
Decommissioning	At the end of its operating life, the site would be returned to its pre-works state. All above ground infrastructure would be removed. Below ground infrastructure would be removed to a depth of 500 mm or removed as necessary to allow restoration of land capability to pre-existing agriculture. The site would be rehabilitated in consultation with the landowner consistent with land use requirements.
Capital investment	Estimated $636.6 million

3.3 PROPOSAL LAYOUT

The proposed layout has been developed iteratively in tandem with the environmental assessment and community consultations to ensure potential impacts are avoided or minimised wherever possible.

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

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 3-8). 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 of the Culcairn development site

High constraint
Remnant woodland vegetation

High constraint
Remnant woodland with native understorey, including EEC in moderate-good Biometric condition. Woodland remnants have high conservation value. Some trees are hollow-bearing and provide potential threatened bird habitat.
Near neighbours Three uninvolved residences are located adjacent to the subject land boundary and would have a high unmitigated visual impact of solar farm infrastructure.
Culturally Significant Trees Cultural and modified trees with Aboriginal cultural significance were identified within the development footprint.
Moderate constraint
Isolated paddock trees Isolated trees in cropland (some derived from an EEC and many hollow-bearing) have habitat and connectivity value for native wildlife.
Near neighbours Six uninvolved residences located around the subject land would have a medium to low unmitigated visual impact from solar farm infrastructure.
Water storage dams 20 dams are present within the subject land. 20 dams are located within the development footprint, which present a practical constraint for the solar farm. However, all these would be retained.
Isolated artefacts A number of isolated Aboriginal artefacts and artefact scatters were identified within the development footprint.
Low constraint
Cleared, cultivated paddocks with no paddock trees These areas do not contain native vegetation and have low habitat value.

3.4 SUBDIVISION

The proposal would require subdivision of the subject land within the Greater Hume LGA (Figure 3-9). The following configuration is proposed:

Lot 70 DP 753764

Subdivide an area of approximately 27 ha from existing Lot 70. This land would be retained by the current landowner for the purpose of carrying out agricultural activities. The balance of the land would contain solar infrastructure and would comprise approximately 33 ha in Lot 70.

Lot 71 DP 753764

Subdivide an area of approximately 8 ha from existing Lot 71. This land would be retained by the current landowner for the purpose of carrying out agricultural activities. The balance of the land would contain solar infrastructure and would comprise approximately 50 ha in Lot 71.

Lot 54 DP 573735

Subdivide an area of approximately 5 ha from existing Lot 54 (‘Lot D’). This land would be used for the proposed internal substation. The balance of the land would contain solar infrastructure and would comprise approximately 121.66 ha (‘Lot E’).

<u>Consolidation of Lots 70 and 71 DP 753764</u>

Land retained by Landowner 3 would be consolidated into one ‘Lot A’ of approximately 35 ha. The balance of the land proposed for solar infrastructure would remain unconsolidated with ‘Lot B’ approximately 32 ha and ‘Lot C’ approximately 50 ha.

Council provided NGH with a letter (dated 4 November 2019), stating that the configuration of the land is not permanently altered by the subdivision of land for leasehold purposes, as a result council do not apply the provisions of the Greater Hume LEP. Council would not be concerned by subdivision for leasehold purposes (Appendix C.1).

A subdivision plan, with the proposed consolidation, is provided at Figure 3-10.

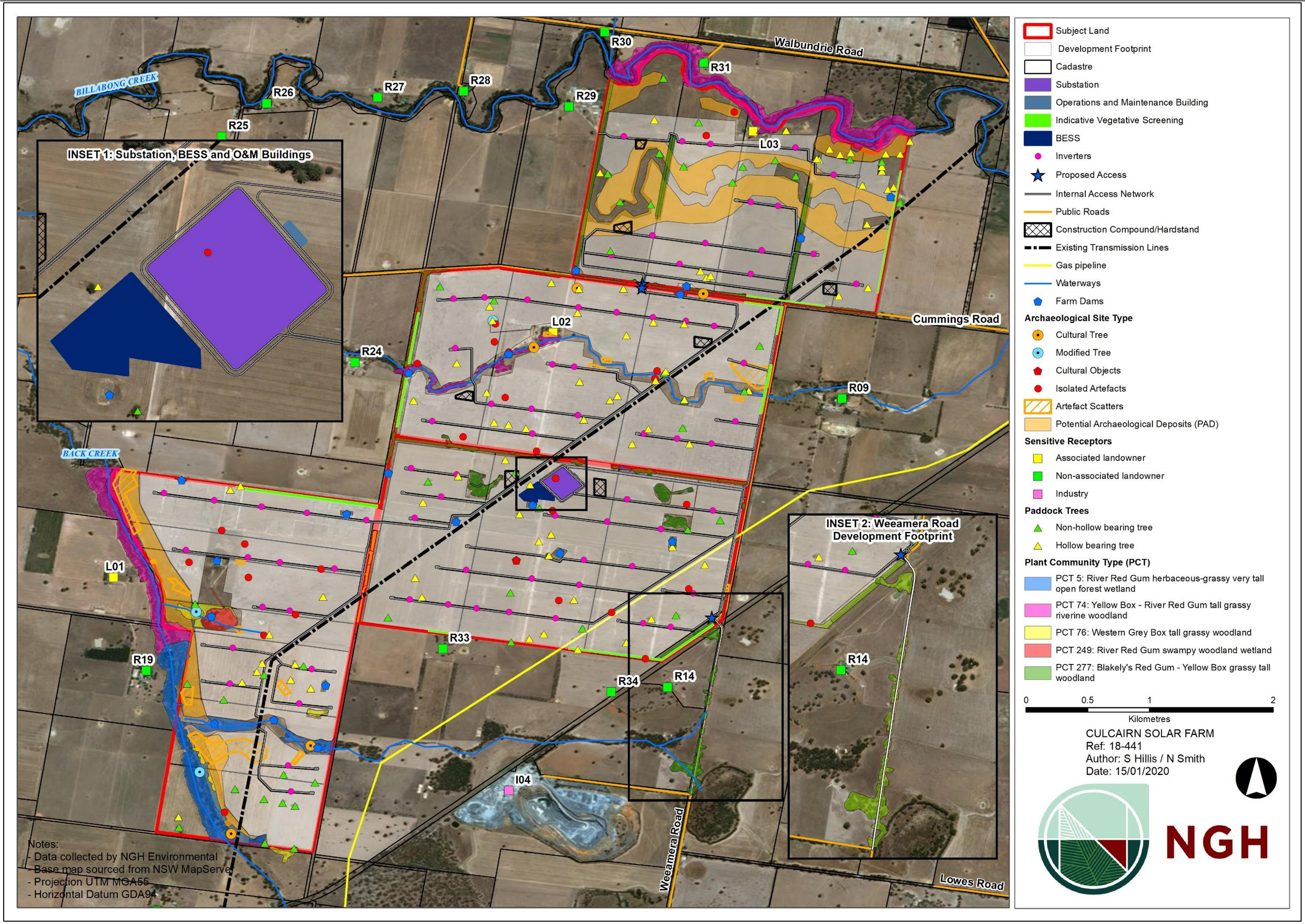

Figure 3-8 Proposal infrastructure layout and site environmental constraints

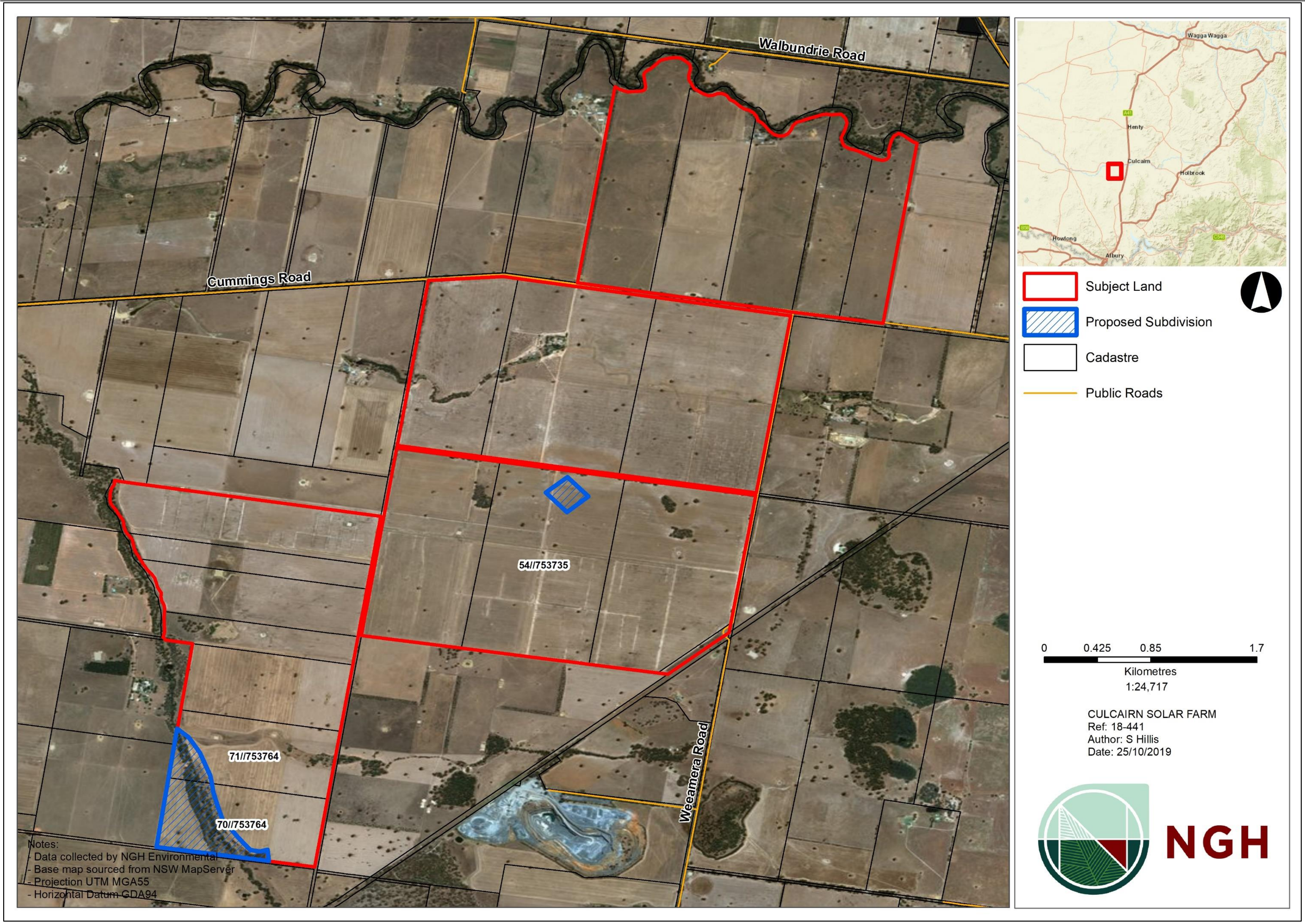

Figure 3-9 Proposed subdivision plan

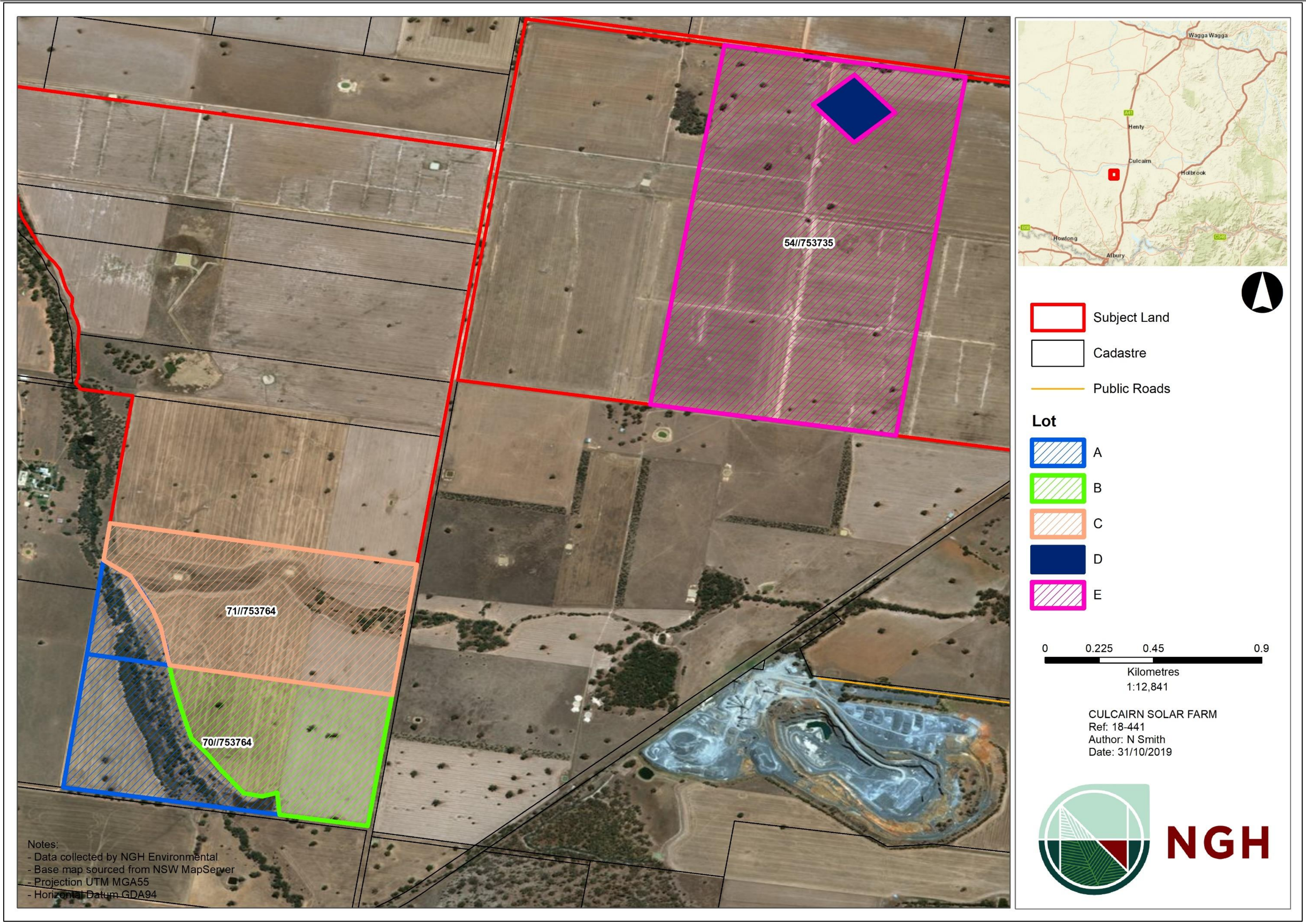

Figure 3-10 Proposed subdivision consolidated lots.

3.5 PROPOSED INFRASTRUCTURE

3.5.1 Solar arrays

It is expected that the array would comprise up to around 1,100,000 single axis tracker photovoltaic (PV) solar panels mounted in rows on steel frames (Figure 3-11).

Two single axis systems are being explored for use, illustrated in Figure 3-12 and Figure 3-13. The Ideematec tracker system would include approximately 1350 motors, while the NexTracker system would include 500 motors. Single axis trackers would have a typical maximum height of 4 m, based on a 2 m vertical height panel and 2 – 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 10 m.

Approximately 80,526 piles for the Ideematec tracker system and 161,052 piles for the NexTracker system 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 - 1.7 m but may be up to 2.4 m. Pile heights would vary according to topography. An example of a solar array is shown in Figure 3-14.

Figure 3-11 Example of 2 m x 1 m solar panels arranged in rows.

Figure 3-12 Ideematec single axis tracking system.

Figure 3-13 NexTracker single axis tracking system.

Figure 3-14 Example solar array.

3.5.2 Inverter/transformers

The proposal includes 67 to 75 containerised inverter/transformer units across the site (locations illustrated in Figure 3-8). Appendix B provides diagrams of the proposed inverter/transformer units and Figure 3-15 illustrates an example of the internal elements of the equipment. The inverter/transformer units would be constructed on concrete footings approximately 300 mm above ground level.

Power from the solar panels would generate direct current (DC) electricity that would be inverted to alternating current (AC) via the inverter, with the voltages stepped up to 33 kV by the transformer.

Figure 3-15 Containerised inverter/transformer unit with battery storage.

There would be one high voltage transformer located near the substation. The high voltage transformer would step-up voltage to 330 kV (Appendix B).

3.5.3 Battery Energy Storage System

The BESS would be located adjacent to the substation in the central section of the development site.

The project will utilise sealed lithium-ion batteries housed in a secure, climate-controlled Battery Energy Storage System (BESS). The BESS would be located adjacent to the substation in the central section of the development site, allowing for proximity to existing transmission infrastructure and maximum distance from visual receivers.

Subject to economic and technical considerations, the proposal would include an approximate 100 MW / 200 MWh rated capacity battery storage system. The units (Figure 3-16) would comprise lithium-ion batteries housed across the site in up to 50 customised containers (Appendix B).

Figure 3-16 Example of a Tesla Battery Energy Storage System.

The climate-controlled battery storage units would be constructed on concrete footings approximately 300 mm above ground level. HVAC units will provide heating and cooling for the BESS modules are required. Heating, ventilation and air conditioning (HVAC) units will provide heating and cooling for the BESS as required. The BESS will house a control room, batteries, inverters and switchboards. Kiosk transformers outside will link the battery system with the site connection.

The BESS is monitored on a constant basis, utilising NEM compliant metering arrangements that automated and individualised control and diagnosis of individual battery modules. The BESS will incorporate a Battery Management System (BMW) for control and safety, ensuring that in case of temperature rise in the battery cabinet (e.g. due to HVAC failure), the battery module and individually fused cells will trip on high temperature and shut down the module or BESS, or both. This is possible due to the dedicated power electronics and system architecture that isolate the batteries from the common DC bus.

It is anticipated that the battery modules will have secondary containment, to ensure that any one battery module failure (e.g. any battery fires or thermal runaway event) is contained. This is an integral design feature of the system's architecture with one of the Proponent's key suppliers, Tesla. Tesla's Battery Safety technology and the safety systems are outlined in Appendix L.

The battery storage units would be constructed on concrete footings approximately 300 mm above ground level.

3.5.4 Overhead and underground cabling

Most cabling at the site would be buried and located along the access tracks.

All underground cabling would be installed at a depth of at least 500 mm or removed as necessary to allow restoration of land capability to pre-existing agriculture. The electrical reticulation buried to either below 500 mm (low voltage) or below 750 mm (high voltage) 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, sand may be used in the trench to create a cable bed. Once the cables are installed another layer of sand may be placed above the cable prior to the trench being backfilled with excavated material, replacing the soil profile to assist revegetation of the disturbed areas. Cables would be protected in accordance with *Australian Standard (AS) 3000:2007 Electrical Installations*.

3.5.5 Transmission network connection

The solar farm would connect directly to the TransGrid 330 kV overhead transmission line which passes through the development area (Figure 3-17). Figure 3-8 shows the location of the substation and connection point to the transmission network. Connection would be via the proposed substation.

Figure 3-17 The transmission line through the centre of the development site.

3.5.6 Substation

A new substation would be constructed on the development area within the subdivided portion of land (refer to Figure 3-8) to step up the solar farm electrical output to match the transmission grid voltage (330 kV). While the design is yet to be finalised, it is expected that the substation would be an area occupying approximately 172 m by 145.5 m and contain transformers, associated switchgear and control and protection equipment, and may include a control building, switch room and drainage and oil containment system (refer to section 3.4 for subdivision proposal). The substation would be surrounded by a security fence. Gravel hardstand would be placed under and around the substation compound to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards.

A photograph of an example substation is provided below (Figure 3-18).

Figure 3-18 Example of a substation from Colleambally Solar Farm.

3.5.7 Site access and internal tracks

The development site would be accessed from Weeamera Road on the south-eastern boundary of the subject land. The Weeamera Road entrance would be approximately 3.5 km from Benambra Road. Access to the northern section of the development site would be internally with two opposite access points, allowing construction traffic to cross Cummings Road. Although the final design has not yet been completed, the location and form of the access road intersection would be developed to provide adequate sightlines for vehicles entering and exiting the site, in accordance with Austroads and RMS guidelines. The final intersection designs would be completed in consultation with Greater Hume Shire following approval of the proposal.

The internal access roads would involve upgrading existing access points, constructing three new entrances and connecting these with a network of tracks accessing the solar farm infrastructure for maintenance. Approximately 44 km of new track would be constructed at the site. The main access and internal tracks would be constructed of engineered fill topped with crushed stone pavement. The driving surface would be nominally 5 – 8 m wide (including shoulders and any required drainage), whilst general internal roads would be approximately 4 – 5 m width. The main track to the substation would be around 8 m wide. The locations of proposed internal tracks are shown on Figure 3-8.

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

3.5.8 Site Office, switch room and storage shed

Separate buildings would be required to provide site office, switch room and storage facilities for the operation of the proposal in a sufficiently proactive manner that will be detailed in a subsequent Construction Environmental Management Plan. Indicative descriptions of these buildings are provided below. The control room, switch room and storage shed would each contain essential fire safety equipment, including fire extinguishers and hose reels. Example of the operations and maintenance building and substation buildings is included in Figure 3-19.

Site office

A single storey building approximately 15 m long, 12 m wide and 4 m high (including timber-decked verandah) would be constructed on concrete footings to house control facilities. The building would have a skillion roof and be clad in fibre cement sheeting. Guttering and a water tank would be installed to collect rainwater. The Site Office building would contain an office and staff amenities (toilet, kitchen).

Switch room

A building approximately 29.5 m long, 5.5 m wide and 4.5 m high would be constructed for the HV switch room, with services, protection and control facilities. The skillion-roofed building would likely be clad in Colorbond sheeting.

Storage shed

A gable roofed storage shed measuring approximately 20 m long, 15 m wide and 6 m high would be constructed at the proposal site. The shed would likely be clad in Colorbond monoclad sheeting and include steel roller doors and windows with fixed metal louvres. Guttering and a water tank would be installed to collect rainwater. A fire extinguisher and hose reel would be installed at the shed.

Figure 3-19 Example of an operations and maintenance building and substation buildings.

3.5.9 Security CCTV, lighting and fencing

Continuously operating CCTV cameras (possibly with a pan function) would be installed with night-time security lighting (infra-red) on posts up to 3.5 m high adjacent to the perimeter security fencing and around the operation and maintenance buildings. The number of cameras would be sufficient to cover the perimeter of the site and building areas.

The security fencing installed around the site would indicatively be 1.8 - 2.7 m high (Figure 3-20), providing adequate access points for project maintenance, land management purposes and for emergency egress.

Figure 3-20 Example of a typical security fence.

3.5.10 Landscaping and revegetation

Landscaping and screen planting would be undertaken in some sections of the perimeter of the site as required to 'break up' or 'soften' views of the infrastructure from key locations. This would entail a barrier of native species planted to break up views of the infrastructure from specific receivers. Native tree and shrub species suited to site conditions would be used, placed and selected to avoid shading impacts on the array and to achieve effective screening of the solar farm infrastructure. Potential screening opportunities are discussed in section 6.2.

The solar array would be mounted above the ground and suitable perennial ground cover would be established and maintained beneath the panels. Groundcover vegetation would be affected by shading, varying according to time of day and time of year. Groundcover grass species would be selected which are tolerant of these shading conditions and suitable for the soil type and climate at the proposal site.

The 10 m minimum asset protection zone (APZ) 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 2018).

Areas disturbed during the construction phase would be stabilised and revegetated with suitable perennial grass species immediately after construction. Groundcover species would be selected to facilitate sheep grazing at the site to control grass height and bushfire hazard.

3.5.11 Temporary construction facilities

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

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction workers.
- Staff amenities (kitchen and toilet/s).
- Temporary security lighting at construction compound.

A fenced construction compound would be developed, including:

- Containers for the use of subcontractors.
- Bunded area for refuelling.
- Storage area.
- Generator for construction compound power supply.
- Skips with wind shield and lid.
- Parking area.
- Staff amenities (kitchen and toilet/s).
- Offices and meeting room.

Chain link fencing up to 2 m high would surround the construction compound. A hardstand area in the compound would consist of compacted stone to provide a clean, firm, level and free draining surface suitable for cabins and heavy traffic. Temporary staff amenities would be designed to accommodate the number of workers at the peak of the construction period (estimated at 500 workers).

3.6 CONSTRUCTION

3.6.1 Construction activities

The construction phase is expected to last approximately 16 to 18 months with a peak construction period of 8 to 12 months. The main construction activities would include:

- Site establishment and preparation for construction - fencing, ground preparation, construction of the internal track system, upgrade of existing access points/intersections, preliminary civil works and drainage.
- Installation of steel post and framing system for the solar panels.
- Installation of underground cabling (trenching) and installation of inverter stations.
- Installation of PV panels.
- Construction of control room, switch room and storage building.
- Construction of the substation and connections.
- Construction of battery storage units.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently. Temporary construction facilities would be located to the east of the proposed substation in one compound (Figure 3-21).

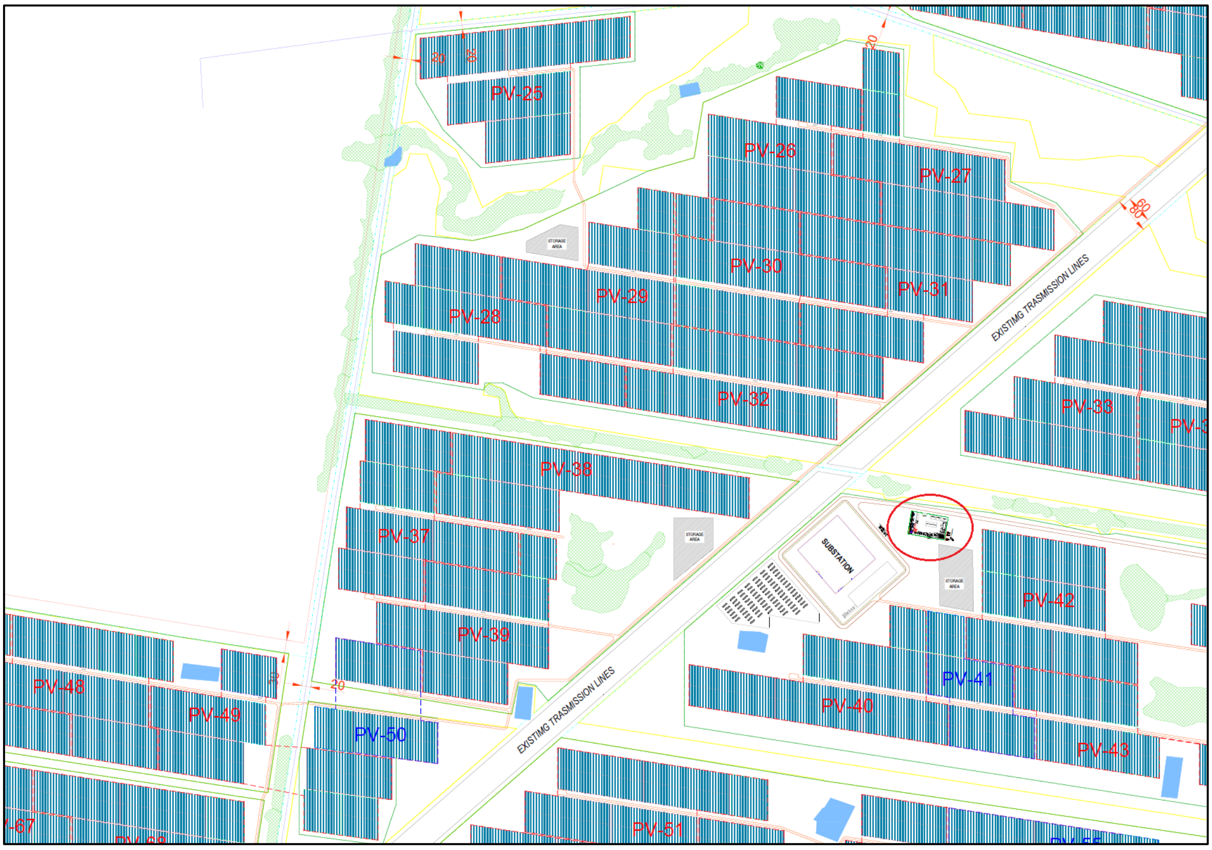

Figure 3-21 The proposed location of temporary construction facilities, east of the proposed substation.

Battery storage

The construction of the battery storage would include:

- Site establishment and preparations.
- Installation of suitable foundation.
- Installation of underground cabling (trenching) and energy storage compliant power conversion units and control systems.
- Delivery of the containers/units.
- Augmenting and connecting into inverters and site solar substation.
- Removal of any temporary works and/or replacement of hardstand areas.

3.6.2 Site preparation and earthworks

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

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of 1.5 – 3 m.
- Construction of internal access tracks and access points and associated drainage.

- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and maintenance building.
- Cable trenches up to 1000 mm deep.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing, infra-red lighting and CCTV.

Topsoil under the footprint of the array area 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.

Where required weed treatments would be undertaken prior to earth works commencing to reduce the potential for spread of these species within the proposal footprint.

3.6.3 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 around 500 construction personnel would be required onsite during the peak construction period of approximately 8 - 12 months. Construction supervisors and the construction labour force, made up of labourers and technicians, would be hired locally where possible.

The Proponent use a proximity principle for labour associated with their infrastructure projects. Where local labour is available it would be used. Those in the labour force who were not local would use existing accommodation within the local area such as Culcairn, Holbrook, Bowna, Albury and Wagga Wagga. It is proposed that bus transfers 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. Culcairn and Albury are the nearest large towns which are a possible source of the bulk of the aggregate material required for construction, followed by Holbrook, Wodonga, and Wagga Wagga.

Approximately 23, 000 m^3 of gravel would be required to surface the access road and internal service track network, inverter/battery storage areas and substation hardstand. Sand may be required for the bedding of underground cables, depending on electrical design and ground conditions. Concrete would be required to construct the inverter, substation, CCTV and battery storage foundations.

Approximately 62 ML of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, onsite amenities and landscaping. The bulk of this water would be commercially available from the Greater Hume Shire Council standpipe and/or the nearby Boral Quarry, and stored on-site in a steel or concrete tank. The Proponent is currently in consultation with Greater Hume Shire Council and Boral seeking approval in principle for water use (Appendix C).

Potable (drinking) water (approximately 2.5 ML) would be imported to the site during the construction period on an as needs basis as bottled water.

Transport and access

A Construction Traffic Management Plan (CTMP) would be prepared following proposal approval to manage haulage traffic during the construction phase. Amber have conducted a Traffic Assessment of the proposal (Appendix H).

Haulage route

Where possible, goods and services for the solar farm would be sourced locally. Items such as solar panels, posts and racking systems which can't be sourced locally would likely come by road from either Melbourne or Sydney. Construction traffic approaching from Albury or Wagga Wagga would be via the Olympic Highway. The entry to the site would be located on Weeamera Road, accessed from Benambra Road off the Olympic Highway, 9 km south of Culcairn. 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.

Olympic Highway and Benambra Road Intersection

Austroads *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 the Olympic Highway and Benambra Road, Basic Right Turn (BAR) and Basic Left Turn (BLT) treatments are required at the intersection. They already exist at the intersection due to the Quarry located on Weeamera Road. Figure 3-22 shows the existing intersection based on a 30 m long A-Double vehicle.

Cummings Road

Two access points between the central and northern sections of the proposal would be on Cummings Road. The access points would be a direct crossing for construction vehicles and allow for two-way truck movement. Cummings Road is a sealed road and already facilitates two-way traffic flow for articulated vehicles.

Weeamera Road

One access point is proposed on Weeamera Road through Lot 1 DP945904 onto Lot 1 DP575478 to the west. Weeamera Road is a local road that runs in a north-south alignment between Cummings Road and Benambra Road. Between Benambra Road and the Boral Resources Quarry site access the road has a sealed width of 8.0 m. North of the quarry access the road is unsealed, has a width of 5.5 m and accommodates two-way vehicle movement. Weeamera Road intersection with Benambra Road is already suitable for heavy vehicles. It is proposed to widen Weeamera Road to accommodate two-way vehicle movement as shown in Figure 3-23.

Road condition surveys

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

Approximately 15 trucks will access the site per day during typical construction periods. The delivery trucks will predominantly be Medium and Heavy Rigid Trucks (MRV and HRV as defined within AS 2890.2:2009). Articulated Vehicles (AV as defined within AS 2890.2:2009) and B-Doubles will occasionally be used to transport larger plant such as the PV panels and BESS module racks.

It is anticipated that during peak construction the site could generate up to 50 heavy vehicles per day and 150 light vehicles per day. Accordingly, the site is expected to generate approximately 100 heavy vehicle movements and 300 passenger vehicle movements per day during the peak construction period of the solar farm.

The largest design vehicle is expected to be a 36 m long A-Double truck, which would occasionally be used to transport larger plant equipment. There will potentially be three oversized deliveries and include delivery of the transformers and the control room.

Figure 3-22 Benambra/Weeamera Road intersection swept path analysis

Figure 3-23 Access design

3.6.4 Work hours

Construction activities would be undertaken during standard daytime construction hours (7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays) or as otherwise agreed by the Secretary. 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.

3.7 OPERATION

3.7.1 Operation activities

Operation activities would include:

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

3.7.2 Materials and resources

During operation, non-potable water would be required for cleaning panels, landscaping and animal care (livestock). Around 1 ML per year would be required for cleaning, likely tankered to the site when required. 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 40,000 L reserved for fire-fighting purposes. Potable water would be required for staff using imported supplies or rainwater collected in tanks beside site buildings.

3.7.3 Transport and access

It is expected that the 5 to 10 full time equivalent (FTE) staff based at the site and up to 6 service contractors during the operation phase would primarily use light vehicles (4WD).

Water for solar panel cleaning would be delivered to the site, requiring around 16 tanker visits per year, based on two washes per year using 0.8 L/panel. Panel washing may not be required once groundcover has been established at the site.

Traffic associated with the operation and maintenance of the solar farm would also use the routes specified for the construction phase (refer section3.6.3).

3.7.4 Personnel and work hours

The solar farm would be monitored and operated remotely and would require a small number of maintenance personnel (5 to 10 full time equivalent staff) to be based at the site.

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

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

- Monday – Friday 7.00 am to 6.00 pm
- Saturday 8.00 am to 1.00 pm

Outside of emergencies or major asset inspection or maintenance programs, night works or work on Sundays or public holidays would be minimised. During summer months, the PV panels would produce electricity prior to 7.00 am and after 6.00 pm. Tracker units would similarly operate outside standard hours in summer.

3.7.5 Lighting

There would be no permanently lit night lighting installed within the array, but lighting would be included in each inverter station for maintenance purposes. There would also be maintenance lighting installed at the substation that would only be used in case of emergency, and security lighting at the operation and maintenance building. All operational lighting would be designed to reduce disturbance to neighbouring properties and would be utilised only when there are staff on site or during emergency situations. Continuously operating security lighting (infra-red) and CCTV cameras would be installed on posts up to 3.5 m high adjacent to the security fencing and operation and maintenance buildings.

3.7.6 Refurbishment and upgrading

The solar farm operator may replace or upgrade solar panels or other infrastructure within the existing development envelope during the projected 30-year life of the solar farm. If any 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 would 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 30-year timeframe.

3.8 DECOMMISSIONING AND REHABILITATION

The proposal is expected to operate for up to 30 years. After this period the solar farm would either be upgraded (pending any additional approval requirements) or decommissioned. A Decommissioning Environmental Management Plan (DEMP) with an indicative timeline would be prepared and submitted to DPIE for approval prior to decommissioning.

The DEMP would describe how project infrastructure would be removed after operations cease. It would establish a methodology to return the site to the pre-existing condition prior to development.

All above ground infrastructure would be removed to a depth of 500 mm or removed as necessary to allow restoration of land capability to pre-existing agriculture. Key elements of decommissioning would include:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse wherever possible.
- All site amenities and equipment would be removed including buildings, inverter stations and substation, and materials recycled or reused wherever possible.
- Posts and cabling installed within 500 mm of the surface would be removed and recycled. Equipment below this depth, such as cabling, would be left in situ or removed as necessary to allow restoration of land capability to pre-existing agriculture.
- Fencing would be removed including small concrete footings.

All areas of soil disturbed during decommissioning would be rehabilitated in consultation with the landowner consistent with post-solar farmland use requirements and in consultation with the following or equivalent resources:

- *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 DEMP.

3.9 INDICATIVE TIMELINE

An indicative timeline for the proposal is outlined in Table 3-3. The commissioning of the solar farm would likely be phased. It is expected that the solar farm would be commissioned progressively in 1-3 phases before full commissioning at the end of the 16 to 18 month construction period.

Table 3-3 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	Winter 2020	16 to 18 months
Operation	Summer 2021	30 years
Decommissioning	Summer 2051	6 months

3.10 CAPITAL INVESTMENT

The proposal would have an estimated capital investment of $636.6 million.

4 PLANNING CONTEXT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *The reasons why the development should be approved having regard to:*
  - *Relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development.*

4.1 PERMISSIBILITY

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

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

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

4.2 NSW LEGISLATION

4.2.1 Environmental Planning and Assessment Act 1979 Objects

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

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

a) to encourage:

i. The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.

ii. The promotion and coordination of the orderly and economic use and development of land.

iii. The protection, provision and coordination of communication and utility services.

vi. The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.

vii. Ecologically sustainable development.

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

Matters for consideration

Section 4.40 of the EP&A Act provides that section 4.15 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 Greater Hume DCP 2013 details local controls on industrial and commercial developments such as flood planning, visual amenity, parking and access and signage, and pollution controls. However, under clause 11 of the SRD SEPP provides that DCPs do not apply to SSD. 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.
Any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration)	Clause 92 of the EP&A Regulation requires consideration of: • The Government Coastal Policy, for development applications in certain local government areas; and • The provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters 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	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in sections 6 and 7 of this EIS. This EIS demonstrates that the environmental impacts of

Provision	Relevance to the proposal
social and economic impacts in the locality	the proposal have been avoided or minimized through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development	The suitability of the site for the development is assessed in section 2.5. Characteristics that make it suitable for development of a solar farm are identified and justified.
Any submissions made in accordance with this Act or the regulations	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. • Providing electrical reliability and security benefits. • Downward pressure on electricity prices.

4.2.2 *Environmental Planning and Assessment Regulation 2000*

Clauses 82 to 85B of the EP&A Regulation 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 28 days.

4.2.3 *Greater Hume Local Environmental Plan 2014*

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

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

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

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

Land zoning

The development area is zoned RU1 - Primary Production under the Greater Hume LEP. Electricity generation is not listed among developments that are permitted within the zone. However, the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) takes precedence over an LEP and permits electricity generating works with consent in a prescribed zone (including the RU1 zone). The *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) provides for the declaration of SSD and declares that the Independent Planning Commission (IPC) is the consent authority for certain SSD (see below).

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

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area;*
- *To minimise the fragmentation and alienation of resource lands;*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones; and*
- *To maintain the rural landscape character of the land.*

For the life of the proposal, the development site would harness a renewable natural resource (solar energy). The activity would impact on land availability for primary production, however, would be developed in a way that would minimise fragmentation and alienation of resource land and minimise land use conflict. Being reversible and involving limited ground disturbance, it would not remove the potential to use the land for primary production at the end of the life of the development. Upon decommissioning of the proposal, the development footprint would be rehabilitated to restore land capability to pre-existing agricultural use.

It is also important to note that solar farms do not preclude the use of land for primary industry production. Some agricultural and production activity is still possible whilst a solar farm is operating (e.g. grazing). Appendix P details the sheep grazing for vegetation management at Neoen's Nurmurkah Solar Farm in Victoria.

4.2.4 Development Control Plans and Council policies

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

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

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

4.2.5 State Environmental Planning Policy (Infrastructure) 2007

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

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) <u>in any other case – any land in a prescribed rural, industrial or special use zone</u>'*.

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

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

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

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

State Significant Development (SDD)

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

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

Clause 20 of Schedule 1 of the SRD SEPP includes:

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

The proposal has an estimated capital investment value of $636.6 million, therefore the proposal is classified as SSD under Part 4 of the EP&A Act.

Clause 8A of the SRD SEPP declares the IPC to be the consent authority for certain SSD projects. For other projects, the consent authority is the Minister for Planning.

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

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

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

A search of the NSW Environment Protection Authority (EPA) contaminated land public record (NSW EPA 2019) was undertaken for contaminated sites within the Greater Hume LGA on 10 July 2019. The research returned no results for contaminated land within the Greater Hume LGA.

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

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

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

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

'Potentially offensive industry' 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 the spread of storage capacity and site-specific hazard mitigation measures that the proposal was not potentially hazardous. However, proposed battery storage for the proposal is above the 30 MW threshold for NSW and therefore, a PHA was completed (refer section 7.4).

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

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

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

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

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

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

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

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

The aims of the *State Environmental Planning Policy (Rural Lands) 2008* (Rural Lands SEPP) are:

(a) *to facilitate the orderly and economic use and development of rural lands for rural and related purposes.*

(b) *to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State.*

(c) *to implement measures designed to reduce land use conflicts.*

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

(e) *to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.*

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

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

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

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

The proposal has not been identified as BSAL or CIC.

4.2.12 Protection of the Environment Operations Act 1997

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

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

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

The works would generate more than 30 MW of electrical power. However, electricity generation would be from solar power which is not considered a scheduled activity. Accordingly, an EPL is not required under the POEO Act for the proposal.

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

4.2.13 Roads Act 1993

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

Any work within the road reserve, such as upgrades that interfere with the structure of the road, require consent from the road authority under Section 138 of the Roads Act. Greater Hume Shire Council is the roads authority for all local roads surrounding the proposal, including Cummings Road, Benambra Road and Weeamera Road, and NSW Roads and Maritime Services (RMS) is the roads authority for Olympic Highway, being the major access route to the area.

A Section 138 consent may be required for any works required to upgrade the Benambra Road/Olympic Highway intersection, the Benambra Road/Weeamera Road intersection and widening of Weeamera Road.

4.2.14 Crown Lands Management Act 2016

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

Schoff's Lane, a Crown Road, (CADID 105500159 and 105271469) is in the final process of being purchased by Landowner 2. The purchase and transfer of the Crown Roads has not been finalised, with no Lot or Deposited Plan (DP) number assigned yet. The sale and transfer of the parcel is expected to be complete prior to construction of the proposal. As such, no impact to Crown Land is expected as a result of the proposal.

In order to link the different freehold properties that comprise the proposed development site, The Proponent will need to have the agreement to lay-down underground Medium Voltage cables across an unused Crown Road (Shoffs Lane). The Proponent has been advised by Crown Land that consent can be granted once a copy of the final EIS has been provided.

4.2.15 Water Management Act 2000

The *Water Management Act 2000* (WM Act), currently administered by the Department of Industry (Water), is progressively being implemented throughout NSW to manage water resources. 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 would be sourced from the Greater Hume Shire standpipe and/or from Boral Quarry, as currently seeking agreement in principle from both the Council and Boral. As such, any water sources specified under the WM Act are not required.

4.2.16 Fisheries Management Act 1994

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

4.2.17 National Parks and Wildlife Act 1974

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

The provisions of the NPW Act have been considered for the proposal. The proposal area is not located within 10 km of any nature reserve or forest protected under the NPW Act, thus no impact on these areas is expected.

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

4.2.18 Heritage Act 1977

The *Heritage Act 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.

A search of the NSW Heritage Register on 10 July 2019 for the Greater Hume LGA identified 1 record under the NPW Act, 4 items under the NSW Heritage Act, and 61 items listed under the Greater Hume LEP and by state agencies. A search of the Australian Heritage Database identified 13 records in the Greater Hume LGA.

The closest listed heritage items are in the township of Culcairn and Walla Walla, including Culcairn Railway Station and yard group, Bakery Shop, Court House/Police Building, Hotel, Street Trees, Walla Walla homestead and Morgan's Lookout which are all at least 3 km from the proposal. The proposal would not impact directly or indirectly on any items of heritage significance.

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.

4.2.19 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 a management protocol for declared priority weeds under the *Biosecurity Act 2015* during construction, operation and decommissioning stages, and weed hygiene protocol in relation to plant, machinery, and fill.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can also potentially increase the risk of pest animals at the development site (mostly cat and fox). A pest management procedure would be developed and implemented by the Proponent (section 6.5).

4.2.20 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) establishes a new regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments. The BC Act contains provisions relating to flora and fauna protection, threatened species and ecological communities listing and assessment, a biodiversity offsets scheme (BOS), a single biodiversity assessment method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The 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 OEH have determined that the proposed development is not likely to have any significant impact on biodiversity values. A BDAR has been prepared as part of this EIS (Appendix D).

4.2.21 Conveyancing Act 1919

The purpose of the *Conveyancing Act 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.

When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under *s*.7A is required when the total of the original term of the lease, together with any option of renewal, is more than five years.

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

4.2.22 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (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 7.4).

4.3 COMMONWEALTH LEGISLATION

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

The EPBC Act identifies nine MNES:

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

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

A search of the Commonwealth Protected Matters Search Tool on 9 August 2019 indicated that there are no World Heritage Properties or National Heritage Places within the proposal area. Search results listed seven Wetlands of International Importance that are either known to occur or have potential to occur in the area, however no Ramsar wetlands are located within 10 km of the proposal sites and are not relevant to the site or proposal. Section 6.8 discusses the results of searches in relation to threatened species, ecological communities and migratory species. Table 4-2, Table 4-3 and Table 4-4 summarise the results of the searches.

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

Matters of National Environmental Significance	Addressed in this EIS
World Heritage Properties	0
National Heritage Places	0
Wetlands of International Significance	4
Great Barrier Reef Marine Park	N/A
Commonwealth Marine Areas	N/A
Threatened Ecological Communities	Section 6.8 and Appendix D – significant impacts not anticipated.
Threatened Species	Section 6.8 and Appendix D – significant impacts not anticipated.
Migratory Species	Section 6.36.8 and Appendix D – significant impacts not anticipated.

Table 4-3 Summary of Other Matters Protected by the EPBC Act (10 km search radius)

Other Matters Protected by the EPBC Act	Addressed in this EIS
Commonwealth Lands	2
Commonwealth Heritage Places	0
Listed Marine Species	N/A
Whales and Other Cetaceans	N/A
Critical Habitats	0
Commonwealth Reserves	0

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

Extra Information	Addressed in this EIS
State and Territory Reserves	0
Regional Forest Agreements	0
Invasive Species	Section 6.8 – significant impacts not anticipated.

Nationally Important Wetlands	1

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in the Biodiversity section (section 6.8) and the BDAR in Appendix D. A significant impact to any of these entities is considered highly unlikely.

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

4.3.2 Native Title Act 1993

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

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

Native title may exist in areas such as:

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

A search of the National Native Title Tribunal Register was carried out on 12 February 2019. Two native title claims were made in the Greater Hume LGA including Eastern Australian Pipeline (NN1996/025) and Greater Hume Shire Council (NN2007/008) but both of these have been discontinued. The development site is located on freehold land and not subject to any native title claims at this time.

4.3.3 Renewable Energy (Electricity) Act 2000

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

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

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

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

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

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

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

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

Presently, there are few facilities to recycle lithium-ion batteries in Australia. Therefore, spent batteries are likely to be exported and would require an export permit under section 40 of the Hazardous Waste Act. The Proponent would coordinate this activity and the associated commercial arrangements with the selected battery supplier.

4.4 OTHER RELEVANT POLICIES AND MATTERS

4.4.1 Ecologically Sustainable Development (ESD)

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

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

a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: *i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and* *ii. an assessment of the risk-weighted consequences of various options.*
The precautionary principle has been adopted in the assessment of expected impacts. All potential impacts have been considered and mitigated commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty. Generally, a worst-case assessment is undertaken to account for unknowns.
b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
Potential impacts of the proposal are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. The proposal is

considered to be reversible in terms of protecting the natural values of the site. Importantly, the proposal provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing carbon emissions intensity of electricity generation.
c) Conservation of biological diversity and ecological integrity should be a fundamental consideration.
The impacts of the proposal on biodiversity, including EPBC listed species, have been assessed in detail in section 6.8. This has included avoidance of higher conservation value areas where possible and management measures to minimise, manage and offset residual impacts. The impacts are considered to have been reduced as much as possible in this context and to be justified.
d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as: *i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,* *ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,* *iii. environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*
Attributes of the proposal area such as existing native vegetation, soil and hydrology have been valued in terms of their broader contribution to the catchment and catchment processes. Pollution risks 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 (2018)

The guideline provides the Proponent and regulators with general guidance on the planning framework for the assessment and determination of state significant large-scale solar energy projects under the EP&A Act.

The objectives of the guideline are to:

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

- Support the development of a sustainable solar industry in NSW by providing a clear, consistent and responsive policy framework.

The proposal has addressed the requirements of the guidelines through the assessment of environmental impacts (sections 6 and 7), site suitability (section 2.5), community and agency consultation (section 5) and policy and framework requirements (section 2).

4.4.3 NSW Riverina Murray Regional Plan 2036

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

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

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

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

Goal 1: Direction and Actions	EIS Consideration
Direction 1: Protect the region's diverse and productive agricultural land 1.1 Develop a regional agricultural development strategy that: • Maps important agricultural land • Identifies emerging opportunities for agriculture • Sets direction for local planning of agricultural development. 1.2 Protect important agricultural land identified in the regional agricultural development strategy from land use conflict and fragmentation and manage the interface between important agricultural lands and other land uses. 1.3 Minimise biosecurity risks by undertaking risk assessments, taking into account biosecurity plans and applying appropriate buffer areas.	The Department of Primary Industries (DPI) is conducting a 3-year program to map and recognise important agricultural land. The draft Riverina Murry Important Agricultural Land Mapping was on public exhibition through November and December 2018; however, the plan is no longer available for public viewing as it is being revised to take into consideration all public feedback. As such, important agricultural land from this draft plan cannot be considered in the EIS. The significance of the land has been assessed under the Primary Production SEPP 2019, the former Rural Lands SEPP 2008, the Mining SEPP 2007 and the Land and Soil Capability (LSC) Scheme. It has been determined that the land is not classified as significant under the relevant SEPPs, and as Class 3 under the LSC Scheme. Use of the subject land for the proposal will not cause conflict or fragment the landscape, given that agricultural activities in the form of grazing can continue on the site. The proposal also provides additional agricultural and economic opportunities for the relevant landowners and broader community.
Direction 2: Promote and grow the agribusiness sector 2.1 Encourage agribusiness diversification by reviewing local plans and removing restrictive land use zonings and outdated land use definitions.	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.

Goal 1: Direction and Actions	EIS Consideration
2.2 Provide opportunities to improve support to agriculture through better guidance on protecting agricultural land and managing the interface with other land uses. 2.3 Facilitate investment in the agricultural supply chain by protecting assets, including freight and logistics facilities, from land use conflict arising from the encroachment of incompatible land uses.	As mentioned above, agricultural activities in the form of grazing can continue on the site. It is the intention of the Proponent and the relevant landowners to continue low density, strategic grazing on the site. Strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.
Direction 11: Promote the diversification of energy supplies through renewable energy generation 11.1 Encourage renewable energy projects by identifying locations with renewable energy potential and ready access to connect with the electricity network. 11.2 Promote best practice community engagement and maximise community benefits from all utility-scale renewable energy projects. 11.3 Promote appropriate smaller-scale renewable energy projects using bioenergy, solar, wind, small-scale hydro, geothermal or other innovative storage technologies.	The Proponent reviewed the solar generation potential of many areas in NSW. The proposed site was selected because it provides the optimal combination of low environmental constraints, level terrain, high quality solar resources, compatible land zoning, capacity in the grid transmission system and onsite access to connect to the network. The community has been engaged throughout the development process, with local benefits including direct and indirect employment, providing significant participation opportunities for local businesses, direct business volume for local services, materials and contracting, increased spending in the community and Council rates revenue.

4.4.4 2018 Draft Riverina Murry Important Agricultural Land Mapping

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

4.5 SUMMARY OF LICENCES

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

Table 4-6 Summary of licences required.

Instrument	Licence or approval requirement
EP&A Act, Part 4	SSD applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPIE.
Roads Act, section 138	Any works to public or classified roads require consent under this act from the road authority. Greater Hume Shire Council is the roads authority for public roads within the Culcairn area and NSW RMS is the roads authority for Olympic 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 is being sought by The

Instrument	Licence or approval requirement
	Proponent from Greater Hume Shire Council for use of a standpipe and to operate an onsite sewage management system.
Workcover Notification	Exceedance of 10,000 kg of lithium-ion batteries requires Workcover notification.
Oversize Overmass Permit	An oversize overmass permit will be required from the relevant road authority (Council and/or RMS) for any oversized vehicles.

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

5 STAKEHOLDER CONSULTATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Consultation –

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

In particular, you must undertake detailed consultation with affected landowners surrounding the development and Greater Hume Local Government Area.

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

Further consultation after 2 years –

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

DEPARTMENT OF INDUSTRY (AGRICULTURE)

Adequate consultation with community –

- *Consult with relevant agencies such as on the design, construction and operation of the proposed infrastructure.*
- *Consult with the owners/managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about the proposal, the likely impacts and suitable mitigation measures or compensation.*
- *Establish a Complaints Register that includes reporting and investigation procedures and timelines, and liaison with Council in relation to complaint issues.*

5.1 AGENCY CONSULTATION

Secretary's Environmental Assessment Requirements (SEARs)

As the proposal is classified as SSD, a Scoping Report was prepared, and the SEARs requested for a 350 MW (AC) / 402.5 MW (DC) PV solar farm at Culcairn. The SEARs were issued by DPIE on 3 May 2019 (refer Appendix A). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

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

Department of Planning and Environment

Issue summary	Addressed in EIS
General Requirements – The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. In particular, the EIS must include: • a stand-alone executive summary; • a full description of the development, including:	 Executive Summary

<table>
<tr><th>Issue summary</th><th>Addressed in EIS</th></tr>
<tr><td>details of construction, operation and decommissioning;</td><td>Section 1.2</td></tr>
<tr><td>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;</td><td></td></tr>
<tr><td>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);</td><td>Section 2</td></tr>
<tr><td>an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:
a description of the existing environment likely to be affected by the development;
an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments in the region (in particular Hurricane Hill Quarry and the proposed Walla Walla, Jindera and Glenellen Solar Farms), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;
a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and
a description of the measures that would be implemented to monitor and report on the environmental performance of the development;</td><td>Section 6, Section 7</td></tr>
<tr><td>a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and</td><td>Section 8</td></tr>
<tr><td>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;</td><td>Section 4.2.1</td></tr>
<tr><td>the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and</td><td>Section 1.2</td></tr>
<tr><td>feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.</td><td>Section 2.4</td></tr>
<tr><td>a detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department’s guidance on the matter.</td><td>Section 2.1.3</td></tr>
<tr><td>The EIS must also be accompanied by a report from a suitably qualified person providing:
a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived; and
certification that the information provided is accurate at the date of preparation.
The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).

The EIS must address the following specific issues:</td><td>Appendix N (confidential)</td></tr>
</table>

Issue summary	Addressed in EIS
Biodiversity – • an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values; • the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and • an assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.	Section 6.8
Heritage – Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.	Section 6.9 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; ○ a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and ○ a cumulative impact assessment of nearby developments; • an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including: ○ consideration of the zoning provisions applying to the land, including subdivision, and; ○ completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide;* and ○ a description of measures that would be implemented to remediate the land following decommissioning in accordance with *State Environmental Planning Policy No 55 - Remediation of Land*.	Section 6.5
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 6.2
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 operations in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	Section 6.3
Transport – • an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation; • an assessment of the likely transport impacts to the site access route (including Olympic Highway, Cummings Road, Benambra Road, and Weeamera Road), 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;	Section 6.6

Issue summary	Addressed in EIS
• a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); • a description of the measures that would be implemented to mitigate any transport impacts during construction; and	
Water – • An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Back Creek, Billabong Creek, drainage channels, wetlands, riparian land, farm dams, floodplains, key fish habitat, groundwater dependent ecosystems and acid sulphate soils) , related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; • Details of water requirements and supply arrangements for construction and operation; and • A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).	Section 6.7
Hazards and Risks – • A preliminary risk screening in accordance with *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33* (DoP, 2011), and if the preliminary risk screening indicates the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DoP, 2011) and *Multi-Level Risk Assessment* (DoP, 2011); and • An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure against the *International Commission on Non-Ionising Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Field*.	Section 7.4
Socio-Economic – Including an assessment of the likely impacts on the local community 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 must consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Greater Hume Local Government Area. 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.	Section 5

Greater Hume Council

Issue summary	Addressed in this EIS
Detailed information concerning the proposed recycling of generated packaging waste.	Section 7.4
Traffic assessment to include cumulative impacts of the possibility of an adjacent large-scale solar development being constructed concurrently to this proposal.	Section 6.6.3
Clarity concerning the numbers employed during the operational phase of the development.	Section 3.7.4
Council wishes to advise that since 2012 a section 94A Fixed Development Contribution Plan has applied to all of the Greater Hume Council area and Council has adopted a new Section 7.12 Fixed Development Contribution Plan. Since the introduction of the Fixed Development Contribution Plan all Proponents of eligible development have had a condition of consent applied upon their development consents requiring payment of the contribution. In accordance with the requirements of Fixed Development Contribution Plans payment is applicable irrespective of whether there is an impact from the development on local infrastructure. Accordingly Council wishes to assert that a failure by the Department of Planning to apply a S7.12 contribution in line with Council's Fixed Development Contribution Plan on this development would be inequitable to those that have previously paid or will in the future pay the levy. Should the Department of Planning be inclined to require the Proponent to enter into a Voluntary Planning Agreement (VPA) with Council, then it is requested that negotiations and the VPA be finalised before determination of development consent for the approval of the project. It is expected that the terms of the VPA would be consistent with the payment that would be received by Council from its Fixed Development Contribution Plan.	

The Proponent held a meeting with the Greater Hume Council on 22 February 2018, 22 October 2018, 28 November 2018, 21 March 2019 and 2 August 2019. Updates of the proposal were provided to Council with consultation continuing through to submission.

The Proponent sought permission for use of a nearby Council standpipe and provided information to Council about the proposed subdivision. Council has provided provisional consent for use of the standpipe and has raised no objection to the proposed subdivision (Appendix C).

Mike Wilson from Amber, who provided the Traffic Impact Assessment, consulted with Greater Hume Council regarding the proposed route for construction access via Benambra and Weeamera Roads. Initial phone discussions were held between Amber and Greg Blackie (Council) in March 2019 regarding confirmation of construction access from Cummings Road. Further consultation with Council confirmed that the access route via Benambra and Weeamera Roads was acceptable and vehicles could cross Cummings Road via rural driveways between the two sections of the site.

Email consultation between Amber and Council continued and primarily involves the provision of daily traffic data for Benambra Road and details for Weeamera Road. It is provided in Appendix C.1.

Department of Industry (DOI)

Issue summary	Addressed in this EIS
DOI Water – • The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to	Section 6.7

Issue summary	Addressed in this EIS
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).	
DPI – Agriculture DPE's Large Scale Solar Energy Guideline for State Significant Developments, highlights areas of constraint for site selection as being "*important agricultural lands, including Strategic Agricultural Land (both critical industry clusters and biophysical strategic agricultural land), and land with soil capability classes 1, 2 and 3*". DPI Agriculture notes that the land that is subject to this proposal is classified as soil capability class 4 and thus is not constrained.	
A baseline soil conditions report should be included in the EIS so that rehabilitation plans and performance measures can be developed to inform the Proponent when decommissioning occurs.	Appendix K
NSW DPI Agriculture provides the following recommended SEARs to assist the Proponent in addressing the recommended SEARs. Site suitable for development –	
• Detail that the proposal is consistent with relevant SEPPs, strategic plans and LEP requirements with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential).	Section 4.2, Section 4.4
• Complete a Land Use Conflict Risk Assessment (LUCRA) to identify potential land use conflict, in particular relating to separation distances and management practices to minimise odour, dust and noise from sensitive receptors. A LUCRA is described in the DPI Land Use Conflict Risk Assessment Guide.	Section 6.5
• Include a map to scale showing the above operational and infrastructure details including separation distances from sensitive receptors.	Section 6.3.2, Figure 6-5
Consideration for impacts to agricultural resources and land – • Describe the current agricultural status and productivity of the proposed development site and surrounding locality including the land capability as per the OEH *Land and soil capability assessment scheme*. • Demonstrate that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated. • Consider possible cumulative effects to agricultural enterprises and landholders. • Detail the expected life span of the proposed development. • Outline strategies to manage impact of agricultural aerial spraying in the area. • Outline details of potential land use sharing with agriculture. Suitable and secure water supply	Section 6.5

Issue summary	Addressed in this EIS
• Outline any impacts to water use from agriculture and mitigation measures if required.	Section 6.7
Biosecurity –	
• Include a biosecurity (pests, weeds and disease) risk assessment outlining the likely plant, animal and community risks. • Develop a biosecurity response plan to deal with identified risks as well as contingency plans for any failures. Including monitoring and mitigation measures in weed, disease and pest management plans. • Details of adequate fencing to keep livestock out.	Section 6.5.2, Section 7.6.2
Suitable traffic movements –	
• Consideration of the route for movements needs to be taken into account so that impacts on sensitive receptors are minimised (e.g. noise, dust, volume of traffic). This should include consideration of Travelling Stock Reserves (TSR) and the movement of livestock or farm vehicles along/across the affected roads.	Section 6.6
Visual amenity –	
• Amenity impacts are assessed in accordance with the methods outlined in the DPE's *Wind Energy Visual Bulletin* and any necessary response to mitigate visual impacts is described and illustrated. In particular night lighting, glare and any impacts on amenity for adjacent landholders.	Section 6.2
Land stewardship met –	
• If any earthworks are proposed, an assessment of the overall footprint where the natural contours of the land will be modified, the total amount of material involved, how any stockpiled material will be managed and outline of how this material will or will not be used for agricultural rehabilitation purposes. • A full soil survey to be undertaken prior to works commencing as a benchmark for agricultural land rehabilitation. • Develop a **Rehabilitation and Decommissioning/Closure Management Plan** that outlines the rehabilitation objectives and strategies to return the land to its pre-project status. This includes but is not limited to removing all above and below ground infrastructure, describing the design criteria of the final land use and landform, indicators to be used to guide the return of the land back to agricultural production, along with the expected timeline for the rehabilitation program. • Measures to remediate the land following decommissioning in accordance with *State Environmental Planning Policy No. 55 – Remediation of Land.* • Outline monitoring and mitigation measures to be adopted for rehabilitation remedial actions. • Any land with a cropping history or land with a capability of category 3 or better as per the *Land and soil capability assessment scheme: second approximation (OEH),* all cables/pipes to be buried at a depth > 500 mm to allow greater opportunity for agricultural activities to continue over the top. • Trenching through sodic soils during construction must include soil amendment with Gypsum at a minimum rate of 10 t/ha. Actual rates to be determined following soil testing (Clay content, ECEC and EC).	Section 6.5, Section 7.3, Appendix K
Adequate consultation with community –	
• Consult with relevant agencies such as on the design, construction and operation of the proposed infrastructure.	Section 5.1, Section 5.3

Issue summary	Addressed in this EIS
• Consult with the owners/managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about the proposal, the likely impacts and suitable mitigation measures or compensation. • Establish a complaints register that includes reporting and investigation procedures and timelines, and liaison with Council in relation to complaint issues. Contingency and Environmental Management Plan developed – • Contingency plans should be developed to enable the operation to deal with emergency situations. Commitment to the preparation of an Emergency Management Plan that outlines procedures and responsibilities for responding to bushfire threats and possible mass mortality events which might result from extreme climatic conditions, routine or emergency animal disease outbreaks.	Section 7.4
DOI Crown Lands – There are two Crown Public Roads located near the proposal. Should the roads be required for site access to the proposal area, it is recommended that application be made to close and purchase the road by the applicant, or the road be transferred to Council. Transfer or closure must be completed before works are undertaken.	Section 6.6

The Proponent sent a request to DOI Crown Lands on 29 October 2019 for landowner consent regarding use and crossing of the paper road, Schoff's Lane. Hannah Smith from Crown Land informed the Proponent on 21 November 2019 that the landowner consent would be recognised with the final EIS document (Appendix C).

DPE (Resources and Geoscience)

Issue summary	Addressed in this EIS
The Division has identified that the 'Hurricane Hill' hard rock quarry operated by Boral Resources is located approximately 1.5 kilometres (km) to the north of the proposal site (Figure 1). Consideration should be given to the impacts the project may have on extractive operations. The draft SEARs require the Proponent to address the projects potential land use conflicts with existing and future surrounding land uses. These include mining, mining and petroleum rights. The draft SEARs also includes the requirement for consultation during the preparation of the Environmental Impact Statement (EIS) with exploration licence holders, quarry operators and mineral title holders. The Proponent should identify any of the above in the EIS and consult with the operators or title holders to establish if the proposal is likely to have a significant impact on current or future extraction of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of resources). The EIS should also document any way the proposed development may be incompatible with existing or approved uses, or current or future extraction or recovery of resources under the land use compatibility requirements of Part 3 (13) of the Mining SEPP. In fulfilling the SEARs relating to the State's mineral resources and rights to assess and extract those resources, the Division requires the following project specific requirements to be addressed in the EIS: • The Proponent should undertake a dated and referenced search for any new mineral, coal and petroleum title applications over or adjacent to the proposal site during the preparation of the EIS. Evidence of the search should be provided in the form of a date referenced map. Current mining and exploration titles and applications can be viewed through the Division's MinView map viewer.	Section 6.5

Issue summary	Addressed in this EIS
• The Proponent must consult with the operators of Hurricane Hill, Boral Resources Pty Ltd and provide evidence of authentic consultation to the Division. This should include a letter of notification of the proposal to the quarry operator including a map indicating the solar farm project area (including associated electricity transmission infrastructure) in relation to the quarry site boundaries, and a letter of response from the quarry operator to the Proponent. If responses are not received from the quarry operator, the Proponent is to contact the Division. No biodiversity offsets have been proposed at this stage. The Division will assess any proposed biodiversity offset areas (both on and off site) or any supplementary biodiversity measures on review of the EIS.	

NGH requested a response from DPIE Division of Resources and Geoscience for a Clause 13 assessment of the subject land. A response was received on 16 November 2018 confirming there are no current mineral, coal or petroleum titles over the site or adjacent lands (Appendix C).

Local Land Services (LLS)

Issue summary	Addressed in this EIS
Clearing provisions under the *Local Land Services Act 2013*, section 60O states that for the purposes of this Part, the clearing of native vegetation in a regulated rural area is authorised under other legislation in any of the following cases: • The clearing was authorised by (i) a development consent under Part 4 of the *Environmental Planning and Assessment Act 1979*, or • A State Significant Infrastructure approval under Part 5.1 of this Act. Although the planning pathway for SSD 10288 negates separate consent under the LLS Act, the following are proposed to be incorporated to inform the SEARs process to this point: • Cleared farmland will likely be deemed Category 1 land, in the absence of a published Native Vegetation Regulatory (NVR) Map https://www.environment.nsw.gov.au/biodiversity/regulatorymap.htm • Remnant areas and scattered trees would be deemed Category 2 land and will generate credits. • Hollow-bearing trees, where dead, will require consideration for potential threatened species impact even though they are not considered live native vegetation under the LLS Act. • Removal or minimising impacts to the ecological values within the project area. Remnant native vegetation and the scattered paddock trees to be avoided as far as practicable. • Where retained, vegetation buffers be created to ensure indirect impacts do not occur during construction or operation of the Solar Farm. • Tree Protection Zones to be established on remnant vegetation and scattered trees <u>not approved</u> for clearing (if any), with retained patches of vegetation to be fenced, and operations excluded from them (if required). • A BDAR will be prepared, and OEH must be consulted (as they will have been to date for input to SEARs). Prior to planning approval being finalised, there must be a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development. Also, a strategy to offset any residual impacts of the development in accordance with the BC Act must be in place.	Section 6.8, Appendix D

Fire and Rescue (FR) NSW

Issue summary	Addressed in this EIS
In the event of a fire or hazardous material incident, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matter are recommended to be addressed: 1. That a comprehensive ERP is developed for the site. 2. That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, battery energy storage systems, bushfires in the immediate vicinity) or potential hazmat incidents. 3. That the ERP detail the appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical hazards). Such measures 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 for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment). 4. Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. 5. That two copies of the ERP (detailed in recommendation 1 above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s. 6. Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC). The ELMC is a committee established by Section 28 of the *State Emergency and Rescue Management Act 1989*. LEMCs are required to be established so that emergency services organisations and other government and non-government agencies can proactively develop comprehensive inter-agency local emergency procedures for significant hazardous sites within their local government area. The contact details of members of the LEMC can be obtained from the relevant local council. 7. As a Condition of Consent that a Fire Safety Study (FSS) be prepared for the BESS part of the site and submitted to FRNSW for review and determination. The FSS should be developed in consultation with and to the satisfaction of FRNSW.	Section 7.4.2

Office of Environment and Heritage

Issue summary	Addressed in this EIS
OEH recommends that the EIS appropriately address the following • Biodiversity and offsetting • Aboriginal cultural heritage • Flooding The EIS should fully describe the proposal, the existing environment, including threatened species habitat not associated with vegetation communities, such as paddock trees, and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data. The assessment must include all ancillary infrastructure associated with the project such as roads, water and power supplies, and Rural Fire Service requirements for asset protection.	Section 6.8 Section 6.9 Section 6.7.2

Issue summary	Addressed in this EIS
The Scoping Report indicates that remnant vegetation will be largely retained but the layout of the development means numerous paddock trees would be removed. The threatened species habitat value of these trees will need to be determined as part of the EIS process, along with an assessment of indirect impacts to the remnant woodland patches occurring within the proposed solar array. Mitigation measures will include an appropriate buffer between the development footprint and remaining native vegetation. Appendix B of the Scoping Report provides the result of a basic AHIMS search undertaken 13 November 2018 that identified 13 sites in, or near, the subject site. Where a basic AHIMS search has shown that there are Aboriginal sites or places recorded within the search area an extensive AHIMS search must be undertaken. We note that Appendix B of the Scoping Report also provides results from an extensive AHIMS search, however these results appear to pertain to a different site at least 22 km further south of the proposed activity. Different parameters have been applied (i.e. coordinates), the search only identifies six known sites, and it is dated 2 August 2018, which is three months earlier than the basic AHIMS search. We recommend that the EIS provide more current AHIMS results and that extensive search results relate to the basic search. Based on OEH records and the archaeological context of the subject site, as detailed by the scoping report, we concur that an Aboriginal cultural heritage assessment of the development footprint should be undertaken. This is to be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (OEH 2010), inclusive of consultation with relevant Aboriginal stakeholders. While there is no requirement to obtain an Aboriginal Heritage Impact Permit (AHIP) for State Significant Developments, the Proponent must comply with all other legislative requirements under Part 6 of the *National Parks and Wildlife Act 1974.* The EIS should specifically address the attached requirements for flooding and conduct flood modelling for the purposes of appropriately locating infrastructure and for addressing post-development impacts outside the site.	
Biodiversity – • Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the BC Act (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values. • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM. • The BDAR must include details of the measures proposed to address the offset obligation as follows; a) The total number and classes of biodiversity credits required to be retired for the development/project; b) The number and classes of like-for-like biodiversity credits proposed to be retired; c) The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d) Any proposal to fund a biodiversity conservation action; e) Any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. • The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM.	Section 6.8, Appendix D

Issue summary	Addressed in this EIS
• The BDAR must be prepared by a person accredited in accordance with the *Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017* under s6.10 of the BC Act.	
Aboriginal cultural heritage – • The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (OEH 2010), and be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW 2011) and consultation with OEH regional branch officers. • Consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for Proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR. • Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH. • The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR. • The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts. • The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	Section 6.9, Appendix G
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: • Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the *NSW Heritage Manual* (1996); • Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria); • Include a statement of heritage impact for all heritage items (including significance assessment); • Consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and	Section 7.2

Issue summary	Addressed in this EIS
access, landscape and vistas, and architectural noise treatment (as relevant); and • Where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.	
Flooding – The EIS must map the following features relevant to flooding as described in the *Floodplain Development Manual 2005* (NSW Government 2005) including: • Flood prone land. • Flood planning area, the area below the flood planning level. • Hydraulic categorisation (floodways and flood storage areas). • Flood hazard. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event. The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: • Current flood behaviour for a range of design events as identified above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change. Modelling in the EIS must consider and document: • Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies. • The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. • Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. • Relevant provisions of the *NSW Floodplain Development Manual 2005*. The EIS must assess the impacts on the proposed development on flood behaviour, including: • Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure. • Consistency with Council Floodplain Risk Management Plans. • Consistency with any Rural Floodplain Management Plans. • Compatibility with the flood hazard of the land. • Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. • Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. • Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses. • Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council. • Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.	Section 6.7

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

NGH contacted the BCD Land Management and Biodiversity Conservation Division on 24 July 2019 for the mapped important areas of the Swift Parrot. A response on 30 July 2019 confirmed that the lots are not within draft important areas for Swift Parrot (Appendix C).

Roads and Maritime Services (RMS)

Issue summary	Addressed in this EIS
The subject site is located with frontage to Weeamera Road and Cummings Road to the southwest of Culcairn. From the information provided it is understood that access to the development site is proposed to be from Weeamera Road, which is classed as a local road, within a 100 km/hr speed zone. Weeamera Road is an approved B-double route. Access to the site particularly for the delivery of components will rely on access to Weeamera Road via Cummings Road or Benambra Road from the Olympic Highway, which is a Classified Road. All these roads are approved B-Double Routes. Given the scale and operational characteristics of the proposed development Roads and Maritime Services considers that the traffic related issues relevant to the development should be considered and addressed in 2 distinct stages as follows: • Construction & Decommission phase – the transport of materials and equipment/components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including workers vehicles, during the construction of the facility; • Operational phase – the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project. Roads and Maritime Services emphasises the need to minimise the impacts of any development on the existing road network and maintain the level of safety, efficiency and maintenance along the road network. Given the type and scale of the proposal and assessment of the potential traffic impacts on the surrounding road network due to the development, particularly during the construction phase, should be submitted with the Development Application to allow for an informed assessment of the development proposal. This is consistent with the draft SEARs which refers to the need to address transport issues. The cumulative traffic with the nearby quarry also needs to be addressed particularly through the intersection of Benambra Road with the Olympic Highway. The required contents and detail of the Traffic Impact Assessment (TIA) will depend on the scale of the proposed development, the characteristics of the potential traffic generation and the traffic volumes and other traffic generating influences on the surrounding public road network. The Traffic Assessment shall detail the potential impacts associated with the construction and operation phases of the development, the measures to be implemented to maintain the standard and safety of the road network, and procedures to monitor and ensure compliance. The workforce traffic to the development site and potential options to minimise traffic generated by the construction workforce to the site and fatigue issues also needs to be addressed. Given the potential volume of traffic and the need for deliveries of the components to the development site during the construction period the supporting documentation identifies that a Traffic Management Plan is required to be prepared.	Section 6.6

Issue summary	Addressed in this EIS
Details for deliveries of ancillary materials such as gravel and concrete should also be considered as part of the submitted documentation. Where road safety concerns are identified at a specific location along the haulage route/s, the TIA may be supported by a targeted Road Safety Audit undertaken by suitably qualified persons. For guidance in the preparation of the TIA the applicant is referred to section 2 of the *Guide to Traffic Generating Developments* prepared by the RTA and the Austroads publications, particularly the Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development and Austroads Guide to Traffic Management Part 3 – Traffic Studies and Analysis. The TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site. Given the type and scale of the proposed development and its proximity to the public road network it is considered appropriate that issues relating to potential for distraction of, and for glare impacts on, passing motorists be addressed in the development submission. As a minimum, consideration should be given to the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.	

Mike Wilson from Amber, who provided the Traffic Impact Assessment, consulted with RMS regarding the proposed route for construction access via Benambra and Weeamera Roads. Phone discussions with RMS in March 2019 followed the initial consultation with Greater Hume Council. Consultation with RMS was with Maurice Morgan and Chris Bamberry regarding the use of Cummings Road for construction access. RMS indicated that turning movements from Olympic Highway to Cummings Road of construction traffic was unsuitable because of the turning angle. As such, they suggested the use of Benambra Road given the recent upgrades to the intersection with the Olympic Highway.

Email consultation between Amber and RMS continued and primarily involves the provision of daily traffic data for Olympic Highway and Benambra Road and is provided in Appendix C.1.

TransGrid

Issue summary	Addressed in this EIS
TransGrid is working closely with Neoen for their Culcairn Solar Farm connection. TrandGrid has already undertaken a formal connection enquiry response and has entered into a formal Connection Processes Agreement with Neoen to complete a detailed scoping study and designs, with a view to entering into a formal project and connection agreements for the generation connection.	Appendix C

A formal Preliminary Connection Enquiry to TransGrid was made by the Proponent. Discussions with TransGrid continue to develop the connection strategy and updates have been provided by the Proponent.

Essential Energy

The Proponent has been in consultation with Essential Energy, as there are 11 vK transmission lines that cross the site. Essential Energy have noted that the Client must allow a 20 m easement (10 m either side of the existing transmission line), and will have to submit a Request to Encroach for any roads or other associated infrastructure that may be within the 20 m easement. The Proponent has started the process for the Request to Encroach (Appendix C.2).

5.2 ABORIGINAL COMMUNITY CONSULTATION

5.2.1 Local Aboriginal Land Council and Registered Aboriginal Parties

The consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the (ACHCRP) guide. 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 G. A summary of actions carried out in following these stages are as follows.

Stage 1. Letters outlining the development proposal and the need to carry out an ACHA were sent to the Albury LALC and various statutory authorities including the former Office of Environment and Heritage (now referred to as DPIE), as identified under the ACHCRP. An advertisement was placed in the local newspapers, the *Eastern Riverina Classifieds* on the 7th of November 2018 seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by the former Office of Environment and Heritage in correspondence to NGH. 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 and an individual registered their interest in the proposal. These were:

- Albury and District Local Aboriginal Land Council (Albury LALC).
- Bundyi Aboriginal Cultural Knowledge (BAC).
- Yalmambirra.

No other party registered their interest.

Stage 2. On the 14th of December 2018, an Assessment Methodology document for the Culcairn Solar Farm was sent to the three registered Aboriginal parties 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 proposal area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from the registered parties however all expressed an interest in participating in fieldwork.

The field survey of the Culcairn Solar Farm proposal area in February 2019 in conjunction with an assessment of contour data, archaeological modelling and consideration of the comments from the Registered Aboriginal Parties who participated in the fieldwork resulted in the identification of several areas considered to have potential for *in situ* subsurface deposits that required further assessment within the proposal area if they could not be avoided. While some areas considered to have potential for *in situ* subsurface deposits have been avoided others were unable to be avoided by the proposed development footprint. Subsequently, a Subsurface Testing Methodology document for the Culcairn Solar Farm was sent to the registered Aboriginal parties on the 17th of May 2019. This document provided details of the proposed subsurface testing methodology and invited comments regarding the proposed methodology. 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 survey fieldwork was organised, and the two registered groups with appropriate insurances were asked to participate in the fieldwork. The survey fieldwork was carried out in early February 2019 by three archaeologists from NGH with local Aboriginal representatives.

The subsurface testing fieldwork was organised for September 2019 and the two registered groups with appropriate insurances were asked to participate in the testing programme. The subsurface testing was carried out between 17th to 25th of September 2019 by two archaeologists from NGH with local Aboriginal representatives.

Stage 4. In November 2019 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal (Appendix G) was forwarded to the RAPs inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was 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 28 day consultation period started 21st November 2019.

5.3 BROADER COMMUNITY CONSULTATION

The Proponent and NGH have undertaken consultation with the local community in addition to any requirements of the SEARs in line with DPE's *Guidelines for Major Project Community Consultation* (October 2007) 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.). The following section describes the consultation undertaken. Consultation activities were informed by Beyond Public Meetings: Connecting community engagement with decision making, Twyford Consulting (2007). The Community Relation Plan (CRP) is available in Appendix C.4.

5.3.1 Community consultation activities to date

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

- Development of a project website to provide information and updates http://www.culcairnsolarfarm.com.au/. The website went live in early 2018 and is updated regularly. An online feedback form can be filled in to submit suggestions.
- Establishment of a dedicated email address for feedback to contact@culcairnsolarfarm.com.au.
- Meetings have been held with representatives of Greater Hume Shire Council on 25 January 2018, 22 February 2018, 22 October 2018, 28 November 2018, 21 March 2019 and 2 August 2019 to discuss proposal information, community concerns and engagement, and Council engagement.

- Consultation with Boral for approval in principle for the use of water during construction and operation. Further consultation with Boral to provide project information and updates (Appendix C).
- Consultation with APA Group regarding the Gas Pipeline easement through the subject land (Appendix C).
- Direct engagement with neighbours through phone calls, letters, emails, face to face meetings and community open day events:
    - Adjacent landowners and those within 3 km of the project site were contacted with an invitation to meet for the first time in November 2018. Initial meetings were held on 8 and 9 November 2018 and 27 and 28 November 2018. Information provided to the adjacent landowners who attended the meeting included:
        - Presentation of the Proponent.
        - Presentation of the development process of a solar farm in NSW.
        - Potential land considered for the development.
        - Discussions on the concerns raised by the landowners.
        - The contact email address of the project was shared.
        - A presentation leaflet on solar development and the Proponent, a 2-page information leaflet on the project and a feedback form were provided to neighbours to allow for early feedback on the project.
    - Neighbours were provided initial answers to their feedback and concerns by phone or email. They were offered the possibility to provide feedback through a face to face meeting or by phone when a face to face meeting was not possible.
    - An opportunity was provided to the neighbours to meet with the Proponent prior to the community open day in Culcairn. An update of the project was provided by email or post mail to neighbours within 3 km of the project site informing them that the Scoping report had been lodged.
    - On 16 May 2019, the Proponent held a Community Drop-in Session at the Culcairn Bowling Club on Olympic Highway. This session was advertised in the Border Mail, and in the two local Newsletters of Walla Walla and Culcairn. The Proponent was available to meet and answer questions from 2 to 8 pm. More than 100 people attended the session. Provided to those in attendance included:
        - Information presented in posters (Appendix C.4).
        - Takeaway information leaflets containing the presented information.
        - Contact numbers, project email address, and project website.
        - Feedback surveys.
- Intensive engagement with three identified stakeholder groups:
    - Immediate neighbours.
    - The wider community.
    - Business community.
- Between mid-August and October 2019 the Proponent:
    - Presented to Councillors of the Greater Hume Council.
    - Presented to the Culcairn Development Committee.
    - Held conversations with some members of the Walla Walla Development Committee independently.
    - Held meetings and phone discussions with farmers and townspeople of the wider community.

  - Engaged with the local Landcare group and local community development groups, offering to hold a workshop with the Culcairn Development Committee and the Walla Walla Community Development Committee.
- The Proponent provided the opportunity to interested community members to visit The Proponent's nearby operational Numurkah Solar Farm in Victoria. On 2 October 2019, around 20 people accepted the invitation to participate in the tour with people attending from Culcairn and Walla Walla.

5.3.2 Results of community consultation

- The main concerns raised during the initial neighbour consultation in November 2018:
  - Development of a solar farm on agricultural land.
  - Local economic impact of a solar farm during its operations compared to normal agricultural operations of the land.
  - Visual amenity and effect on adjacent property values.
  - Heat effect of solar farms and impact on neighbouring farming operations.
  - Health impacts of a solar farm.
  - Bush fire risk management.
  - Weed and vegetation management.
- Between mid-August and October 2019 over 130 interviews were conducted with residents of Walla Walla and Culcairn, and with some of the wider shire. The majority of these were held in private homes with family members; a smaller number were with neighbours, friends or in business settings. A small number were by phone where respondents could not schedule a meeting or felt their concerns could be captured by a brief conversation.
- All of those who had left their details on feedback forms at the Community Drop-in Session were contacted.
- Priority concerns identified by neighbours and the Proponent's response and strategies to the priority concerns are provided in the Table 5-1 and Table 5-2:

Table 5-1 Priority concerns of neighbours.

Level of concern	Description of concern
High	The loss of productive agricultural land in an agricultural landscape increasingly being impacted by drought and climate change.
High	Inequity concerns: there are no neighbour benefits, neighbours have no voice in the process and yet neighbours will potentially be the most directly affected by this change.
High	The loss of agricultural landscape i.e. aesthetic impacts and how this will impact them in an ongoing way, particularly for those that identified as intergenerational farmers.
High	Fire risk from neighbouring properties and implications for insurance of neighbours/ community.
Medium	Construction impacts: • Noise, dust and heat impacts on livestock. • Dust effects from high traffic on dirt roads.
Medium	Length of time for any new planting of vegetation to grow and provide screening of solar farm.

Medium	Impacts on wildlife corridors/ landscape connectivity through construction and lifetime of project, including tree removal.
Medium	General concerns about management of solar project and potential risks for community e.g. weed management, drainage.
Medium	Fear of decline in property values in the area.
Low	Fear that drainage lines will be modified on solar farm block, resulting in changes to hydrology of area.

High: Referenced by neighbours as a central issue (no prompting).

Medium: Referenced by all neighbours as secondary concern.

Low: Referenced by some neighbours.

Table 5-2 Response and strategies to address neighbour concerns.

Concern	Response and strategies to address concerns
Loss of Productive Agricultural Land	• Provide opportunities for adjacent landowners to utilise land under solar panels for sheep grazing. Communicate with neighbours regarding other opportunities for maximising land use on solar farms (as per advice from local agronomists, farmers and Landcare) • The Proponent commissioned an expert review into sheep grazing, which is currently undertaken on all 5 of its operating solar farms in NSW and VIC. Early indications show there is the potential for up to 80% grazing carrying capacity under solar panels. Appendix P is the sheep grazing vegetation management trial report for the Proponent's Nurmurkah Solar Farm in Victoria. • The Dubbo Solar Farm sheep grazing experience was captured in a short community information video which showed the co-benefits of combining grazing with solar. During periods of drought the productivity of the land has actually increased due to the shade provided by the panels and the dripping of dew and moisture along the leading edge of the panels causing strips of green growth. This video has been widely shared on social media, and has been shown to Great Hume Shire Council, and at a number of community presentations, as well as the recent Renewables & Agriculture Forum in Wagga. • The Proponent initiated discussions with CSIRO about a 3 year longitudinal 'agrisolar' research project exploring agrisolar co-benefits and ways to maximise productivity yields as well as soil quality, biodiversity and the potential for carbon sequestration. This research opportunity was presented at the Clean Energy Council's Utility-scale PV Directorate meeting in October and an industry consortium is currently advancing the research project. • The Proponent's response to the concern about the use of agricultural land has been considered and comprehensive. The intention has been to seek to understand and then to communicate the existing knowledge around the opportunities for combining agriculture and solar and then to take an active role in leading the industry to advance our understanding of how to maximise combined land use productivity. **Land use impacts addressed in section 6.5.**
Inequity Concerns & Construction Impacts	• In an industry-first, the Proponent is offering solar farm neighbour payments totalling $200-$300k. The payment is configured as a one-off 'construction-disruption payment' to acknowledge the potential impacts of the construction phase on adjacent neighbours. • The Community Benefit Sharing package totals ~$10million. • Communicate with neighbours about how construction will impact on the land and identify areas of concern with neighbours.

	• Share projected timeframe with neighbours of construction process and likely impacts at each stage to help them with farming operations. • Consult with neighbours regarding plans to seal/ bitumise roads pre-construction. **Noise impacts addressed in section 6.3 and traffic impacts addressed in section 6.6.**
Loss of Agricultural Landscape & Vegetation Screening Maturity	• Plant a vegetation buffer to provide visual screening and habitat to reduce the view of the solar farm at adjacent neighbours. Consider the suggestion of a minimum number of tree rows. Ensure vegetation buffer includes mixed height vegetation to provide habitat for small birds. Consider inclusion of mature or fast-growing trees in planting of vegetation buffer. • Where hollow bearing trees must be removed from the site (old trees that are dead but provide hollows and important habitat for wildlife) consider re-locating them to nearby swamp or riparian areas where they can be retained as habitat for wildlife, preferably in a vertical position. **Visual impacts addressed in section 6.2 and biodiversity impacts addressed in section 6.8.**
Management of Project	• Share relevant management plans with neighbours e.g. weed management plan, dust management plan. • Provide opportunities for neighbours to visit other Neoen solar project sites. **Ongoing consultation described in section 5.3 and the Community Relations Plan (Appendix C.3).**
Property Values	• Share evidence from other sites to address concern around property devaluation. **Property value impacts addressed in section 6.4.**
Fire Risk & Insurance Liability	**Fire impacts addressed in section 7.4.**
Water Flows	**Impacts of infrastructure on flooding and flows addressed in section 6.7.**

- Feedback from community-wide consultation was mixed. However, majority of community feedback was in support of the proposal. Priority concerns identified by the community and the Proponent's response and strategies to the priority concerns are provided in the Table 5-3 and Table 5-4:

Table 5-3 Description of concern of wider community.

Level of concern	Description of concern
High	The loss of agricultural landscape i.e. aesthetic impacts, particularly expressed as a concern regarding immediate neighbours.
High	Fire risk from neighbouring properties and implications for insurance of neighbours/ community.
Medium	The loss of productive agricultural land in an agricultural landscape increasingly impacted by drought and climate change.
Medium	Impacts on wildlife corridors/ landscape connectivity through construction and lifetime of project, including tree removal.
Medium	General concerns about management of solar project and potential risks for community e.g. weed management, drainage, ongoing management of infrastructure, remediation of land when lease expires
Medium	Fear of decline in property values in the area.

Medium	Long term effects of community division resulting from proposal for four solar farms in the area.
Low	Community benefits fund mismanagement: fear of not having the funds used for local initiatives and used in the wider council area.

High: Referenced by the majority of interviewees as a critical issue when asked about concerns.

Medium: Referenced by around half of interviewees.

Low: Raised by some interviewees.

Table 5-4 Response and strategies to address wider community concerns.

Response and strategies to address concerns
Facts sheets developed and distributed by Neoen to help address specific points of concern raised by community members. This includes information about weed management, retention of landform, protection of biodiversity, heat-island effect, glare from solar panels, remediation of land etc. **Land use impacts addressed in section 6.5, weed management and biodiversity impacts addressed in section 6.8, heat-island effect addressed in section 7.1 and glare addressed in section 6.2.**
One on one meetings offered to all interested community members to discuss concerns and provide information. **Community Relations Plan (Appendix C.3).**
Fire impacts addressed in section 7.4.
Opportunity for community input to shape the proposed community benefit fund, including preferred structure and benefits. **Community Relations Plan (Appendix C.3).**
Discussion with local arborists, agronomists and Landcare to ensure local input to managing biodiversity impacts. Biodiversity impacts addressed in section 6.8 and visual screening addressed in section 6.2.

- The majority of local businesses that were involved during consultation were supportive of the proposal and identified potential benefits. The priority concerns identified by local businesses and the Proponent's response and strategies to the priority concerns are provided in the Table 5-5 and Table 5-6:

Table 5-5 Priority concerns of local businesses.

Level of concern	Description of concern
High	Business opportunities will be monopolised by larger external contractors with economies of scale.
High	Construction and management of solar farm will have little benefit to the local economy.
High	The potential for long term business impacts from the community division (many local businesses have staff both opposing and supporting the solar farm proposal).

High: Referenced by the majority of interviewees as a critical issue when asked about concerns.

Table 5-6 Response and strategies to address local business concerns.

Response and strategies to address concerns
Development of a Local Participation Plan to maximise the local business opportunities on the project. **Community Relations Plan (Appendix C.3).**

Response and strategies to address concerns
Development of a business registry to communicate opportunities at each stage of the process. **Community Relations Plan (Appendix C.3).**
Continue to meet with local businesses to share information and collect contact information. **Community Relations Plan (Appendix C.3).**
Provide information from other solar projects on the local business opportunities. **Community Relations Plan (Appendix C.3).**

- Although during consultation there was a focus on concerns with the proposal, there were also substantial positive views expressed and are provided in Table 5-7:

Table 5-7 Positive opinions of the proposal from neighbours, community and business.

Stakeholder group	Description of concern
Neighbours	Positive impacts on the local economy
	Farming opportunities e.g. sheep grazing
	Potential for access to solar farm infrastructure e.g. WIFI
	Improvements to local roads.
	Opportunity for community benefit fund to support agricultural enterprise.
Community	Positive impacts on the local economy through employment and education.
	Represents a practical response to climate change and supports the transition to renewables.
	Potential for new ideas to help reenergise the local economy and community
	Long term impacts of the community benefits fund over the life of the project.
	Contribution to native vegetation recovery through offsets and revegetation work
	Potential for community to invest in the solar farm.
	Solar farm installation gives the land a rest from intensive agriculture regime.
	Opportunity for local agronomists and farmers to have input to land management practices on the solar farm.
	Opportunities for local schools to support student learning about renewables.
Business	Positive impacts on the local economy during the construction period.
	Employment opportunities for local businesses and contractors.
	Potential for development of skills and expertise in the renewables sector (and future application to other projects).
	Potential for local businesses to take on apprentices during the construction period.
	Permanent employment for local people.

5.3.3 Continued engagement

Engagement activities would continue throughout the EIS determination period.

The CRP would be reviewed regularly, as well as at key transition phases between different stages of project development (e.g. prior to construction or operation). The Plan would continue to guide engagement activities at all stages of the project, ensuring that engagement is appropriate and in line with good practice.

A second tour to Neoen's operational Nurmurkah Solar Farm in Victoria is being organised for late November / early December 2019.

Continued consultation would continue to be carried out with the nearest neighbours regarding visual impact and vegetation planting where required following commissioning of the solar farm, as discussed in section 6.2.

6 ENVIRONMENTAL IMPACT ASSESSMENT

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:*
    - *A description of the existing environment likely to be affected by the development;*
    - *An assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments in the region (in particular Hurricane Hill Quarry and the proposed Walla Walla, Jindera and Glenellen Solar Farms), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes or practice;*
    - *A description of the measures that would be implemented to monitor and report on the environmental performance of the development.*

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

OEH recommends that the EIS appropriately address the following:

1. *Biodiversity and offsetting*
2. *Aboriginal cultural heritage*
3. *Flooding.*

The EIS should fully describe the proposal, the existing environment, including threatened species habitat not associated with vegetation communities, such as paddock trees, and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data. The assessment must include all ancillary infrastructure associated with the project such as roads, water and power supplies, and Rural Fire Service requirements for asset protection.

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 proposals. 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 impacts were investigated.

Table 6-1 Analysis of adverse environmental issues.

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
Visual	• Design modified to include 30 m infrastructure setbacks to adjacent properties. • Security fence setback from property boundary and screened by any existing vegetation and proposed planting. • Location of substation in the middle of the proposal to minimise visual impact on nearest residences. • Strategic screening plantings.	High	Low to Medium
Noise	• Design to include infrastructure setbacks adjacent to near neighbours. • Location of substation in the middle of the proposal to minimise noise impact on nearest residences. • No inverters installed within 320 m of nearest residence. • Construction mitigation measures implemented to minimise noise impacts on adjacent neighbours.	High	Low
Socioeconomic	• The proposal would provide approximately 350 FTE jobs during construction and approximately 5 to 10 FTE during operation. • The proposal would diversify employment opportunities, reducing reliance on the agriculture sector (vulnerable to climate and market fluctuations) in Walla Walla/Culcairn. • Desktop investigations indicate that property prices of adjacent productive agriculture land would	Medium	Low

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
	not be adversely impacted by the proposal.		
Land use	• Investigations into the likely impacts of the proposal on regional agricultural productivity suggest minimal impact. • Sheep grazing capacity partly retained during operation. • Income diversification can assist farmers to offset input costs for the portion of their land used solely for primary agriculture.	High	Low to Medium
Transport	• Main construction access relocated to Weeamera Road to make use of heavy vehicle enabled Benambra Road and southern Weeamera Road. Remaining construction access would be through the site, reducing noise and dust impact outside the development footprint. • Crossing points on Cummings Road would minimise impacts on local roads.	High	Low to Medium
Biodiversity	• Designed to reduce clearing of remnant vegetation patches. • The full 20 farm dams would be retained. • Significant vegetation screening would enhance retained habitat.	High	Low
Aboriginal heritage	• Design modified to avoid PADs, modified trees and cultural trees. Isolated artefacts and artefact scatters would be relocated and retained within the development site.	Medium	Low
Soil and water	• Desktop investigations suggest that the proposal could improve soil health and structure over time. • Soil stability is suitable to support solar farm infrastructure.	Medium	Low

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
	• Existing landform and drainage would not be altered by the proposal. • Infrastructure would be placed so that the proposal has minimal impact on surface water (and debris) moving during a flood event.		
Climate	• 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
Hazards	• Fire preparation measures would exceed Planning for Bushfire Protection Guidelines (RFS 2018).	High	Low to Medium
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.	Medium	Low
Cumulative impacts	• Cumulative impacts for noise, visual amenity and traffic have been addressed for the proposal and the proposed Walla Walla Solar Farm. • Noise impacts, there is one sensitive receiver within 1 km of both proposed solar farms. There are no exceedances for construction or operation noise impacts at this receiver.	Medium	Low

Environmental risk	Outcomes	Impact (unmitigated)	Impact (mitigated)
	• Visual impact, there is one sensitive receiver where broken views of solar farm infrastructure of both proposals would be visible. • Traffic impacts are considered unlikely and would be short-term if both proposals are approved and construction times are concurrent. Ongoing consultation with the developers and Boral Quarry staff would ensure traffic impacts along Benambra Road are minimal. • Agricultural land use, only 0.44% of agricultural land within the Greater Hume Shire would be temporarily removed.		

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

- Visual amenity.
- Noise and vibration.
- Socio-economic and community.
- Land use and resources.
- 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 and air quality, historic heritage, soil, health and safety-related hazards, resource use and waste, and cumulative impact.

Visual amenity, biodiversity, Aboriginal heritage, traffic and flooding were investigated by specialists.

Full visual impact and quantitative noise assessments are provided in sections 6.2 and 6.3, whereas the reports for biodiversity and Aboriginal heritage, traffic and flood potential are attached as Appendix D, Appendix G, Appendix H and Appendix I respectively (also summarised in section 6). Land use has been assessed in section 6.5 and addresses guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013) and the *Land and soil capability assessment scheme* (OEH 2012). Lower risk issues are addressed in section 7.

Where a particular risk has also been captured during the community engagement as being a concern for community members, these concerns or queries have also been provided.

6.2 VISUAL IMPACT

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

Visual –

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

DEPARTMENT OF INDUSTRY (AGRICULTURE)

Visual amenity –

Amenity impacts are assessed in accordance with the methods outlined in the DPE's Wind Energy Visual Bulletin and any necessary response to mitigate visual impacts is described and illustrated. In particular night lighting, glare and any impacts on amenity for adjacent landholders.

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

- Landscape character and scenic vistas.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints.
- Addressing requirements of the SEARs.
- Addressing the requirements of the NSW Large-scale Solar Energy Guidelines (DPE 2018).

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

6.2.1 Approach

The VIA has been completed in the following stages:

1. Background investigations and mapping to define where infrastructure may be visible in the landscape and identify key viewpoints such as major travel routes and potential receivers.
2. Field survey including reconnaissance, ground truthing and photography.
3. Consultation, including understanding community values and documenting community perception.
4. Impact assessment, describing the potential impact on visual amenity during operation of the proposal.
5. Development of a visual impact mitigation strategy.

The impact assessment is based on describing the potential impact on visual amenity at the residences of all sensitive receivers within and just beyond a 1 km radius of the development site. A visual impact would be more likely at these receivers within this radius of the flat landscape. One receiver was included situated beyond the 1 km radius. Panoramic photographs were taken at all the receivers who were identified within the 1 km radius and accepted the offer of photography. Photomontages were prepared for all receivers with a potential view of the proposal and are further described below.

Sensitive receivers assessed for visual impact are mapped in Figure 6-1. It includes the representative viewpoints used for R28, R30 and R31 who refused the opportunity to have a panoramic photograph from their residence. R03 was not offered the opportunity for a photomontage as it was assumed that there would be no view due to the riparian vegetation along Billabong Creek. Therefore, a representative viewpoint has been used. R25 and R26 were offered the opportunity for a photomontage but refused. The viewpoints for Weeamera Road, Cummings Road and Morgan’s Lookout are mapped in Figure 6-2.

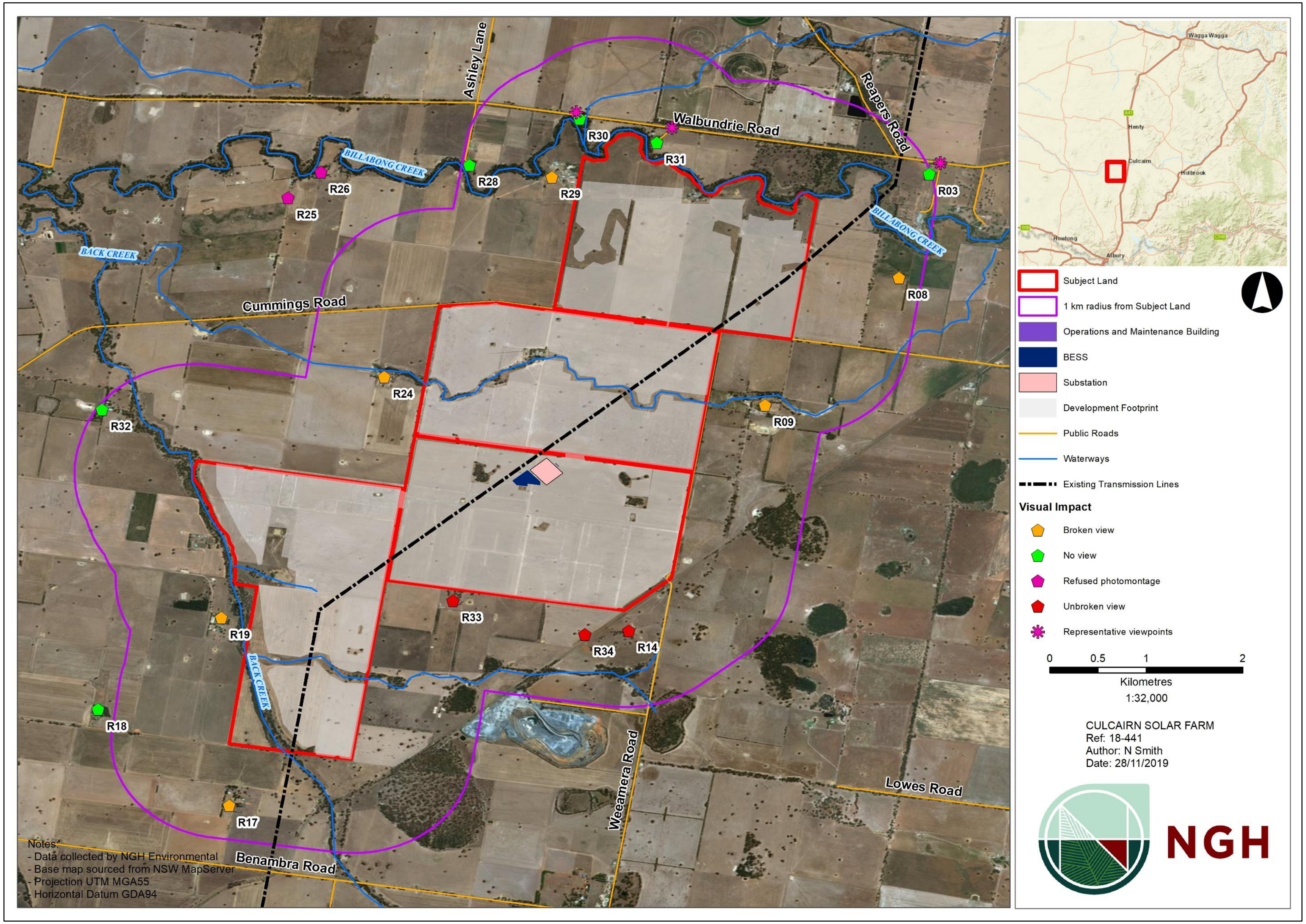

Figure 6-1 Location of receiver impacts assessed and the representative viewpoints used for R03, R28, R30 and R31.

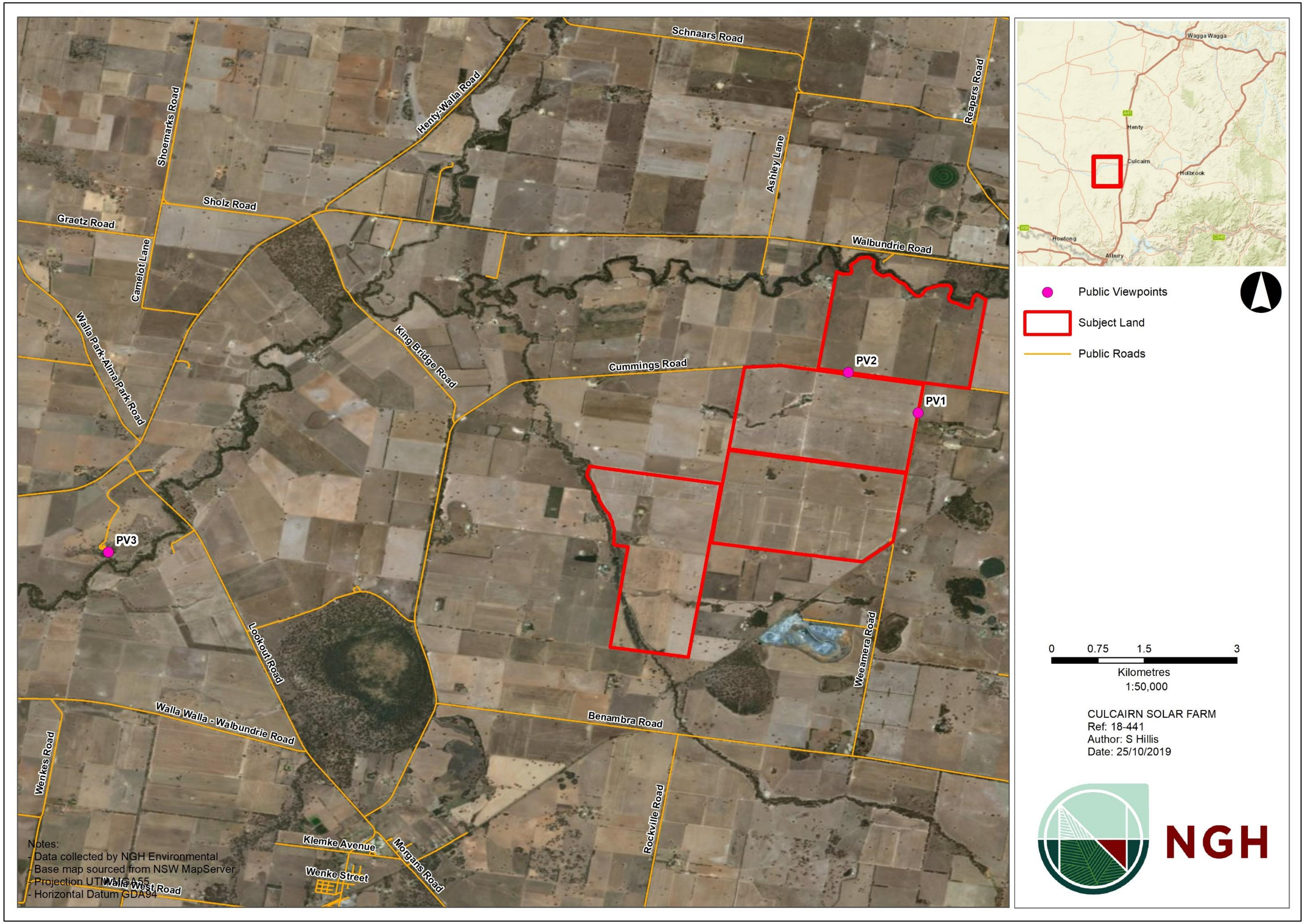

Figure 6-2 Public viewpoints of the proposed Culcairn Solar Farm including Weeamera Road (PV1), Cummings Road (PV2) and Morgan's Lookout (PV3).

6.2.2 Photomontages

Photomontages provide a realistic impression of the operational solar farm. The viewpoints for the photomontages reflect the potential view of the operational solar farm from all receivers within a 1 km radius of the development site who accepted the opportunity to have a panoramic taken from their residence. Three public viewpoints included a frequently used road, a local road and a lookout. The photomontage for the road views include proposed security fencing.

The photomontages for receivers have been included in this report with permission from the resident. Descriptive text of the potential visual impact of the operation of the proposal has been used in place of the photomontages where permission was not received from the resident for the use of the montage in this document. A list of the receivers who were offered an opportunity for a panoramic / montage and the response is include in Table 6-2.

Table 6-2 Receivers and responses to panoramic/montage.

Receiver	Offer for a photomontage accepted?
R03	Assumed no view, therefore no offer.
R08	Yes
R09	Yes
R14	Yes, includes security fence.
R17	Yes
R18	Yes
R19	Yes
R24	Yes, includes security fence.
R25	No
R26	No
R28	No
R29	Yes
R30	No
R31	No
R32	Not offered
R33	Yes, includes security fence.
R34	Yes

Each montage shows a specific view from a residence and has been provided to the relevant resident. The photomontages were produced to facilitate discussion between the affected resident and the Proponent.

The photomontages show an artist's impressions of the proposed solar farm and the extent of the view based on available knowledge of the proposed activity at the time of preparation. Actual infrastructure types and location may be subject to change.

6.2.3 Community values

Community consultation specific to the assessment of visual impacts for the proposal was conducted for near neighbours and the broader community. 34 households within 3 km were directly consulted as part of the process.

Nearest neighbours

- During November 2018, landholders within 3 km of the proposal were contacted by the Proponent.
- In May and September 2019, Urbaine Architecture visited the homes of residents within 1 km of the proposal who accepted the offer of a photo montage from their property. Montages of what the proposal may look like, including rendered images of solar panels, were created and provided to the relevant landowners in October 2019.
- One open community meeting was held in May 2019 in Culcairn.
- From May 2019, intensive engagement has continued with the near neighbours (within 3 km) via phone calls, emails, letters, face-to-face meetings, and via the website form and company contact details.
- All residents within a 3 km radius and community members that requested follow up with the Proponent during the community engagement period were contacted as per their requested contact method. This included face-to-face meetings, phone calls, emails and letters.

Broader community

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

A community Open Day was held on 16 May 2019, inviting all interested parties to query and comment on the proposal. The open day was advertised via the *Border Mail* and in two local newspapers of Walla Walla and Culcairn and the project website.

From May 2019, engagement has continued with the three identified community groups, including neighbours (within 3 km), wider community and local business. Consultation has been via phone calls, emails, letters, face-to-face meetings, response to feedback forms from the open day, and via the website form and company contact details.

Feedback forms

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

Results and visual concerns

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

During consultation with adjacent landowners, vegetative screening was discussed and agreed that the plantings would assist in breaking up the views:

- Proposed vegetative screening for a minimum of one row of mixed height native vegetation would be planted in strategic locations to break-up or soften views of the proposal. A minimum of three rows of mixed height vegetation would be planted where there are clear views from neighbouring dwellings.

6.2.4 Potential impacts

An operational visual impact assessment has been conducted considering:

- The proposed solar farm components.
- The potential for the proposed solar farm to be viewed from representative viewpoints.
- The potential impact from glare.

Evaluation criteria

The visual impact level is defined as:

- High impact: contrast to surrounds is greater than what is acceptable.
- Medium impact: contrast to surrounds is acceptable.
- Low impact: visual contrast to the surrounding environment is little or not perceived and is acceptable.

For high impact viewpoints, mitigation must be considered.

Photomontages

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

15 sensitive receivers were offered the opportunity for a panoramic from their residence. 8 of these were provided with a photomontage where the model discerned a view of proposed infrastructure.

Evaluation results

Table 6-3 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures (i.e. vegetative screening) and evaluates the expected level of visual impact from receiver viewpoints. Table 6-3 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures from the chosen public viewpoints. Note, three high impact viewpoints were identified.

Table 6-3 Visual impact at the residences of sensitive receivers with reference to the proposed solar farm at Culcairn.

R03

Existing view

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from Walbundrie Road facing south-west towards the proposal. The Viewpoint is representative of rural view of R03. Dominant features include cropping and grazing paddocks, scattered vegetation, fencing and the riparian vegetation along Billabong Creek. Proposed infrastructure is not likely to be discernible by residence due to distance and vegetative screening.
Proximity	Middle Ground (1-2 km)	
Inherent Visual Impact	**Indistinct**	The substation, control room, operations and maintenance building and BESS are more than 4 km south-west. **No mitigation required.**

R08

Existing view

Photomontage view of proposed solar infrastructure

R08

Extent of visual impact

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R08, infrastructure of the proposed solar farm is approximately 800 m west. Dominant features include scattered paddock trees, unsealed roads, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 3.5 km south-west. Broken views of the proposed infrastructure through scattered paddock trees are likely to be discernible. **Mitigation recommended.** A vegetative screen (minimum 15 m width) is recommended for the length of the solar farm boundary that is visible from the residence of R08 (LC305 Appendix E). The vegetative screening would assist in reducing the view of the proposed solar farm, resulting in a low mitigated visual impact.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Medium impact**	
Mitigated Visual Impact	**Low impact**	

R09

Existing view

Photomontage view of proposed solar infrastructure

Extent of visual impact

R09

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R09, infrastructure of the proposed solar farm is approximately 500 m west. Dominant features include scattered paddock trees, unsealed roads, grazing paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 1.8 km south-west. Broken views of the proposed infrastructure through scattered paddock trees would be noticeable. **No mitigation required.**
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Low impact**	

R14

Existing view

Photomontage view of proposed infrastructure

R14

Extent of visual impact

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R14, infrastructure of the proposed solar farm is approximately 250 m north-west. Dominant features include few scattered paddock trees, unused rail corridor, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 1.6 km north-west. Unbroken views of the proposed infrastructure through scattered paddock trees would be discernible. The photomontage includes proposed security fencing. There is potential for R14 to have views of the upgrade to Weeamera Road. However, Weeamera Road is approximately 250 m from R14 residence, and any impacts would be minimal and temporary. **Mitigation recommended.** A vegetative screen (minimum 40 m width) is recommended for the length of the solar farm boundary that is visible from the residence of R14 (LC301 Appendix E). The vegetative screening would assist in reducing the view of the proposal from the lower level of the residence and over time, break views from the upper level. The mitigated visual impact from this property would be medium as a result of the double storey residence.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**High impact**	
Mitigated Visual Impact	**Medium impact**	

R17

Existing view

Photomontage view of proposed infrastructure

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R17, infrastructure of the proposed solar farm is approximately 750 m north-east. Dominant features include few scattered paddock trees, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 4 km north-east.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Low impact**	Broken views of the proposed infrastructure through the riparian vegetation along Back Creek would be noticeable. **No mitigation required.**

R18

Existing view

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R18, infrastructure of the proposed solar farm is approximately 1.5 km east. Dominant features include few scattered paddock trees, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared with a slight rise east from the residence, as indicated in the image. The substation, control room, operations and maintenance building and BESS are more than 4 km north-east.
Proximity	Middle ground (< 1.5 km)	
Inherent Visual Impact	**Indistinct**	No views of the proposed infrastructure are visible from the residence R18. **No mitigation required.**

R19

Existing view

Photomontage view of proposed solar infrastructure

R19

Extent of visual impact

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R19, infrastructure of the proposed solar farm is approximately 350 m east. Dominant features include scattered paddock trees, grazing and cropping paddocks, fencing and extensive riparian vegetation along Back Creek. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 2.8 km east.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Low impact**	Minor broken views of the proposed infrastructure would be visible through the Back Creek riparian vegetation from the residence R19. **No mitigation required.**

R24

Existing view

Photomontage view of proposed infrastructure

Extent of visual impact

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R24, infrastructure of the proposed solar farm is approximately 370 m east. Dominant features include few scattered paddock trees, grazing and cropping paddocks, unsealed tracks, agricultural infrastructure and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 1.5 km south-east. Broken views of the proposed infrastructure through the riparian vegetation along the unnamed waterway and mature woodland along the undeveloped council road would be noticeable. The photomontage includes proposed security fencing. **Mitigation recommended.** A vegetative screen (minimum 15 m width) is recommended for the length of the solar farm boundary that is visible from the residence of R24 (LC304 Appendix E). The vegetative screening would assist in reducing the view of the proposed solar farm, resulting in a low mitigated visual impact.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Medium impact**	
Mitigated Visual Impact	**Low impact**	

R25		
No representative photograph. **Refer to Figure 6-1.**		
Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	The opportunity for a photomontage was refused. The proposal is approximately 2.4 km east of the residence R25. Dominant features include cropping and grazing paddocks, scattered paddock trees and fencing. The substation, control room, operations and maintenance building and BESS are more than 3 km south-east. Proposed infrastructure is not likely to be discernible by residence due to distance. **No mitigation required.**
Proximity	Background (> 2 km)	
Inherent Visual Impact	**Low impact**	

R26		
No representative photograph. **Refer to Figure 6-1.**		
Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	The opportunity for a photomontage was refused. The proposal is approximately 2.2 km east of the residence R26. Dominant features include cropping and grazing paddocks, scattered paddock trees and fencing. The substation, control room, operations and maintenance building and BESS are more than 3 km south-east. Proposed infrastructure is not likely to be discernible by residence due to distance. **No mitigation required.**
Proximity	Background (> 2 km)	
Inherent Visual Impact	**Low impact**	

R28	
Existing view	

Summary of Viewpoint	Viewpoint Description / Impact

R28		
Location	Residential	The landowner at R28 was provided with the opportunity for a panoramic to be taken from their property. However, this offer was refused. Taken from Walbundrie Road facing south towards the proposal. The proposal is approximately 950 m east from R28. The substation, control room, operations and maintenance building and BESS are more than 3 km south-east. The viewpoint is representative of rural view of R28. Dominant features include cropping and grazing paddocks, scattered paddock trees, fencing and the riparian vegetation along Billabong Creek. Proposed infrastructure is not likely to be discernible by residence due to distance and vegetative screening. **No mitigation required.**
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Indistinct**	

R29

Existing view

Photomontage view of proposed solar infrastructure

Extent of visual impact

R29

Summary of Viewpoint		Viewpoint Description / Impact
Location	Rural road	Taken from the residence R29, infrastructure of the proposed solar farm is approximately 270 m east. Dominant features include few scattered paddock trees, grazing and cropping paddocks, unsealed roads and tracks, agricultural infrastructure and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 2.9 km south-east. Proposed infrastructure is not likely to be discernible from residence due to distance and planted vegetative screening along the property boundary that adjoins the proposal. **No mitigation required.** Planted native vegetation along the boundary fence line of R29 and the proposal would continue to grow and screen the proposed infrastructure.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Low impact**	

R30

Existing view

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	The landowner at R30 was provided with the opportunity for a panoramic to be taken from their property. However, this offer was refused.
Proximity	Foreground (< 1 km)	

R30		
Inherent Visual Impact	**Indistinct**	Taken from Walbundrie Road facing south towards the proposal. The proposal is approximately 600 m south from the residence R30. The substation, control room, operations and maintenance building and BESS are more than 3.5 km south. The viewpoint is representative of rural view of R30. Dominant features include cropping and grazing paddocks, scattered paddock trees, fencing and the riparian vegetation along Billabong Creek. Proposed infrastructure is not likely to be discernible by residence due to distance and vegetative screening. **No mitigation required.**

R31

Existing view

Summary of Viewpoint		Viewpoint Description / Impact
Location	Rural road	The landowner at R31 was provided with the opportunity for a panoramic to be taken from their property. However, this offer was refused. Taken from Walbundrie Road facing south towards the proposal. The proposal is approximately 450 m south from the residence R31. The substation, control room, operations and maintenance building and BESS are more than 3.3 km south-east. The viewpoint is representative of rural view of R31. Dominant features include cropping and grazing paddocks, scattered paddock trees, fencing and riparian vegetation along Billabong Creek. Proposed infrastructure is not likely to be discernible by residence due to distance and vegetative screening. **No mitigation required.**
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**Indistinct**	

R32			
No representative photograph. **Refer to Figure 6-1.**			
Summary of Viewpoint		Viewpoint Description / Impact	
Location	Residential	The proposal is approximately 1 km south-east or 2.7 km east of the residence R32. The substation, control room, operations and maintenance building and BESS are more than 3.7 km east. Dominant features include cropping and grazing paddocks, scattered paddock trees, fencing, riparian vegetation along Back Creek and the woodland vegetation along the unformed Council road before the property boundary of the proposal. Proposed infrastructure is not likely to be discernible by residence due to distance and vegetative screening. **No mitigation required.**	
Proximity	Foreground (< 1 km)		
Inherent Visual Impact	**Low impact**		

R33

Existing view

Photomontage view of proposed solar infrastructure

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the residence R33, currently an unoccupied dwelling, infrastructure of the proposed solar farm is approximately 120 m north. Dominant features include paddock trees between the dwelling and boundary with the proposal, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 1.3 km north.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**High impact**	
Mitigated Visual Impact	**Low impact**	

R33		
		Unbroken views of the proposed infrastructure through scattered paddock trees would be discernible. The photomontage includes proposed security fencing. **Mitigation recommended.** A vegetative screen (minimum 20 m width) is recommended for the length of the solar farm boundary that is visible from the residence of R33 (LC302 Appendix E). The vegetative screening would reduce the visual impact of the proposed solar farm, resulting in a low mitigated visual impact.

R34

Existing view

Photomontage view of proposed infrastructure

Extent of visual impact

R34

Summary of Viewpoint		Viewpoint Description / Impact
Location	Residential	Taken from the unoccupied residence R34, infrastructure of the proposed solar farm is approximately 300 m north. Dominant features include scattered paddock trees between the dwelling and boundary with the proposal, grazing and cropping paddocks and fencing. Currently, the land is predominately cleared and flat. The substation, control room, operations and maintenance building and BESS are more than 1.5 km north. Unbroken views of the proposed infrastructure through scattered paddock trees would be discernible. **Mitigation recommended.** A vegetative screen (minimum 15 m width) is recommended for the length of the solar farm boundary that is visible from the residence of R34 (LC301 Appendix E). The vegetative screening would reduce the visual impact of the proposed solar farm, resulting in a low mitigated visual impact.
Proximity	Foreground (< 1 km)	
Inherent Visual Impact	**High impact**	
Mitigated Visual Impact	**Low impact – with mitigation**	

Table 6-4 Photomontages of Weeamera Road, Cummings Road and Morgan's Lookout.

PV1 – Weeamera Road

Existing view

Photomontage view of proposed infrastructure

Location	Weeamera Road
Proximity	Foreground (< 1 km)
Inherent Visual Impact	**Medium impact**
Mitigated Visual Impact	**Low impact**

Taken from Weeamera Road facing west towards the proposed solar farm. The viewpoint is representative both of the rural nature of the area and the industrial view of Weeamera Road. Dominant features include the sparsely tree lined, unsealed road, grazing and cropping paddocks, fencing and vegetation. Currently, the land is predominantly cleared and flat.

The location represents the view that motorists using this local road would have of the proposal as they drive north on the low to moderately used section of Weeamera Road, north of the turn-off to the Boral Quarry. Predominantly unbroken views of the proposed infrastructure through scattered roadside vegetation would be noticeable and may cause initial distraction to motorists using Weeamera Road. Views would, however, be fleeting due to speed of travel. The photomontage of proposed solar infrastructure includes proposed security fencing.

Mitigation recommended.

A vegetative screen (minimum 10 m) is recommended at the intersection of Weeamera and Cummings Road to reduce any motorist distraction at the intersection (LC305 Appendix E). This will increase overall safety of the intersection by screening the view of infrastructure from road users on the corner of Weeamera Road and both sides of Cummings Road.

PV2 – Cummings Road

Existing view (north)

Photomontage with proposed solar infrastructure (north)

Existing view (south)

Photomontage with proposed solar infrastructure (south)

Location	Cummings Road
Proximity	Foreground (< 1 km)
Inherent Visual Impact	**Medium impact**
Mitigated Visual Impact	**Low impact**

These photomontages are from Cummings Road, the top images are facing north from Cummings Road and the bottom images are facing south from Cummings Road. The viewpoint is representative both of the rural nature of the area and the industrial view of Cummings Road. Dominant features include the sparsely tree lined, sealed road, grazing and cropping paddocks, fencing and vegetation. Currently, the land is predominantly cleared and flat.

The location represents the view that motorists using this local road would have of the proposal as they drive east-west on the moderately used section of Cummings Road. Predominantly unbroken views of the proposed infrastructure through scattered roadside vegetation would be noticeable and may cause initial distraction to motorists using Cummings Road. Views would, however, be fleeting due to speed of travel. The photomontage of proposed solar infrastructure includes proposed security fencing.

Mitigation recommended.

A vegetative screen (minimum 5 m width) is recommended at the intersection of Weeamera and Cummings Road to reduce any motorist distraction at the intersection (LC305 Appendix E). This will increase overall safety of the intersection by screening the view of infrastructure from road users on the corner of Weeamera Road and both sides of Cummings Road.

PV3 – Morgan's Lookout

Existing view

Photomontage view of proposed infrastructure

Extent of visual impact

Location	Morgan's Lookout	Taken from the top of Morgan's Lookout facing north-east towards the proposed solar farm, which is approximately 7 km away. The viewpoint is representative of the rural nature of the area with 360-degree views of the surrounding landscape of the Greater Hume Shire. Dominant features include topographic highs and lows of the landscape, remnant vegetation, the extensive agricultural landscape (cleared, grazing and cropping paddocks) and exposed bedrock. Currently, the land is predominantly cleared and undulating. The location represents the view that individuals using this local tourist attraction would have of the proposal as they look out towards the north-east. Views of the proposed infrastructure through scattered vegetation would likely be discernible. Views of proposed infrastructure would however be distant. **No mitigation required.**
Proximity	Background (< 3 km)	
Inherent Visual Impact	**Low impact**	

6.2.5 Results summary

An indicative vegetative screening map has been provided in Figure 6-3 and a Concept Landscape Plan detailing proposed vegetative buffers, species type and planting density in Appendix E. The screening map and Landscape Plan is based on the visual assessment in section 6.2.4.

High impact – mitigation required

Three closest uninvolved receivers (R14, R33, R34) would be highly visually impacted by operation of the proposal. Views are in the foreground with minimal existing screening between the residence and the proposal to break up views of proposed infrastructure. It is noted that the dwellings in R33 and R34 are currently uninhabited.

Off-site vegetative screening as a mitigation strategy would be considered in consultation with the landowners and would be included in a Landscaping Plan approved prior to construction. Discussion would occur during the design phase of the proposal. Off-site screening would break up views of the solar farm and associated infrastructure, such as security fencing.

Medium impact – mitigation should be considered

Medium impacts are identified for two receivers (R08 and R24) and the public viewpoints from Cummings Road and Weeamera Road.

R08 is located approximately 800 m east of the proposal with views overlooking the proposed infrastructure. Existing paddock trees, agricultural fencing and unsealed access tracks break up the view of the development site. Dominant views would continue to be grazed and cropped agricultural land with the solar farm and associated infrastructure clearly visible towards the back of the foreground. The form of the infrastructure, low (generally <4 m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area. On-site vegetative screening as a mitigation strategy has been considered in consultation with the landowners and included in a Landscaping Plan approved prior to construction.

R24 is located approximately 370 m west of the proposal with views overlooking the proposed infrastructure. Existing paddock trees, agricultural fencing and unsealed access tracks break up the view of the development site. Dominant views would continue to be grazed and cropped agricultural land with the solar farm and associated infrastructure clearly visible in the middle of the foreground. The form of the infrastructure, low (generally <4 m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area. On-site vegetative screening as a mitigation strategy has been considered in consultation with the landowners and included in a Landscaping Plan approved prior to construction.

Vegetation screening comprising of native trees has been proposed to shield impacted dwellings from proposed infrastructure along the boundary of the development site where no existing native vegetation exists. It includes at the intersection of Weeamera and Cummings Road.

Low impact – no mitigation

Low impacts are seen for remaining residences and public viewpoint 3 (PV3), Morgan's Lookout. The views of the solar farm infrastructure would be difficult to perceive or indistinct. Low impacts are expected for the majority of the study area due to the distance to infrastructure, existing vegetative screening, retained on-site vegetation and the overall undulating terrain of the area. No mitigation is required for these locations.

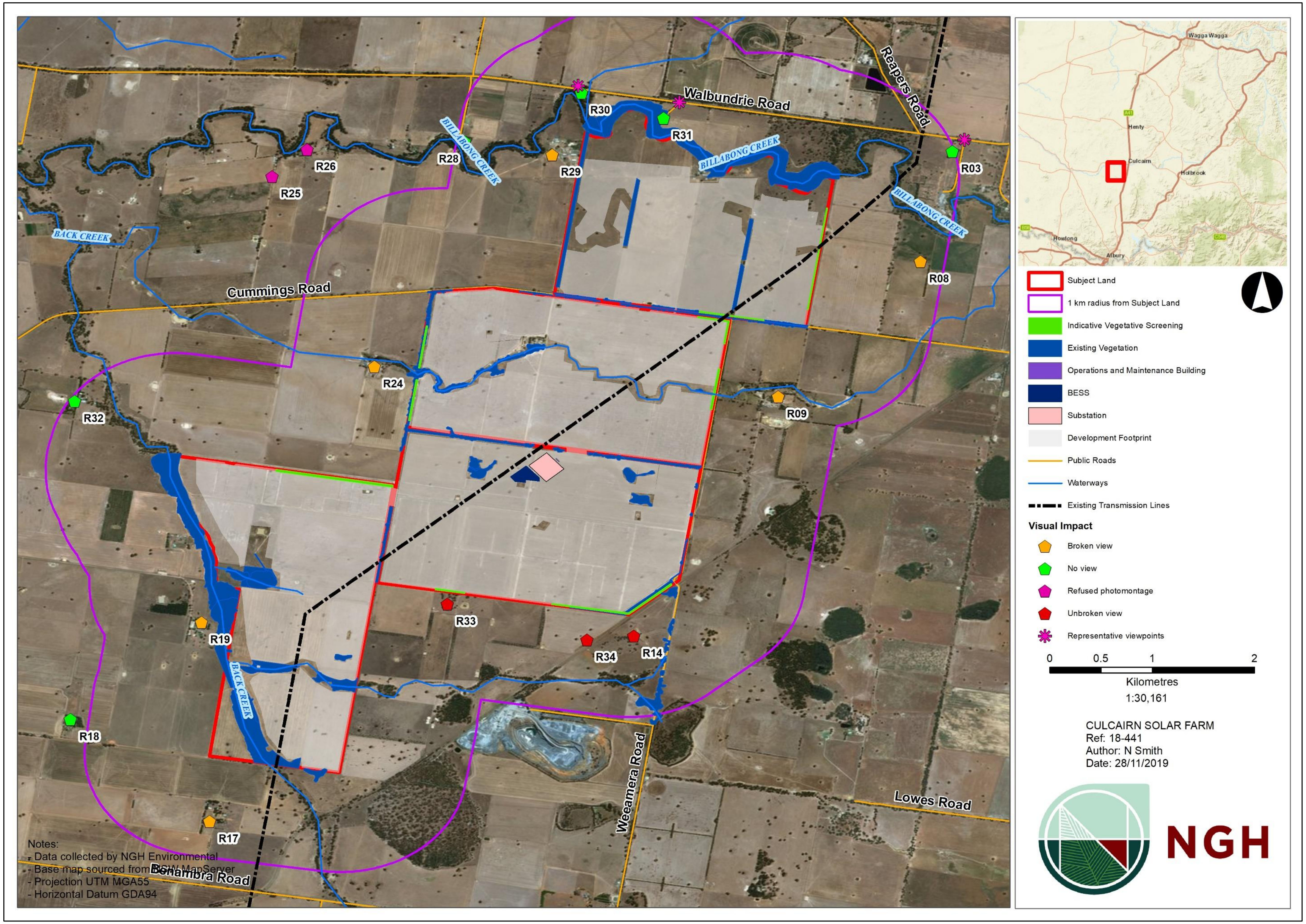

Figure 6-3 Indicative landscaping to break up views of the proposed infrastructure.

6.2.6 Glare

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. Improved manufacturing techniques on tier 1 panels include anti-reflective (AR) coatings on solar panels. This increases the amount of energy converted by the panels from sunlight. In addition, by minimising reflective losses from (or trapping more light within) solar panels, their performance can be increased while costs are lowered.

PV solar panels are designed to reflect as little sunlight as possible, generally around 2-4% of the light received (Spaven Consulting, 2011), resulting in negligible glare or reflection. This is supported by Fresnel's equation, which predicts that roughly 4% of the sunlight is reflected off the panel at normal incidence (i.e. when the sun's rays make an angle of 90°). Because every photon makes a difference in the efficiency electricity generation, significant investment has been made in AR coatings. 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.

AR coating can reduce the normal incidence reflectance to less than 1%. The AR coating performance results in increased power and energy output, which is designed to achieve greater than 99% transmittance. This spray-coating process is integrated into the panel manufacturing process.

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 photovoltaic farms have been installed on a number of airports around the world and in Australia such as Brisbane, Adelaide, Mildura 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.
- The onsite delivery station.
- Perimeter fencing.
- Permanent staff amenities.
- BESS.

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

6.2.7 Night lighting

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

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

Night lighting would be used on a very infrequent basis for:

- Construction security.
- Delivery of oversized, over mass vehicles.
- Operational maintenance.

6.2.8 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. The proposed Walla Walla Solar Farm is located within 2 km south of the proposal. The location of the proposed Culcairn Solar Farm in proximity to the proposal and sensitive receivers is shown in Figure 6-4.

Only 1 residential receiver, R17, would have views of both solar farms. Existing and retained vegetative screening and undulating terrain of the site would block out views from other residences. R17 has broken views of the southern section of the Culcairn Solar Farm, east of Back Creek (section 6.2.4). A view of the proposed Walla Walla Solar Farm infrastructure is also likely to be discernible to the southeast (Figure 6-4).

Construction

During construction, the additional traffic and dust generation impacts are probably the greatest potential for cumulative visual impacts. The visual impact of increased traffic movements to the site would be predominantly limited to construction. A Traffic Management Plan (TMP) would be developed to minimise vehicle movements and dust as much as practical for construction. Should both of these proposed solar farm proposals be approved, the TMP would include scheduling of vehicle movements to ensure congestion along the shared transport route of Benambra Road is minimised.

R15 would be the only common receiver, with the proposed Walla Walla Solar Farm impacted by traffic movements associated with the simultaneous construction of both solar farms and includes the traffic along Benambra Road and tuning onto Weeamera Road.

Operation

The operational view of the solar farm may generate a cumulative impact for residence R17 only. Screening to soften cumulative impacts has been recommended for this receiver. Generally, adverse cumulative visual impacts are anticipated to be manageable due to the existing and retained vegetative screening and undulating nature of the site that blocks out the majority of views.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles would be required. Cumulative visual traffic impacts are considered negligible. During operation, light vehicles would be able to access the proposal from the access points on Cummings Road and not via Benambra and Weeamera Roads.

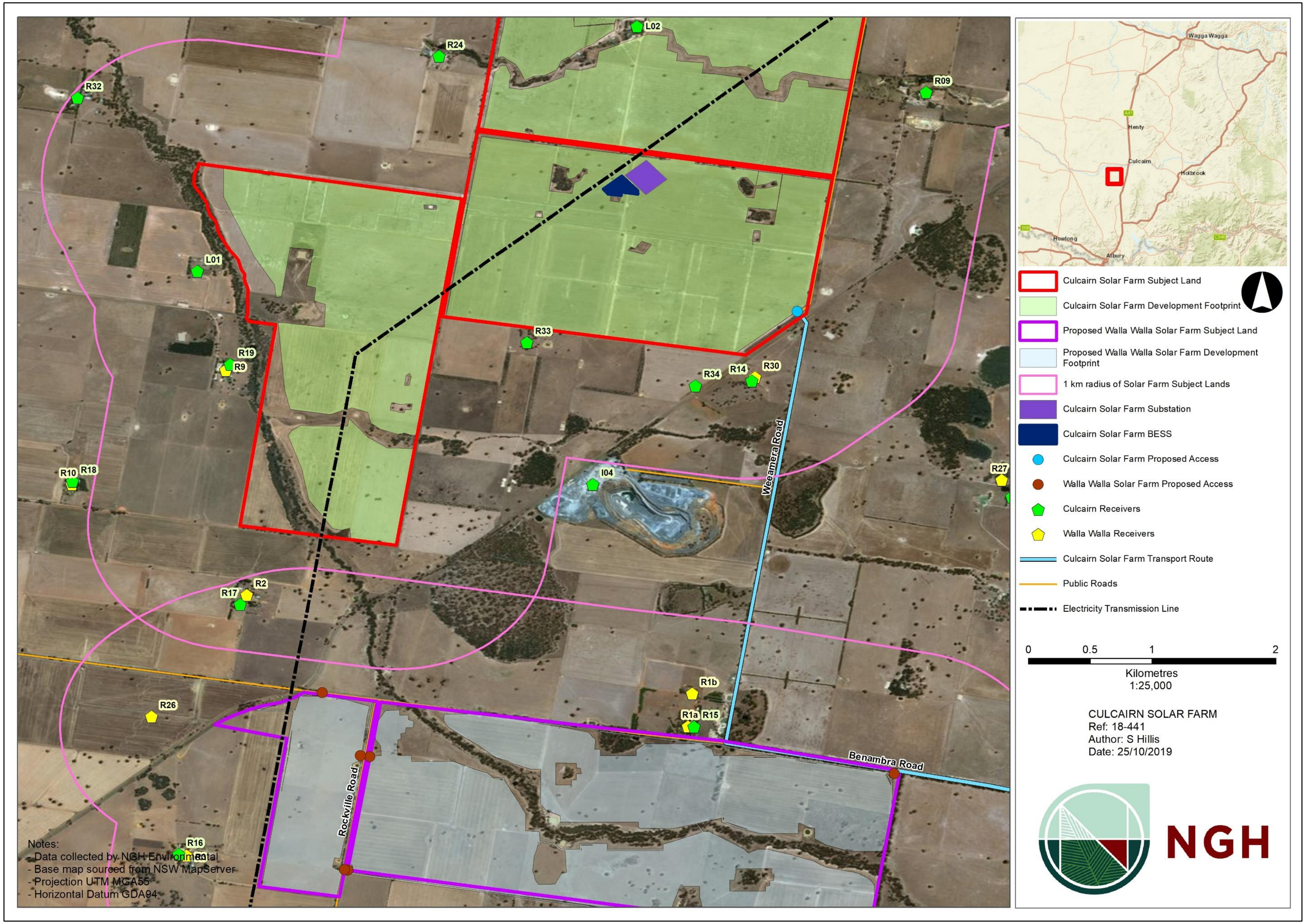

Figure 6-4 Cumulative impacts and proximity to the proposed Walla Walla Solar Farm.

6.2.9 Mitigation strategy

Screening

Screening vegetation has been considered in accordance with the draft infrastructure layout. Where there is no existing vegetative screening, a vegetative screen would be planted to reduce the view of the proposal for sensitive receivers and at the intersection of Weeamera Road and Cummings Road (Concept Landscape Plan – Appendix E). Mixed height vegetation would be planted for the screen where there are clear views from neighbouring dwellings. The purpose of the screening is to break up the view of the site. Screening requirements include:

- Plantings would be more than one row deep and planted on the outside of the permitter fence, to break up views of infrastructure including the fencing.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. They should be fast growing with mixed canopy height. Species selection could be undertaken in consultation with affected near neighbours and a botanist, horticulturalist or landscape architect.
- The timing is recommended to be chosen to ensure the best chance of survival and can commence during the construction of the proposal if timing suits.
- The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.

Plant species chosen for the visual screening as per the Concept Landscape Plan were chosen based on the existing Plant Community Types (PCT) on site, the General Native Vegetation Profile for the Walla Walla District, specialist input from a local Landscape Architect and known species available from local nurseries. It is expected that the mid-stratum shrubs will be fast growing and dispersing, providing effective coverage prior to establishment of the larger evergreen trees.

Species proposed on the site are as follows:

Table 6-5 Proposed species for vegetative screening

Large evergreen trees	Medium evergreen trees	Shrubs and groundcovers
Eucalyptus blakelyi (Blakely's Red Gum) *Eucalyptus melliodora* (Yellow Box) *Eucalyptus polyanthemos* (Red Box)	*Acacia dealbata* (Silver Wattle) *Acacia implexa* (Lightwood) *Allocasuarina luehmannii* (Bulloak) *Allocasuarina verticillata* (Drooping Sheoak)	*Acacia acinacea* (Gold-dust Wattle) *Acacia rubida* (Red-stemmed Wattle) *Bursaria spinosa* (Sweet Bursaria) *Dodonea viscosa* subsp. *angustissima* (Narrow-leaf Hop-bush)

It is noted that the aim of plant screens is to break up the view and not eliminate it entirely. Partial views will occur, particularly while vegetation is developing to maturity.

Landscaping plan

Prior to the commencement of construction, a detailed Landscaping Plan will be prepared including:

- Screening location.
- Species type.
- Planting density and spacing.
- Method for planting.

- Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method).
- A program to manage, monitor and report on the effectiveness of implemented measures.

General measures

The following measures are recommended to reduce the general visual impact of the development for all receivers:

DESIGN

The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:

- Buildings will be non-reflective and in eucalypt green, beige or muted brown.
- Pole mounts/piles will be non-reflective.
- Security fencing posts and wire will be non-reflective.
- Avoidance of unnecessary lighting, signage and logos.
- Retain and protect existing boundary landscaping.
- Large and obtrusive infrastructure such as the internal substation and the BESS will be located in the centre of the site, to afford the greatest distance from and to obscure the view from any potential receivers.

CONSTRUCTION

- 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.

NIGHT LIGHTING

- Comply with all relevant standards, codes of practice and policies.
- Light spill is light that fall outside the area that is intended to be lit and can contribute to glare and waste energy. Spill light above the horizontal plane also contributes to artificial skyglow. All light fittings should be located, aimed or shielded to avoid spill. Measures to prevent spill include:
    - Installing light fittings with an opaque cover and flat glass, mounted horizontally on both axes.
    - Mounting lights under part of a building (including awnings, verandah or roof) so light is blocked above the horizontal plane.
    - Design buildings to internalise lights.
- Wherever possible, light should be directed downwards. Mitigation measures include:
    - Installing direction fittings, such as floodlights or spotlights.
    - Use higher mounting heights that allow lower main beam angles that are closer to the vertical.
    - Lighting of all-night operations need to be downward facing, of a peach colour and shielded.
- Operational light from the proposal must be directed downwards, or inwards towards the work area.

- Light fittings that are specifically designed to minimise light shining near to or above the horizontal plane should be used.
- Energy efficient globes include LEDs and high-pressure sodium.
- Where floodlights are required, wherever possible use fittings with asymmetric beams that permit horizontal glazing. These are to be kept at or near parallel to the surface being lit, usually the ground, and should prevent light spill. An asymmetric beam also allows the light fitting to be mounted on the edge of an area and avoids the need for fittings to be tilted upwards. Flat glass light fittings should be installed with the glass horizontal to make efficient use of the brightest part of the beam and to eliminate light spill.

6.2.10 Safeguards and mitigation measures

Table 6-6 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
VA1	Screening would be required on-site, generally in accordance with the Landscaping Plan developed in consultation with neighbouring landholders. • Barrier plantings would be and, where practical, planted on specific sections of the outside of the perimeter fence to break up views of infrastructure including the fencing. • The proposed plant species to be used in the screen are native, fast growing, with spreading habitat and mixed mature heights of 2-4 m, 3-5 m and 5-10 m. Proposed plants derived from the naturally occurring vegetation community in this area. • Plants were selected in consultation with affected near neighbours and a botanist or landscape architect, and/or local Landcare groups. • The timing is recommended to be within 2 months of completion of construction so that actual views of infrastructure can be more certain. The timing of planting should also be chosen to ensure the best chance of survival. The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.	C	O	D
VA2	Prior to the commencement of construction, a detailed Landscaping Plan will be prepared including: • Screening location. • Species type. • Planting density and spacing. • Method for planting. • Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method). • A program to manage, monitor and report on the effectiveness of implemented measures.	Design stage		
VA3	The materials and colour of onsite infrastructure 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 and operational night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations. Lighting will comply with *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*, including: • Eliminating upward light spill, directing light downwards and directing light away from sensitive receivers. • Use of shielded light fixtures. • Using asymmetric beams. • Compile and record a complaint register.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

6.3 NOISE IMPACTS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Noise –

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

6.3.1 Policy setting

Construction noise

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

The ICNG provides direction on the calculation of 'noise management levels (NML)' for noise sensitive receivers. The NMLs are relative to the time of day. During standard construction hours, construction noise levels measured at a receiver should comply with Table 6-7. Receivers are 'highly noise affected' when measured construction noise is above 75 dB(A) at the receiver. Adhering to the levels described in the guidelines will minimise the impact of construction noise on adjacent receivers. The **rating background noise level** (RBL) is a single figure that represents background noise levels for noise assessment purposes. The noise descriptor L_{AF90} is the noise level that is exceeded for 90% of the time and is used to describe the RBL. The RBLs for the project have been adopted from Table 2.3 of the *Noise Policy for Industry* (NPI).

Table 6-7 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. 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 6-8.

Table 6-8 NPI intrusive noise goals.

Time of day	Intrusive noise = RBL + allowance
Day - 7 am to 6 pm	RBL + 5
Evening - 6pm to 10pm	RBL + 5
Night - 10pm to 7am	RBL + 5

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 represents the objective for noise from a single industrial development at a receiver. Industrial noise during operation should not normally exceed the acceptable noise levels for rural properties. The NPI describes the calculation of the project amenity noise level for industrial developments as the recommended amenity noise level minus 5 dB(A) (Table 6-9).

Table 6-9 NSW Noise Policy for Industry amenity goals.

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

6.3.2 Background

Existing environment

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

- Livestock grazing and management.
- Spraying, cultivation, planting and harvesting of crops.
- Transporting rural supplies and commodities.
- Hay making and transport.
- Quarrying and transport of materials.
- Road traffic noise from Benambra Road, Weeamera Road, Cummings Road, Walbundrie Road and the Olympic Highway.

Existing noise generating equipment and activities include; tractors, headers, bailers, grain and livestock transport, quad bikes, light vehicles, loaders, crushing plants, excavators, and heavy vehicles. These land uses characterise the background noise within the area. Noise levels from farm activities are likely to be concentrated at peak times during the year. Noise from adjacent quarry activities and road traffic are likely to be more continuous throughout the year.

Traffic volumes were obtained from Council for Benambra Road (southern boundary of the site). The most recent traffic volumes were recorded between May and June 2016. The average daily traffic (adt) volumes recorded from 7:00am to 7:00pm Monday to Friday were 46 vehicles per day (vpd) on the eastern length of Benambra Road. Benambra Road is one of two routes to Boral Resources' Hurricane Hill rock quarry. Heavy vehicles for quarry activities are expected to be a large percentage of the vehicle numbers on Benambra Road. Traffic utilising Benambra Road between Weeamera Road and Olympic Highway are dominated by heavy vehicle movements associated with Hurricane Hill Quarry.

The Olympic Highway about 3.5 km to the east of the proposal is a major transport route in the region. In 2010 over 4500 vehicles per day used the route. This was composed of 13% heavy vehicles including B-double semitrailers. If a 1.5% traffic growth rate is assumed the traffic volume on the Olympic Highway will be about 5200 in 2020. The traffic noise on the Olympic Highway contributes to the noise character of the area.

Sensitive receivers

Within 3 km of the proposed solar farm boundary 34 residential properties were identified (Figure 6-5). Also located within 3 km of the proposal are four industrial activities. Of the residential properties, 14 are considered to be sensitive receivers potentially affected by noise from the proposal. These 14 sensitive receivers are further evaluated for noise impacts. The 14 receivers were identified as potentially impacted based on their position in the relatively flat landscape. Sensitive receivers further than 1 km from the solar farm boundary and the internal substation are not adversely affected by noise. The dwelling at R33 is currently uninhabited. The distances between receivers and solar farm infrastructure has been increased by a 30 m setback from the subject land boundary to proposed infrastructure. The distance between these receivers and the proposed solar farm boundary and the internal substation are shown in Table 6-10.

Table 6-10 Distance between the nearest sensitive receivers and the proposal.

Receiver	Distance (m) to Subject Land boundary	Distance (m) from internal substation
R03	987	4362
R08	809	3480
R09	499	1843
R14	213	1657
R17	629	4253
R19	250	3015
R24	343	1557
R28	934	3097
R29	228	2903
R30	355	3516
R31	129	3389
R32	958	3659
R33	121	1428
R34	297	1577

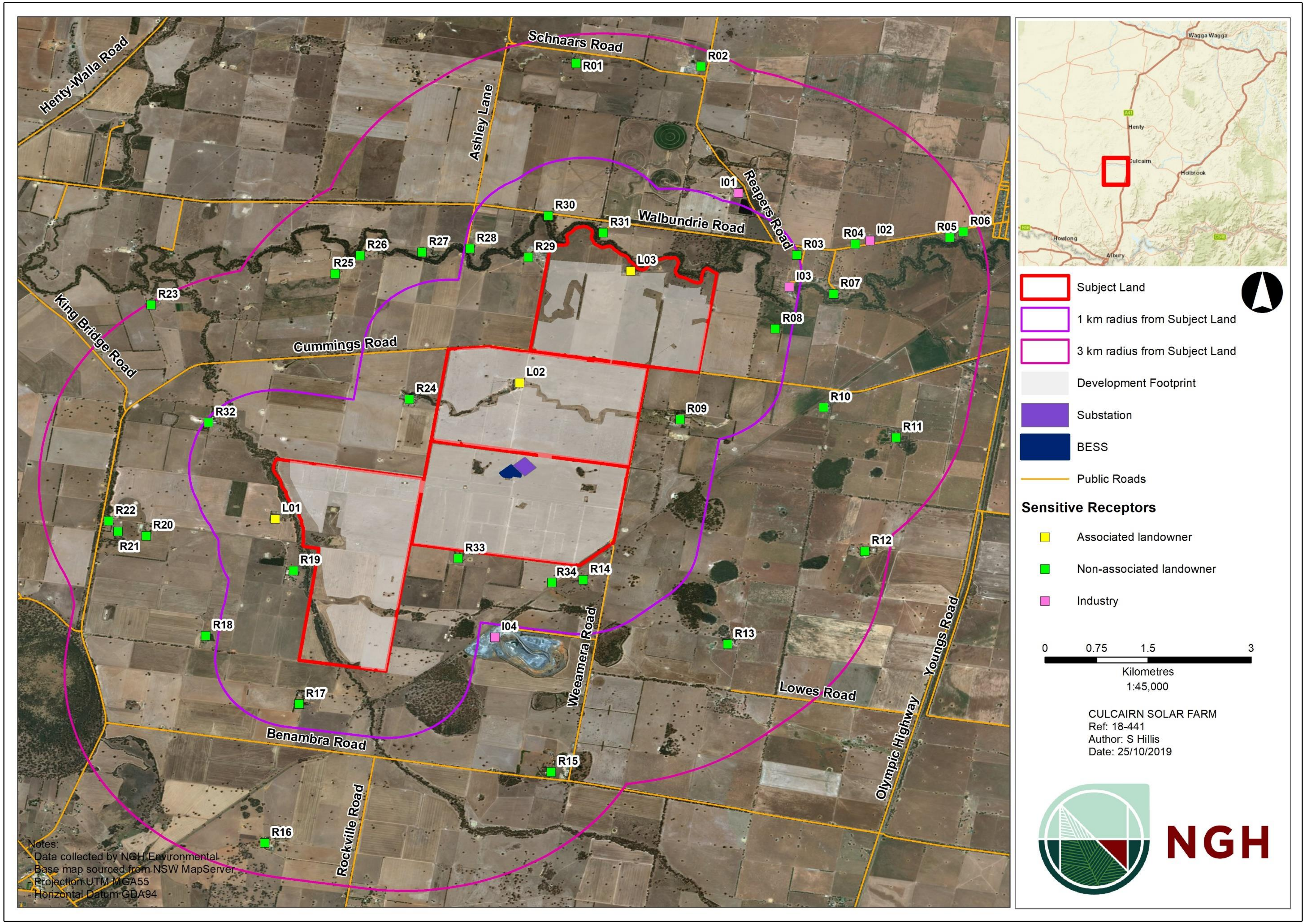

Figure 6-5 Sensitive receivers

6.3.3 Assessment criteria

The RBLs have been adopted from Table 2.3 of the *Noise Policy for Industry* (NPI). Background noise levels were adopted from the NPI due to the rural location of the proposal. The adopted levels are considered to be conservative due to the proximity of activity adjacent to the site including agricultural activity, rural and regional road traffic and quarrying. The RBLs for the site have been used to calculate the construction noise management levels (Table 6-11) and the operational intrusive noise levels.

Construction activities would be limited to standard working hours, the relevant NML (RBL + 10 dBA) for standard hours and (RBL + 5 dBA) out of hours work are summarised in Table 6-11.

Table 6-11 Construction noise management levels.

Location	Time of day	RBL, dB(A)	NML dB $L_{Aeq, 15 min}$
All Residences	Day	40	50
	Evening	35	40
	Night	30	35
	Highly Noise Affected (Day)	-N/A	75

Operational project intrusive noise levels (PINLs) for the proposal were determined based on the RBLs + 5 dB(A) (Table 6-12).

Table 6-12 Project intrusive noise levels.

Location	Time of day	Adopted RBL dB(A)	PINL dB $L_{Aeq, 15min}$
All Residences	Day	40	45
	Evening	35	40
	Night	30	35

Operational project amenity noise levels (PANLs) for the proposal were determined based on the recommended amenity noise level for rural area minus 5dB(A) (Table 6-13).

Table 6-13 Project amenity noise levels

Receiver type	Noise amenity area	Time of day	PANLs dB(A)
Residence	Rural	Day	45
		Evening	40
		Night	35

The project operational noise trigger levels (PNTLs) are the lower of either the PINLs or the PANLs. In this situation the figures are the same.

Table 6-14 Project noise trigger levels

Catchment	Time of day	Intrusive Noise Level dB $L_{Aeq, 15 min}$	PANL dB $L_{Aeq, 15 min}$	PNTL dB $L_{Aeq, 15 min}$
Rural Receptors	Day	45	45	45
	Evening	40	40	40
	Night	35	35	35

The road traffic noise criteria are provided in the NSW Road Noise Policy 2011 (RNP). The 'local road' category was used for this assessment for Benambra Road, Schneiders Road, Walbundrie Road and Weeamera Road and 'arterial road' for Olympic Highway. The road noise criteria are provided in Table 6-15.

Table 6-15 Road traffic noise assessment criteria for residential land uses.

Road category	Road name	Type of project / development	Assessment criteria dB(A)	
			Day (7 am to 10 pm)	Night (10 pm to 7 am)
Local roads	Benambra Road Schneiders Road Walbundrie Road Weeamera Road	Existing residences affected by additional traffic on existing local roads generated by land use developments	55 dBA L_{Aeq} (1 hr) external	50 dBA L_{Aeq} (1 hr) external
Freeway/arterial/sub-arterial road	Olympic Highway	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	55 dBA L_{Aeq} (15 hr) external	55 dBA L_{Aeq} (9 hr) external

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB(A). This is generally accepted as the threshold of perceptibility to a change in noise level.

Receivers experiencing increases in total traffic noise levels above those presented in Table 6-16 due to the addition of project vehicles on Olympic Highway may be considered for mitigation. This relative increase is not applicable to local roads.

Table 6-16 Increase criteria for residential land uses.

Road category	Type of project / development	Total traffic noise level increase (dBA)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transit ways	New road corridor/development or existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic L_{Aeq} (15 hr) +12 dB (external)	Existing traffic L_{Aeq} (9 hr) +12 dB (external)

6.3.4 Construction noise modelling methodology

A computer model was used to quantify project noise emissions at neighbouring receptors for typical construction activities and operations (including road noise). The NSW Roads and Maritime Services (RMS) construction noise calculator was used to predict noise impacts. The calculator uses relevant noise source data, ground type and free field conditions to calculate noise levels at potentially affected sensitive receivers. Plant and equipment were modelled at various locations, representative of realistic construction and operational conditions for assessed scenarios.

Construction activities are proposed to be progressive and would occur at several locations simultaneously. Noise emissions were modelled for the following scenarios (Table 6-17):

- Earthworks for internal roads and laydowns.
- Piling of panel supports.
- Assembly of frames and panels.

Table 6-17 Construction noise scenario plant.

Construction equipment	Sound pressure level @ 7 m ((dB(A))	No. of units
Scenario 1 – Earthworks for internal roads and laydowns		
Grader	88	1
Excavator (tracked) 35t	85	1
Water cart	82	1
Vibratory roller	84	1
Dump truck	85	1
Scenario 2 – Piling of panel supports		
Front end loader	66	1
Dump truck/road truck	85	1
Piling rig	87	1
Light vehicle	63	1
Power hand tools	80	2
Scenario 3 – Assembly of frames and panels		
Front end loader	66	1
Light vehicle	63	1
Power generator	78	1
Power hand tools	80	5

It is proposed that all three scenarios would occur across the site but at different locations at different times. Generally, earthworks for roads and hardstands (scenario one) will precede scenarios two and three. Noise predictions were modelled for a worst-case scenario.

Noise emission can also be influenced by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source toward the sensitive receiver. Prevailing winds for the proposal were obtained from the Bureau of Meteorology (BoM) weather station near Albury 35 km to the south (http://www.bom.gov.au/climate/averages/wind/selection_map.shtml). The wind roses indicate that winds are unlikely to be blowing toward the nearest sensitive receiver to the site (Figure 6-6).

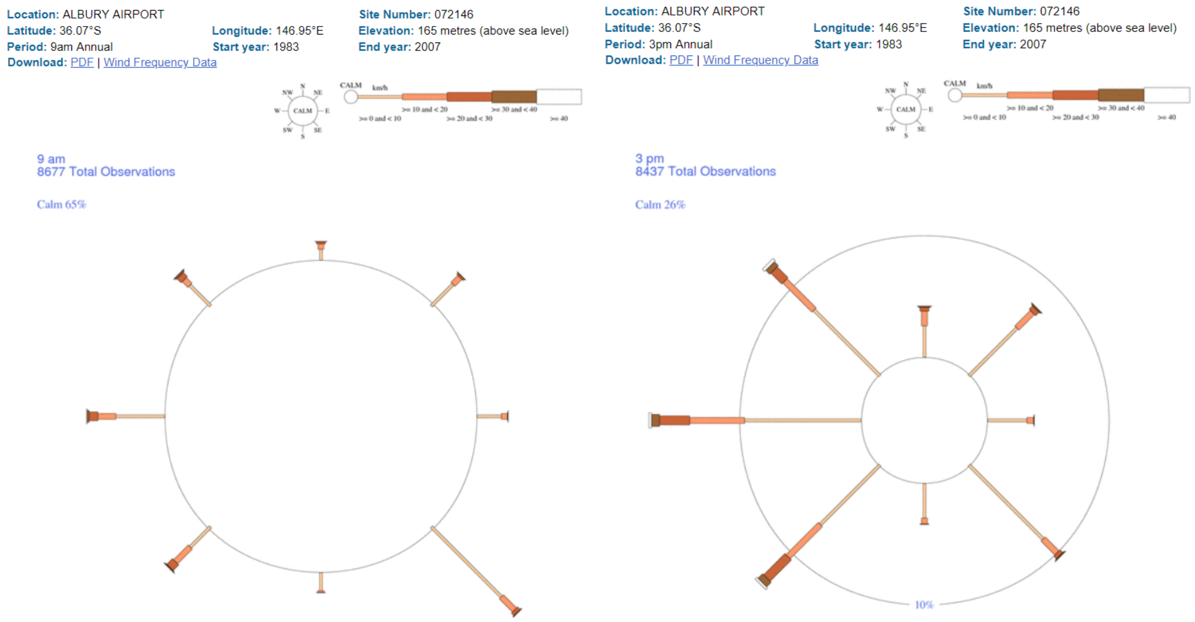

Figure 6-6 Albury BOM annual wind roses.

6.3.5 Construction noise impact assessment

Three construction noise scenarios were used to predict the likely impact of noise at adjacent residential receivers. The predicted noise level for each scenario was calculated for each residential receiver (Table 6-18 to Table 6-20).

Table 6-18 Construction noise assessment Scenario 1.

Receiver ID	Address	Distance (m) to site boundary	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R30	591 Walbundrie Road Culcairn	355	49	50	No
R31	511 Walbundrie Road Culcairn	129	**62**	50	Yes
R29	586 Cummings Road Culcairn	228	**55**	50	Yes
R28	679 Walbundrie Road Culcairn	934	36	50	No
R24	725 Cummings Road Walla Walla	343	49	50	No
R32	1061 Cummings Road Walla Walla	958	35	50	No
R19	216 Wattlevale Road Walla Walla	250	**54**	50	Yes
R17	932 Benambra Road Walla Walla	629	41	50	No
R33	Weeamera Road Culcairn	121	**63**	50	Yes
R34	Weeamera Road Culcairn	297	**51**	50	Yes*

Receiver ID	Address	Distance (m) to site boundary	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R14	299 Weeamera Road Culcairn	213	**56**	50	Yes
R09	379 Cummings Road Culcairn	499	44	50	No
R08	Olympic Highway Culcairn	809	38	50	No
R03	279 Walbundrie Road Culcairn	986	35	50	No

Note: * Exceedances of ≤2 dB(A) are not perceptible.

Table 6-19 Construction noise assessment Scenario 2

Receiver ID	Address	Distance (m) to site boundary	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R30	591 Walbundrie Road Culcairn	355	46	50	No
R31	511 Walbundrie Road Culcairn	129	**60**	50	Yes
R29	586 Cummings Road Culcairn	228	**52**	50	Yes*
R28	679 Walbundrie Road Culcairn	934	33	50	No
R24	725 Cummings Road Walla Walla	343	47	50	No
R32	1061 Cummings Road Walla Walla	958	33	50	No
R19	216 Wattlevale Road Walla Walla	250	51	50	Yes*
R17	932 Benambra Road Walla Walla	629	39	50	No
R33	Weeamera Road Culcairn	121	**61**	50	Yes
R34	Weeamera Road Culcairn	297	49	50	No
R14	299 Weeamera Road Culcairn	213	**53**	50	Yes
R09	379 Cummings Road Culcairn	499	42	50	No
R08	Olympic Highway Culcairn	809	35	50	No
R03	279 Walbundrie Road Culcairn	986	32	50	No

Note: * Exceedances of ≤2 dB(A) are not perceptible.

Table 6-20 Construction noise assessment Scenario 3

Receiver ID	Address	Distance (m) to site boundary	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R30	591 Walbundrie Road Culcairn	355	39	50	No
R31	511 Walbundrie Road Culcairn	129	**52**	50	Yes*
R29	586 Cummings Road Culcairn	228	45	50	No
R28	679 Walbundrie Road Culcairn	934	26	50	No
R24	725 Cummings Road Walla Walla	343	39	50	No
R32	1061 Cummings Road Walla Walla	958	25	50	No
R19	216 Wattlevale Road Walla Walla	250	44	50	No
R17	932 Benambra Road Walla Walla	629	31	50	No
R33	Weeamera Road Culcairn	121	**53**	50	Yes
R34	Weeamera Road Culcairn	297	41	50	No
R14	299 Weeamera Road Culcairn	213	46	50	No
R09	379 Cummings Road Culcairn	499	34	50	No
R08	Olympic Highway Culcairn	809	28	50	No
R03	279 Walbundrie Road Culcairn	986	25	50	No

Note: * Exceedances of ≤2 dB(A) are not perceptible.

The construction works would occur in a rural environment with a low level of background noise. The works are likely to generate an exceedance of the NMLs for five of the 14 sensitive receivers for Scenario 1 (given exceedances of ≤2 dB(A) are not perceptible). Exceedances of the NMLs are likely for three sensitive receivers for Scenario 2. and one sensitive receiver for Scenario 3. Predicted exceedances at the sensitive receiver's ranges from four dB(A) above the NML to 13 dB(A) above the NML (R33 / R31 for Scenario 1). No residences would be Highly Noise Affected.

The maximum continuous duration that would affect residents and is likely to be experienced under a worst-case construction noise (e.g. from internal road construction) is two to three hours. Plant operators would stop for scheduled lunch and rest breaks. In addition, construction activities, especially earth works, move location during the day. Construction activities would move progressively around the site as work stages are completed. As such impacts at any one receiver, from a worst-case construction noise would typically last less than several hours over a period of 2-3 weeks.

Overall, construction noise is likely to noticeably affect five nearby residential receivers. Those effects would be temporary and intermittent during the construction of the solar farm. Of those five sensitive receivers none were predicted to be Highly Noise Affected at any time. All near neighbours would receive a letter from The Proponent detailing potential impacts of construction noise (Appendix C.4).

Weeamera Road construction noise impact assessment

A 1.4 km section of Weeamera Road would require upgrading for construction traffic between the left turn to the Boral Quarry (south) and the proposed construction access (north) (Figure 1-3). Road upgrade activities would increase the width of this section of Weeamera Road from a 5.5 m unsealed pavement to a 6 m side sealed pavement, allowing for two heavy vehicles to pass concurrently.

The predicted noise level for the proposed work was calculated using construction scenarios in the Roads and Maritime Services' Construction Noise Estimator. The construction would involve two 'worst case' scenarios (Table 6-21) and include:

- Scenario 1 – Clearing and grubbing.
- Scenario 2 – Bulk earthworks.

Table 6-21 General plant and equipment for proposal construction.

Construction equipment	Sound pressure level @ 7m dB(A)	No. of units
Scenario 1 – Clearing and grubbing		
Utility vehicles	63	2
Chainsaw	89	1
Excavator 5T	76	1
Excavator 12T	80	1
Scenario 2 – Bulk earthworks		
Water Cart	82	2
Tip Truck	85	2
Front-end Loaders	88	1
Utility vehicles	63	2
Rollers	84	2
Grader	88	2

A distance-based assessment was used for each scenario for each sensitive receiver in the vicinity of the road upgrades. Receiver distances vary from 270 m from R14 to 1992 m at R15. The predicted noise levels for receivers for scenario 1 is provided in Table 6-22 and for scenario 2 in Table 6-23. The predicted noise levels were modelled for construction work occurring during standard hours of work.

Table 6-22 Highest predicted noise levels for scenario 1.

Receiver ID	Distance (m) to Weeamera Road works	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R09	1950	22	50	No
R13	1524	26	50	No
R14	270	50	50	No
R15	1992	22	50	No
R33	1791	24	50	No
R34	639	38	50	No

Table 6-23 Highest predicted noise levels for scenario 2.

Receiver ID	Distance (m) to Weeamera Road works	Highest Predicted Noise Level dB(A)	NML Standard Hours dB (A)	Above NML?
R09	1950	28	50	No
R13	1524	32	50	No
R14	270	**56**	50	Yes
R15	1992	28	50	No
R33	1791	29	50	Yes
R34	639	44	50	No

Weeamera Road construction works for the proposal would be during standard hours of work. Construction noise predictions assume most plant items would be operating simultaneously for construction of the road upgrade. Simultaneous operation of all plant is unlikely and as a result any predictions are conservative.

For scenario 2 it is predicted that there would be an exceedance of the NML for R14. There would be no exceedance for the other receivers identified within the vicinity of the proposed road works. Construction noise would move along the length of the works on a regular basis as works progress. As such sensitive receivers would be exposed noise above the NMLs of short periods of time during road construction. Mitigation measures are recommended for R14 who is likely to be noise affected during proposed road construction.

6.3.6 Construction noise management plan

A detailed construction noise management plan would be developed prior to construction to mitigate impacts on sensitive receivers where NML exceedances are likely. Noise impact assessment results conclude that nine residential receivers would be affected for any and all of the three predicted construction noise scenarios.

The noise management plan would include the following actions:

1. Conversation with affected receivers to identify their specific needs (e.g. respite periods).
2. Identify and mark buffers across the development site within which NMLs at sensitive receiver locations are potentially exceeded.
3. Implement noise mitigation measures within buffer areas including:

- erecting a noise shield.
- timing use of plant and hand tools to reduce simultaneous noise emissions from multiple machines and equipment.
- Works within buffer areas must only be during the normal construction hours of:
  - Monday – Friday 07:00 to 18:00.
  - Saturday 08:00 to 13:00.
  - No work on Sundays or public holidays.

6.3.7 Operational noise assessment

Operational noise sources

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

1. The onsite substation.
2. Maintenance activities such as visual inspections of panels and structures, general maintenance (e.g. replacing fuses, replacing panels), cleaning of panels and emergency repairs (e.g. replacing tracking motors).
3. Tracking motors and movement of the solar panels.
4. Inverter stations.
5. Centralised Battery Energy Storage System (BESS) including Heating, Ventilating and Air Conditioning (HVAC) systems.

The proposed activities above use readily available equipment. As such, noise levels associated with that equipment (Table 6-24) and activity is well understood and able to be modelled. The 'null effect distance' was modelled for each piece of equipment for operation of the proposed solar farm and the BESS (Table 6-24 and Table 6-25). This represents the distance at which each individual piece of equipment no longer exceeds the PNTLs criteria. Further detail is provided in Appendix M.

Table 6-24 Operational equipment sound levels.

Equipment	No. of units	Sound power level (dB (A)) at 7 m	Sound pressure level (dB) at 7 m	Null effect (≤45 dB(A)) distance (m)
Internal substation - transformers	2	72	61	70
Light vehicle	1	78	77	280
Tractor – slashing grass	1	92	81	450
Tractor – washing panels	1	92	81	450
Truck	1	83	72	160
Telehandler	1	81	70	130
Tracking motor	10	60	49	35
Invertor station	1	73.9	62.9	50

The proposed centralised BESS would include up to 50 battery container units. On either side of these battery units is a heating, ventilation and air conditioning (HVAC) unit. In addition, the BESS would require the operation of up to 100 power conversion units, two step-up transformer units and one control room.

During operation, approximately one staff member would attend to the BESS daily during the daytime period to monitor the equipment. This staff member would travel around the site in a light vehicle.

Table 6-25 Operational sound levels for BESS plant and equipment.

Equipment		Sound Pressure Levels, L_{Aeq} dB(A) (@ 7 m)	Number of units	Combined sound pressure level dB(A)	Null effect distance (m)
BESS	HVAC equipment (fans, pumps etc)	67	200	92.3	370
	Power Conversion Units (inverter stations)	80.5	50	97.5	710
	Step up transformers (33kV)	59	2	95	700
	Light Vehicles	79	1	78	240

Operational noise assessment

Noise levels have been calculated for five operational scenarios using equipment sound power levels:

- Operation of tracking motors, internal substation, the inverter stations and BESS during standard work hours.
- BESS operation out of standard work hours.
- Maintenance vehicles accessing the site.
- Grass slashing and panel cleaning.
- Repairing faulty equipment.

These scenarios are deemed to have the highest noise impact, that is all of the plant listed (refer to Table 6-26, Table 6-31, Table 6-28) would be operating simultaneously. The activities selected provide a worst-case scenario for noise generated from the site.

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

Intrusiveness criteria used for the proposal (Table 6-12) was used to determine exceedances presented in Table 6-27 to Table 6-36.

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

During operation, the internal substation, invertor stations and BESS would generate continuous noise. The tracking motors rotating the panels would generate intermittent noise during the day, operating every 15 minutes for about 0.5 minutes. This scenario considers the continuous operation of the internal substation, invertor substation and tracking motors. It predicts the typical noise levels that may be experienced during the operation of the solar farm infrastructure only with no maintenance activities occurring (Table 6-26).

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

During operation, there would be 67 inverter stations of two inverter units distributed throughout the development site. Due to their distribution across the site, for any one receiver, it is expected that only one invertor station would be close enough to affect the noise environment. Accordingly, only one inverter station has been used in the noise model below. There would be one tracking motor for 25 rows of 90 solar panels. This would equate to a maximum of 600 tracking motors distributed across the site. It is expected only 10 would be close enough to affect the noise environment at any one sensitive receiver.

Table 6-26 Operational equipment for Scenario 1.

Equipment	Quantity	Sound power level (dB (A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9
BESS	(refer to Table 6-25)	

Table 6-27 Predicted noise levels for receivers during scenario 1 (during standard hours).

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[1]	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R30	654	853	3662	22	Not noticeable
R31	462	653	3561	26	Not noticeable
R29	279	433	3040	32	Not noticeable
R28	985	1117	3196	17	Not noticeable
R24	437	670	1524	37	Not noticeable
R32	1143	1333	3540	15	Not noticeable

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[1]	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R19	362	560	2836	29	Not noticeable
R17	1157	1308	4106	15	Not noticeable
R33	165	357	1313	41	Not noticeable
R34	384	593	1595	36	Not noticeable
R14	308	486	1686	36	Not noticeable
R09	584	706	2059	24	Not noticeable
R08	977	1108	3692	17	Not noticeable
R03	1363	1555	4569	12	Not noticeable

Table 6-28 Predicted noise levels for receivers during Scenario 1 (during evening hours).

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R30	654	853	3662	22	Not noticeable
R31	462	653	3561	26	Not noticeable
R29	279	433	3040	32	Not noticeable
R28	985	1117	3196	17	Not noticeable
R24	437	670	1524	37	Not noticeable
R32	1143	1333	3540	15	Not noticeable
R19	362	560	2836	29	Not noticeable
R17	1157	1308	4106	15	Not noticeable
R33	165	357	1313	41*	Not noticeable
R34	384	593	1595	36	Not noticeable
R14	308	486	1686	36	Not noticeable
R09	584	706	2059	24	Not noticeable
R08	977	1108	3692	17	Not noticeable

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R03	1363	1555	4569	12	Not noticeable

Note: * Exceedances of ≤2 dB(A) are not perceptible.

The sensitive receivers within 1 km of the solar farm infrastructure are **not** predicted to experience any noise exceedances above the daytime PNTL.

The solar farm would not normally be in operation during the evening and not in the night hours. The exception being summer with extended day lengths (Table 6-29). This coincides with daylight savings (NSW daylight savings is from the first Sunday in October to the first Sunday in April), where the inverter stations, tracking motors and on-site substation would be operating until sunset.

Table 6-29 Daylight hours at Albury (Willyweather.com.au)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rise (am)	6.13	6.44	7.12	6.46	7.02	7.21	7.19	6.53	6.11	6.22	5.57	5.51
Set (pm)	8.30	8.08	7.30	5.56	5.16	5.05	5.17	5.40	6.04	7.23	7.58	8.25

Scenario 2 – Operation of the BESS out of standard work hours

During operation, the BESS would not operate continuously. The noise modelling is based on the BESS operating at full output. However, the level of output would be intermittent. As such, these noise levels should be considered as a peak in operation of the BESS rather than the ongoing operational noise levels.

The project amenity noise level for evening is 40 dB(A) and night is 35 dB(A). The figures in Table 6-25 were calculated using a web-based calculator (http://www.sengpielaudio.com/calculator-distance.htm). The maximum noise output from the BESS at 7 m with all components operating at full power is predicted to be 99.9 dB(A). This scenario predicts the 'worst case scenario' and assumes that all plant and machinery are operating continuously and concurrently.

Based on the predicted operational noise levels presented in Table 6-25, noise levels at all sensitive receivers would comply with the evening criteria outside standard working hours. The calculations predict there would be audible noise of an acceptable level at each of the sensitive receivers (Table 6-30). This assessment does not include any effect that the landscape may have on noise transmission.

However, if the BESS is operational at 'worst-case scenario' for periods during night-time hours, the BESS would be audible at receivers R24, R33 and 34. Noting that the residence at R33 and 34 is currently unoccupied. The PNTL for operation is 40 dB LAeq, 15 min for evening hours and 35 dB LAeq, 15 min. There is an exceedance of 1 dB at R24 and R34 during night-time hours and an exceedance of 4 dB at R33.

Table 6-30 Predicted noise levels for receivers for Scenario 2 during evening hours / night-time hours.

Receiver	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R30	3662	N/A	Not noticeable
R31	3561	N/A	Not noticeable
R29	3040	N/A	Not noticeable
R28	3196	N/A	Not noticeable
R24	1524	36	Audible during night-time hours
R32	3540	N/A	Not noticeable
R19	2836	15	Not noticeable
R17	4106	N/A	Not noticeable
R33	1313	39	Audible during night-time hours
R34	1595	36	Audible during night-time hours
R14	1686	35	Not noticeable
R09	2059	15	Not noticeable
R08	3692	N/A	Not noticeable
R03	4569	N/A	Not noticeable

Scenario 3 – Maintenance vehicle activity

During operations, five to ten staff would be required on-site to maintain the solar farm. Noise from maintenance vehicles on site will be infrequent. Maintenance activities would mostly be conducted inside a maintenance/control building located in the central section of the development site. Noise from other maintenance works (replacing fuses, inspecting equipment) would be intermittent. Noise from on-site maintenance vehicles would be intermittent. However, there could be instances where several light vehicles access the site daily.

An operational maintenance scenario includes up to two maintenance vehicles across the project site replacing fuses or completing inspections. The scenario also includes the continuous noise generated by the internal substation, invertor stations, BESS and intermittent noise associated with the tracking motors rotating the panels (Table 6-31).

Table 6-31 Operational equipment for Scenario 3.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9
Light vehicle	2	81
BESS	Refer to Table 6-25	

Table 6-32 Predicted noise levels for Scenario 3.

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[2]	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R30	654	853	3662	33	Not Noticeable
R31	462	653	3561	37	Not Noticeable
R29	279	433	3040	44	Not Noticeable
R28	985	1117	3196	27	Not Noticeable
R24	437	670	1524	41	Not Noticeable
R32	1143	1333	3540	25	Not Noticeable
R19	362	560	2836	41	Not Noticeable
R17	1157	1308	4106	25	Not Noticeable
R33	165	357	1313	51	Clearly Audible
R34	384	593	1595	42	Not Noticeable
R14	308	486	1686	44	Not Noticeable
R09	584	706	2059	34	Not Noticeable

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[2]	Description Clearly audible = < 10 dB (A) above PNTL Moderately intrusive = >10 dB (A) above PNTL Highly intrusive = > 75 dB (A)
R08	977	1108	3692	27	Not Noticeable
R03	1363	1555	4569	23	Not Noticeable

Sensitive receivers located within 120 m of maintenance works are predicted to experience a minor exceedance (up to 6dB (A)) above the NPI criteria. The detailed noise assessment indicated that 13 of the 14 sensitive receivers within 1 km of the proposal would not be adversely affected by the operational noise under scenario 3.

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

Scenario 4 – Grass slashing and panel cleaning

Grass slashing and panel cleaning would be required during operation of the proposal. Slashing would generally occur in spring following the optimal growing period for groundcover vegetation and may be required following sporadic summer rainfall. Panel cleaning would occur after dusty conditions during summer or as required.

This operation scenario includes one tractor with a slasher attachment. Due to safety concerns both slashing and panel cleaning activities would be kept separate from other activities. It is unlikely and unsafe to run slashing and panel cleaning simultaneously. The scenario also includes the continuous noise generated by the internal substation, invertor stations, BESS and intermittent noise associated with the tracking motors rotating the panels.

Table 6-33 Operation equipment for Scenario 4.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Tractor – slashing grass or panel cleaning	1	92
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9
BESS	Refer to Table 6-25	

Table 6-34 Predicted noise levels for scenario 4.

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Duration of exceedance	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R30	654	853	3662	40	1- 2 hours, twice per year	Not noticeable	-
R31	462	653	3561	45	1- 2 hours, twice per year	Clearly audible	N
R29	279	433	3040	52	1- 2 hours, twice per year	Clearly audible	N
R28	985	1117	3196	35	1- 2 hours, twice per year	Not noticeable	-
R24	437	670	1524	47	1- 2 hours, twice per year	Clearly audible	N
R32	1143	1333	3540	33	1- 2 hours, twice per year	Clearly audible	-
R19	362	560	2836	48	1- 2 hours, twice per year	Clearly audible	N
R17	1157	1308	4106	33	1- 2 hours, twice per year	Not noticeable	-
R33	165	357	1313	59	1- 2 hours, twice per year	Moderately Intrusive	N
R34	384	593	1595	48	1- 2 hours, twice per year	Clearly audible	N

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Duration of exceedance	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)	Recommended additional mitigation measures*
R14	308	486	1686	51	1- 2 hours, twice per year	Clearly audible	N
R09	584	706	2059	42	1- 2 hours, twice per year	Clearly auditable	N
R08	977	1108	3692	35	1- 2 hours, twice per year	Not noticeable	-
R03	1363	1555	4569	30	1- 2 hours, twice per year	Not noticeable	-

*Note: N = notification letter

Sensitive receivers located within 120m of grass slashing are predicted to experience a moderate exceedance (up to 19 dB (A)) above the NPI criteria. The detailed noise assessment indicated that 8 of the 14 sensitive receivers within 1 km of the proposal would not be adversely affected by the operational noise under scenario 4.

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

Scenario 5 – Repairing faulty equipment

Repair and replacement of broken, faulty, or worn equipment would likely be required during operational lifespan of the proposal. This repair scenario considers the replacement of a torsion bar that operates the movement of the panels (Table 6-35). This scenario also includes the continuous noise generated by the internal substation, invertor stations, BESS and intermittent noise associated with the tracking motors rotating the panels.

Table 6-35 Operation equipment for Scenario 5.

Equipment	No.	Sound power level (dB (A)) at 7 m
Truck	1	83
Telehandler	2	81
Light vehicle	1	78
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9
BESS	Refer to Table 6-25	

Table 6-36 Predicted noise levels for scenario 5.

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[3]	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R30	654	853	3662	36	Not Noticeable

Receiver	Distance from development infrastructure (m)	Distance from Invertor station (m)	Distance from BESS (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected[3]	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R31	462	653	3561	40	Not Noticeable
R29	279	433	3040	47	Clearly Audible
R28	985	1117	3196	30	Not Noticeable
R24	437	670	1524	43	Not Noticeable
R32	1143	1333	3540	28	Not Noticeable
R19	362	560	2836	44	Not Noticeable
R17	1157	1308	4106	28	Not Noticeable
R33	165	357	1313	54	Moderately intrusive
R34	384	593	1595	44	Not Noticeable
R14	308	486	1686	46	Clearly Audible
R09	584	706	2059	37	Not Noticeable
R08	977	1108	3692	30	Not Noticeable
R03	1363	1555	4569	26	Not Noticeable

Sensitive receivers located within 120m of the solar farm infrastructure are predicted to experience a moderate noise exceedance of up to 9 dB (A)) above the intrusive daytime NML. The detailed noise assessment indicated that 11 of the 14 sensitive receivers within 1 km of the proposal would not be adversely affected by the operational noise under scenario 5.

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

Overall, operational noise impacts associated with the project are considered unlikely to significantly affect nearby sensitive receivers with the implementation of the recommended mitigation measures. However, it is recommended that a one-off noise validation monitoring assessment should be conducted during operation of the project to confirm the project meets the intrusive NMLs (Table 6-9).

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, mechanical plant associated with the solar panel infrastructure would not 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 invertor stations will not be operating. It is expected that noise levels at the closest receivers would be well below the sleep disturbance criteria.

However, the BESS would be operating intermittently during the night-time to recharge battery energy and discharge battery energy to the electricity network. Based on the predicted operational noise levels presented in Table 6-24, calculations predict there would be audible noise of an acceptable level at each of the sensitive receivers (Table 6-27). An exceedance of 2 dB (A) above the evening NML may occur for R33.

Transmission line

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest sensitive receiver from the overhead power line and the TransGrid substation 660 m (R33) and 1440 m (R33) respectively, aeolian noise impacts are expected to be negligible.

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

At a distance of 30 m along the ground from the line, a L_{eq} noise level of about 44 dB (A) was measured. At a distance of 660 m the corona noise was calculated to below a detectable level. The night-time intrusive criteria determined is 35 dB (A).

_6.3.8_ Cumulative Impacts

There is potential for cumulative impacts associated with other known or foreseeable developments occurring in proximity to the proposal to impact upon sensitive receivers. There are currently 4 major solar farms developments within the Greater Hume LGA including the proposal, Walla Walla, Glenellen and Jindera (see section 7.6). Note, none of these solar farms have received development approval at this stage.

Walla Walla Solar Farm is the closest major project, located within 2 km south of the proposed Culcairn Solar Farm. Cumulative construction and operation noise impacts could occur.

One residential receiver (R17, Figure 6-7) could be affected from cumulative impact of noise from both solar farms.

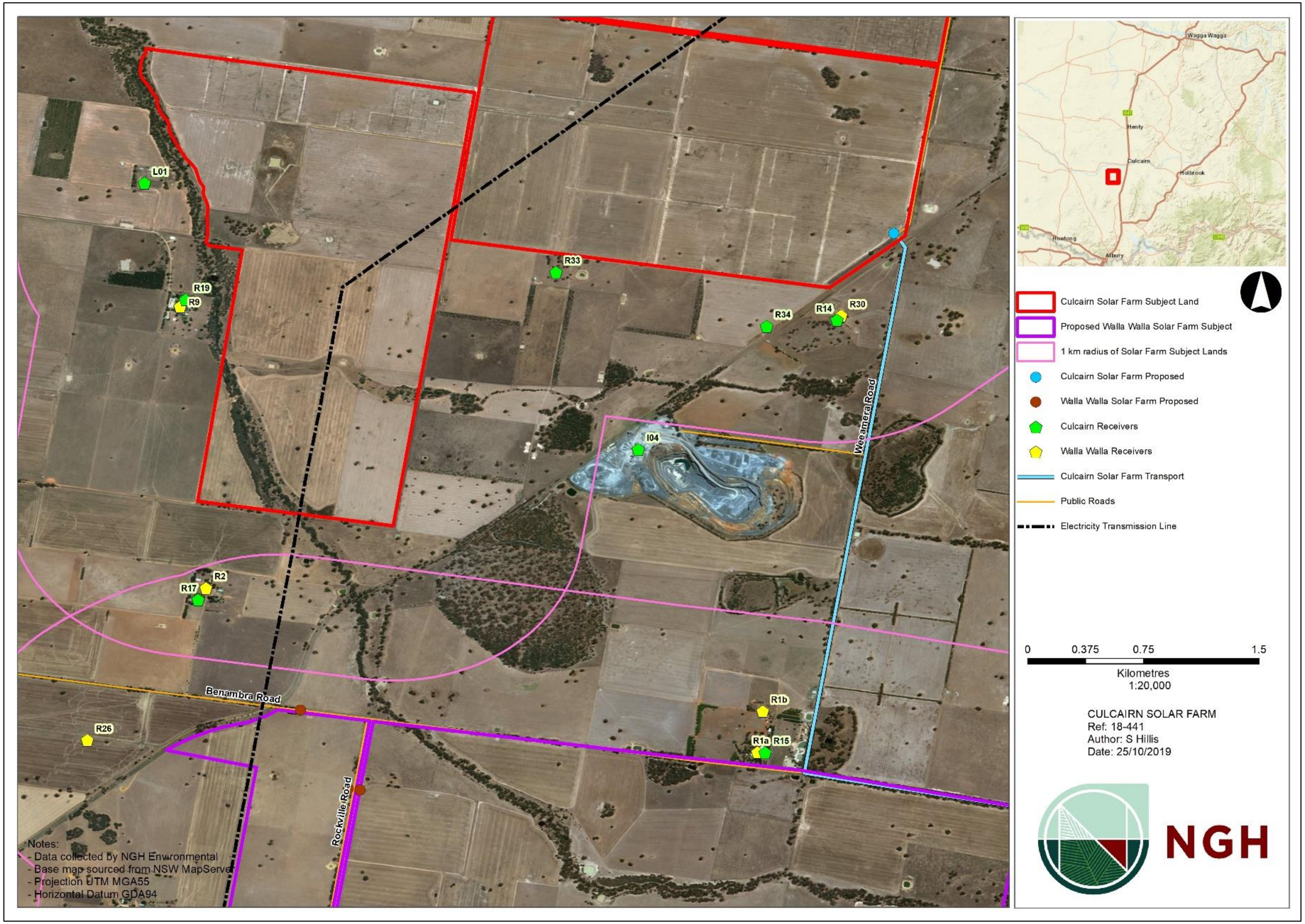

Figure 6-7 Common receivers with 1 km of either solar farm.

Construction

The planned construction period for the proposed Walla Wall Solar Farm is from early 2021 for 16 to 20 months with a peak construction period of 8 to 12 months. If both proposals were to be successful, the timing of construction could be concurrent. Due to the relative proximity of both proposals there is potential for cumulative noise impacts to occur during construction and operation. The proposed Walla Walla Solar Farm does not include a BESS.

The distance of R17 from the proposed Walla Walla Solar Farm is shown in Table 6-37. Based on the assumption that Walla Walla Solar Farm would utilise the same types of plant and equipment as the proposal, cumulative impacts resulting in NML exceedances are estimated.

Table 6-37 Cumulative construction noise impacts

Receiver ID	Address	Distance (m) to Culcairn SF infrastructure	Distance (m) to Walla Walla SF boundary	Above NML Culcarin SF?	Above NML Walla Walla SF?
R17	932 Benambra Road Walla Walla	1157	820	No	No

Operation

Noise from the operation of both the proposed Walla Walla Solar Farm and the proposal would be generated at each site by:

1. The onsite substation.
2. Maintenance activities.
3. Tracking motors and movement of the solar panels.

Additional noise impacts would be generated intermittently by the BESS, adjacent to the substation, of the proposal. The following scenarios have calculated the potential cumulative noise impacts for common residential sensitive receivers.

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

An operation noise assessment was conducted to provide a worst-case scenario for noise generated from the site during the operation of both solar farms simultaneously. The assessment considers receiver R17 located in close proximity to solar farm infrastructure of both proposed solar farms (Figure 6-7).

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

Table 6-38 Operational equipment for Scenario 1.

Equipment	No.	Sound power level (dB(A)) at 7 m (per item)
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9

BESS	Refer to Table 6-25

Table 6-39 Predicted noise level for receivers located within 1 km during operation of the solar farm.

Receiver	Distance from Culcairn Solar Farm infrastructure (m)	Distance (m) from Invertor station	Distance from Culcairn Solar Farm BESS (m)	Distance from Walla Walla Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R17	1157	1308	4106	820	22	Not noticeable

No exceedance above the NML is predicted to occur during the operation of the both solar farms at receiver R17 (Table 6-41).

Scenario 2 – Grass slashing and panel cleaning

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

Table 6-40 Sound power level of a tractor grass slashing.

Equipment	No.	Sound power level (dB (A)) at 7 m (per item)
Tractor – slashing grass or panel cleaning	1	92
Internal substation - transformers	2	72
Tracking motor	10	60
Invertor station	1	73.9
BESS	Refer to Table 6-25	

Table 6-41 Predicted noise level for receivers located within 1 km during grass slashing.

Receiver	Distance from Culcairn Solar Farm infrastructure (m)	Distance (m) from Invertor station	Distance from Culcairn Solar Farm BESS (m)	Distance from Walla Walla Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R17	1157	1308	4106	820	39	Not noticeable

No exceedance above the NML is predicted to occur during grass slashing at receiver 17 (Table 6-41). This assumes a worst-case scenario of grass slashing occurring simultaneously on both solar farms. Grass slashing would occur about twice a year, and the equipment would move progressively across the site. In the worst case slashing noise typically would last for 0.5 - 1 hour at receiver R17.

Given the proposal occurs in a rural environment surrounded by agricultural properties, tractors, headers, quad bikes, light vehicles and heavy vehicles are common noise generating activities. In comparison to the operation of a tractor grass slashing on a solar farm, a header operates at a sound power level 3 dB (A) higher (Table 6-42).

Table 6-42 Sound power level of a header.

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

Table 6-43 Predicted noise levels for receivers located within 1 km of a header operating.

Receiver	Distance from Culcairn Solar Farm infrastructure (m)	Distance (m) from Invertor station	Distance from Culcairn Solar Farm BESS (m)	Distance from Walla Walla Solar Farm Subject Land (m)	Predicted Noise Level dB (A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise affected	Description Clearly audible = < 10 dB (A) above NML Moderately intrusive = >10 dB (A) above NML Highly intrusive = > 75 dB (A)
R17	1157	1308	4106	820	42	Not Noticeable

No exceedance above the NML is predicted to occur during operation of a header at receiver 17 (Table 6-43). This assumes a worst-case scenario of 2 headers operating simultaneously within 1 km of receiver R17.

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

6.3.9 Vibration

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

Based on the plant items to be used onsite during the construction phase including graders, dump trucks, rollers, water cart, piling and other vehicles, vibration generated by construction plant was estimated and potential vibration impacts summarised in Table 6-44.

Table 6-44 Potential impact from vibration to the two closest sensitive receivers.

Receiver	Distance (m) from site proposal (Approximate)	Type of receiver	Level of risk for potential impact	Monitoring required

R33	121	Residential	Very low	Not Required
R14	213	Residential	Very low	Not required

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at the nearest residential dwellings (120 m). Potential vibration impacts from operations are therefore not assessed any further.

6.3.10 Safeguards and mitigation measures

Table 6-45 Safeguards and mitigation measures for noise and vibration impacts.

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 07:00 to 18:00. • Saturday 08:00 to 13:00. • No work on Sundays or public holidays.	**C**		
NS2	A Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The CNVMP would generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The CNVMP would include the following: • Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Noise measurements would be consistent with the procedures documented in AS1055.1-1997 Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Vibration measurements would be undertaken in accordance with the procedures documented in the OEH's Assessing Vibration-a technical guideline (2006) and BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings.	**Prior to construction**		**D**
NS3	Operate plant in a conservative manner, which includes: • Selection of the quietest suitable machinery. • Avoidance of noisy plant working simultaneously where practical. • Turning off plant and equipment that is not being used. • Utilise broadband reverse alarm in lieu of high frequency type.	**C**	**O**	**D**
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	**C**	**O**	**D**
NS4	Consult with R30, R31, R29, R24, R19, R33, R34, R14 and R09 prior during pre-construction to develop suitable mitigation measures.	**C**		
NS5	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**
NS6	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	**C**	**O**	**D**
NS7	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	**C**		**D**

No.	Mitigation strategies	C	O	D
NS8	For receivers located within 300 m of development infrastructure during maintenance activities including grass slashing, panel cleaning or major works/repairs: • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur at least two weeks prior to the commencement of works. • Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of activities.		**O**	

6.4 SOCIOECONOMIC AND COMMUNITY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Socio-Economic –

Including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.

GREATER HUME SHIRE COUNCIL'S REQUIREMENTS

Clarity concerning the numbers employed during the operational phase of the development.

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

6.4.1 Background

Socio-economic profile

Greater Hume Shire is located in the southern NSW transport corridor between the regional centres of Albury and Wagga Wagga. The shire borders Victoria and is linked by the Hume Freeway, Riverina and Olympic Highways. The Main Southern Railway Line traverses the shire, which has proximity to the Ettamogah Rail Hub, regional airports at Albury and Wagga Wagga and offers frequent direct flights to Sydney and Melbourne.

The town of Culcairn is located approximately 39 km north of Albury-Wodonga and 68.5 km south of Wagga Wagga. The population of Culcairn was 1473 in 2016 (ABS 2019).

Culcairn has the largest Lutheran church in NSW. Walla Walla has the only Lutheran secondary school in NSW in St Paul's College. Attractions within the locality include Morgan's Lookout, Zion Lutheran Church and Gum Swamp, a nationally important wetland that covers an area of approximately 200 ha.

The median age of persons in the Greater Hume LGA is 44; this is higher than the Australian average of 38 (ABS 2019). The 2016 census records state that 3.3% of the population are Aboriginal and Torres Strait Islander people (ABS 2019). A large portion, 86.2% of the community were born in Australia; 1.9% in England, 0.9% in New Zealand, 0.5% in Germany and 0.4% in the Netherlands (ABS 2018).

The largest employment industries in Culcairn are education (7.1%), grain farming (6.8%), mixed grain and sheep (6.4%), specialised sheep farming (6.1%), and healthcare (4.1%) (ABS 2018). The unemployment rate for Greater Hume LGA is 4.1%, which is less than the national rate of 5.6% (ABS 2018).

Culcairn township is a service centre for the area, located approximately 4 km from the proposal. It is located in the north-east Riverina region in NSW off the Olympic Highway approximately 543 km from Sydney and approximately 352 km from Melbourne via the Hume highway.

Culcairn includes:

- Second hand shop.
- Agricultural suppliers and agronomy services.

- Steel fabrication.
- Earthworks and concreting services.
- Shopping precinct including newsagency, hairdressers, supermarket, hotel automotive services etc.
- St Paul's Lutheran School.
- Culcairn Pioneer Museum.
- Recreational facilities including the Culcairn swimming pool and Culcairn Country Gold Club.

It is likely that Culcairn and Walla Walla would be the key service centres of the Culcairn Solar Farm construction work force, with other service centres including Burrumbuttock, Table Top, Henty, Holbrook, Albury, Wodonga, and other smaller surrounding towns.

Community make up and priorities

Greater Hume Shire Council has four key strategic themes in their Community Strategic Plan 2017 - 2030 (Greater Hume Shire Council 2017). The Shire's vision for the future is:

"Partnering to advance our rural communities."

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

- Leadership and communication.
- Healthy lifestyle.
- Growth and sustainability.
- Good infrastructure and facilities.

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with particular reference to "growing our economy and promoting the culture and heritage offered in our communities."

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 6.2 of this EIS assesses the visual impacts of the proposal at sensitive receivers and the visual amenity of the area.

Community feedback on the proposal

The Proponent has undertaken extensive preliminary consultation with surrounding neighbours and the general community. Engagement has occurred via two community open days and direct engagement through letters, emails, phone calls and face to face meetings. The Proponent also created a dedicated website and email address for the proposal to provide information about the proposal and enable communication and feedback to be received (section 5.3).

DIRECT ENGAGEMENT AND OPEN DAY

One open day was held in Culcairn on 16 May 2019. Feedback forms were completed at this session. Concerns were raised during all methods of engagement with specific reference to the proposal, being:

- The loss of productive agricultural land in an agricultural landscape increasingly being impacted by drought and climate change.
- Inequity concerns: there are no neighbour benefits, neighbours have no voice in the process and yet neighbours will potentially be the most directly affected by this change.
- The loss of agricultural landscape i.e. aesthetic impacts and how this will impact them in an ongoing way, particularly for those that identified as intergenerational farmers.
- Fire risk from neighbouring properties and implications for insurance of neighbours/ community.
- Construction impacts:
    - Noise, dust and heat impacts on livestock.
    - Dust effects from high traffic on dirt roads.
- Length of time for any new planting of vegetation to grow and provide screening of solar farm.
- Impacts on wildlife corridors/ landscape connectivity through construction and lifetime of project, including tree removal.
- General concerns about management of solar project and potential risks for community e.g. weed management, drainage, ongoing management of infrastructure, remediation of land when lease expires.
- Fear of decline in property values in the area.
- Fear that drainage lines will be modified on solar farm block, resulting in changes to hydrology of area.
- Long term effects of community division resulting from proposal for four solar farms in the area.
- Community benefits fund mismanagement: fear of not having the funds used for local initiatives and used in the wider council area.

Visual impact was addressed with the concerned individuals through direct correspondence. In some instances, visual montages were provided to the concerned residence to show the before and after impacts of proposed vegetative screening, which was also developed with input from concerned residents.

Road maintenance was also addressed through direct correspondence with concerned residents.

All concerns were addressed and responded to where details were provided. A comprehensive list of responses and strategies to address community concerns is detailed in Appendix C.

WEBSITE

The Proponent has established a dedicated project website (https://Culcairnsolarfarm.com.au), which provides information on the proposal. The website includes an online community feedback form that can be filled in by any members of the community. A dedicated email address contact@Culcairnsolarfarm.com.au and phone number also allows anyone interested to reach the Proponent about general enquiries and project related enquiries.

Accommodation availability

Culcairn, with a population of about 1,121, offers a hotel, motel and a caravan park. Walla Walla has a hotel motel and Henty has a bed and breakfast. These accommodation facilities are within 30 km of the development site. A police station, fire station and hospital are located in Culcairn.

Holbrook is approximately 50 km east of the development site and has four motels and a hotel. Holbrook has a population of 1,335 and is home to the HMAS Otway Submarine, a major tourist attraction for the region.

Other services

Other services required by temporary construction staff that are not local include (but are not limited to) food outlets, local retail, health services and entertainment. While providing an economic boost to the area, it can also put pressure on services.

6.4.2 Potential impacts

Economic Impact Assessment

Neoen engaged Ethos Urban to provide an Economic Impact Assessment of the proposal, available in Appendix O. In summary, the Economic Impact Assessment found:

- Over the construction period the proposal would involve approximately $640 million in investment. It would support 350 full time equivalent (FTE) direct and 560 FTE indirect (multiplier or flow-on) jobs.
- During operation, 7 FTE direct and 20 FTE indirect jobs would be supported by the proposal.
- The region has the capability to manage multiple infrastructure projects concurrently in regard to construction-related workers and businesses.
- The proposal would provide significant participation opportunities for business and community.
- Economic benefits from the external labour force and relocation for the period of construction.
- Small agricultural impacts, including less than 1% of loss of agricultural land within the Greater Hume Shire and no net loss of jobs.
- Potential Council and community benefits.
- Continuing annual payments to host landowners across the 30-year period.
- The proposal has the capacity to supply sufficient clean energy to power the equivalent of approximately 105,000 homes.
- The proposal could provide small-scale tourism once in operation.
- The total economic benefit of the construction and operation phases of the proposal would equate to around $84.3 million over a 30-year period.

Construction

During construction, it is considered the proposal would generate some adverse socio-economic impacts, however significant positive impacts are also likely. Likely positive impacts include:

- Significant boost to the local and regional economies through generation of employment. About to 500 workers would be employed during peak construction. Using the Proponent's proximity principle, these would be drawn from the local area where possible.
- Significant boost to the local and regional economies through increased demand for accommodation, goods and services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to section6.6.2).
- Change in the rural landscape character and visual amenity of the area (refer to section 6.5).
- Influx of workers may put pressure on local accommodation, health and broader services.
- Demand for accommodation and increase in traffic movements may have an impact on tourism if the construction phase coincides with local festivals or events.

Greater Hume and surrounding areas provide many visitor accommodations. It is possible that, in conjunction with other major projects, shortages of accommodation may occur at times during the construction stage. It is important to note that the construction workers could be local and would not require commercial accommodation. The Proponent would engage with local accommodation providers and Greater Hume Shire Council if necessary, to provide additional short term and temporary accommodation at these businesses. The Proponent would also consult with Greater Hume Shire Council to co-ordinate construction schedules to minimise conflict with any local festivals or activities. Scheduling staff 'rostered days off' could help alleviate accommodation pressures by allowing itinerant workers to go back home.

It is considered that the demand for health care and other services would also be dispersed throughout the surrounding towns to coincide with where workers are staying.

Support of the development is reflected in the strategic principles of the *Greater Hume Community Strategic Plan 2030.* Overall, it is considered that the proposal would have a positive socio-economic impact given the significant economic boost the proposal would generate. It is considered that the expected adverse impacts would be minimal given the temporary nature of the construction phase and that impacts would be managed through the implementation of safeguards.

Operation and decommissioning

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 $12 000 per MW DC per year of spending to maintain, or about $4,800,000 per year. This is mostly on local wages, local contractors and material. Over the life of the project, this could provide around $144M of economic activity in the local community.

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

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

Some community respondents listed solar farm effects on land use or land values as a concern via the community feedback forms and ongoing consultation. 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. One lifestyle property is located within proximity to the development site. It is therefore considered unlikely that land prices would be adversely affected by the proposal.

6.4.3 Safeguards and mitigation measures

Table 6-46 Safeguards and mitigation measures for socioeconomic and community impacts

No.	Safeguards and mitigation measures	C	O	D
SE1	A Neoen Community Relations Plan and Local Participation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	C	O	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C	O	
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	C		D

C: Construction; O: Operation; D: Decommissioning

6.5 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

***Land –** Including:*

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

DPE (RESOURCES AND GEOSCIENCE) REQUIREMENTS

In fulfilling the SEARs relating to the State's mineral resources and rights to assess and extract those resources, the Division requires the following project-specific requirements to be addressed in the EIS:

- *The Proponent should undertake a dated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date-referenced map. It should also be noted in the EIS there are no operating quarries in the vicinity. Current mining and exploration titles and applications can be viewed through the Division's Minview map viewer.*
- *The Proponent must consult with the operators of Hurricane Hill, Boral Resources Pty Ltd and provide evidence of authentic consultation to the Division. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including associated electricity transmission infrastructure) in relation to the quarry site boundaries, and a letter of response from the quarry operator to the Proponent. If responses are not received from the quarry operators, the Proponent is to contact the Division.*
- *No biodiversity offsets have been proposed at this stage. The Division will assess any proposed biodiversity offset areas (both on and off the site) or any supplementary biodiversity measures on review of the EIS.*

DEPARTMENT OF INDUSTRY (AGRICULTURE)

Conditions for impacts to agricultural resources and land –

- *Describe the current agricultural status and productivity of the proposed development site and surrounding locality including the land capability as per the OEH* Land and soil capability assessment scheme*.*
- *Demonstrate that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated.*
- *Consider possible cumulative effects to agricultural enterprises and landholders.*
- *Detail the expected life span of the proposed development.*
- *Outline strategies to manage impact of agricultural aerial spraying in the area.*
- *Outline details of potential land use sharing with agriculture.*

Site suitable for development –

- *Detail that the proposal is consistent with relevant SEPPs, strategic plans and LEP requirements 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).*

- *Complete a Land Use Conflict Risk Assessment (LUCRA) to identify potential land use conflict, in particular relating to separation distances and management practices to minimise odour, dust and noise from sensitive receptors. A LUCRA is described in the DPI Land Use Conflict Risk Assessment Guide.*
- *Include a map to scale showing the above operational and infrastructure details including separation distances from sensitive receptors.*

DEPARTMENT OF INDUSTRY (CROWN LANDS)

There are two Crown Public Roads located near the proposal. Should the roads be required for site access to the proposal area, it is recommended that application be made to close and purchase the road by the applicant, or the road be transferred to Council. Transfer or closure must be completed before works are undertaken.

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

Given the location of the site, the discussion is centred on agricultural land use but also considers residential use, road and electricity networks and mining.

6.5.1 Existing environment

Agriculture and land capability

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

The Mining, Petroleum, Production and Extractive Industries State Environmental Planning Policy 2007 (the Mining SEPP) applies to land in the State. The proposal is consistent with the aims and planning principles of the SEPP (Primary Production and Rural Development) 2019. Part 2 of the Primary Production and Rural Development SEPP relates to state significant agricultural land. The proposal area is not identified in Schedule 1 as State Significant Agricultural Land or mapped as State Significant Agricultural Land. Therefore, Part 4 does not apply.

The land is classified as Class 4 under the Land and Soil Capability Assessment Scheme (OEH 2012) and is described as sloping land capable of sustaining cultivation on a rotational basis (Figure 6-8). 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 no mineral applications relevant to the development site (Figure 6-9) indicated in the Minview database (DPE 2017). This was confirmed by a letter from the NSW Division of Resources and Geoscience, stating there are no current mineral, coal or petroleum titles over the site or adjacent lands. It was however noted that the Boral Quarry is located approximately 1.5 km from the proposal, and consideration should be given to any potential impacts.

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

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

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

It is important to note that solar farms do not preclude the use of land for agriculture. Some agricultural activity is still possible whilst a solar farm is operating (e.g. grazing). Additionally, the degree of permanent land disturbance in the construction and operation of solar farms is small, and upon decommissioning of the proposal, the development footprint would be rehabilitated to restore land capability to pre-existing agricultural use.

For example, the Proponent engaged in a two-stage sheep grazing trial at their Nurmurkah Solar Farm located in Victoria (Appendix P). The two-stage trial was used to determine if the use of sheep grazing to control vegetation within the boundary of the solar farm:

- Did not cause any damage to solar farm infrastructure.
- Maintained groundcover to a maximum height of 100 mm during the fire danger season, which is a regulatory requirement of the development application.
- Reduced the machine operation and purchase costs.
- Reduction in the requirement of slashing.
- Could develop into a sustainable and long-term partnership between the Nurmurkah Solar Farm and local graziers.

Conclusions of the trial included that the sheep were effective in managing the height of groundcover, they did not cause any damage to solar farm infrastructure or impact on solar farm operations.

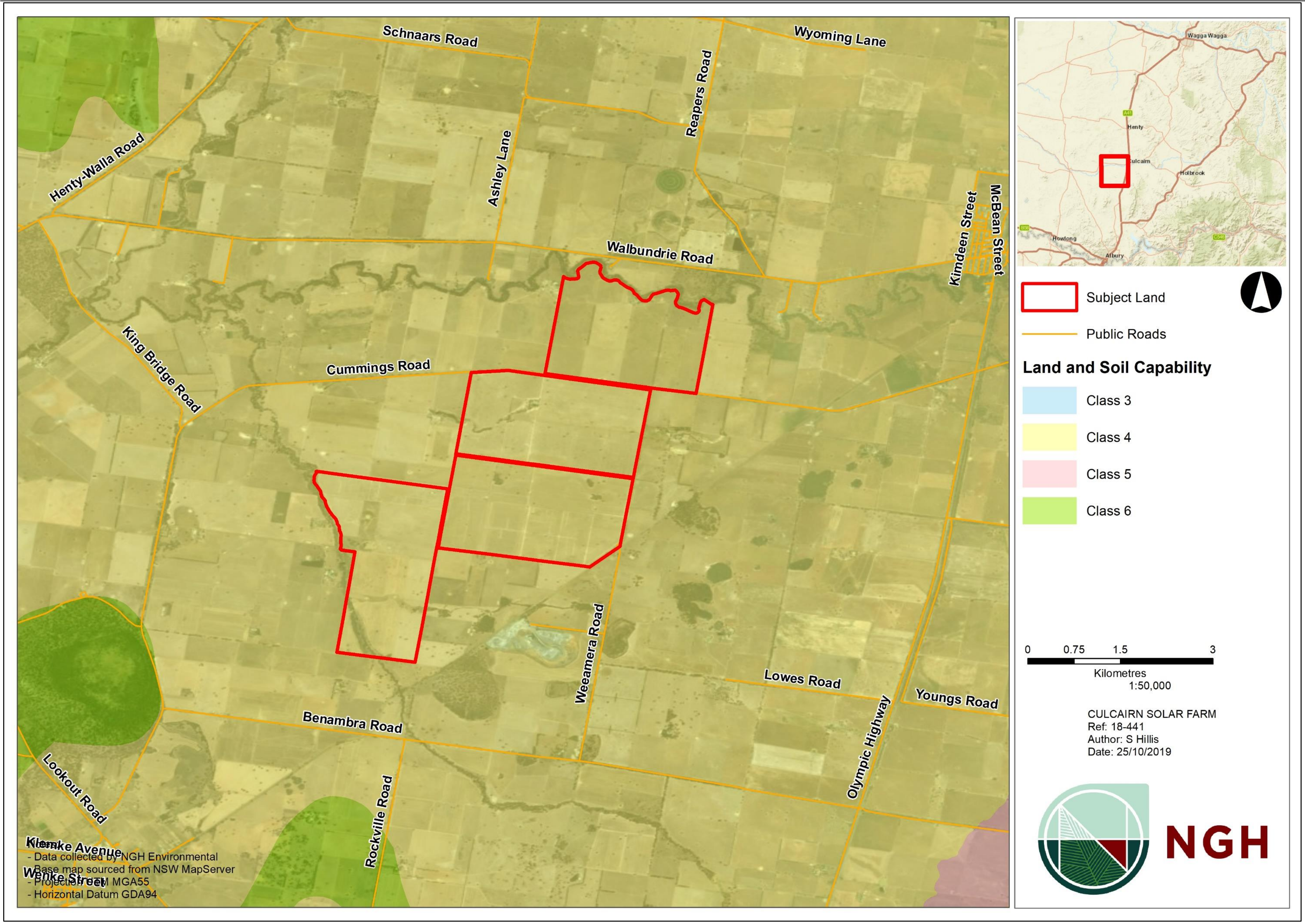

Figure 6-8 Land and soil capability mapping of the development site and surrounding area

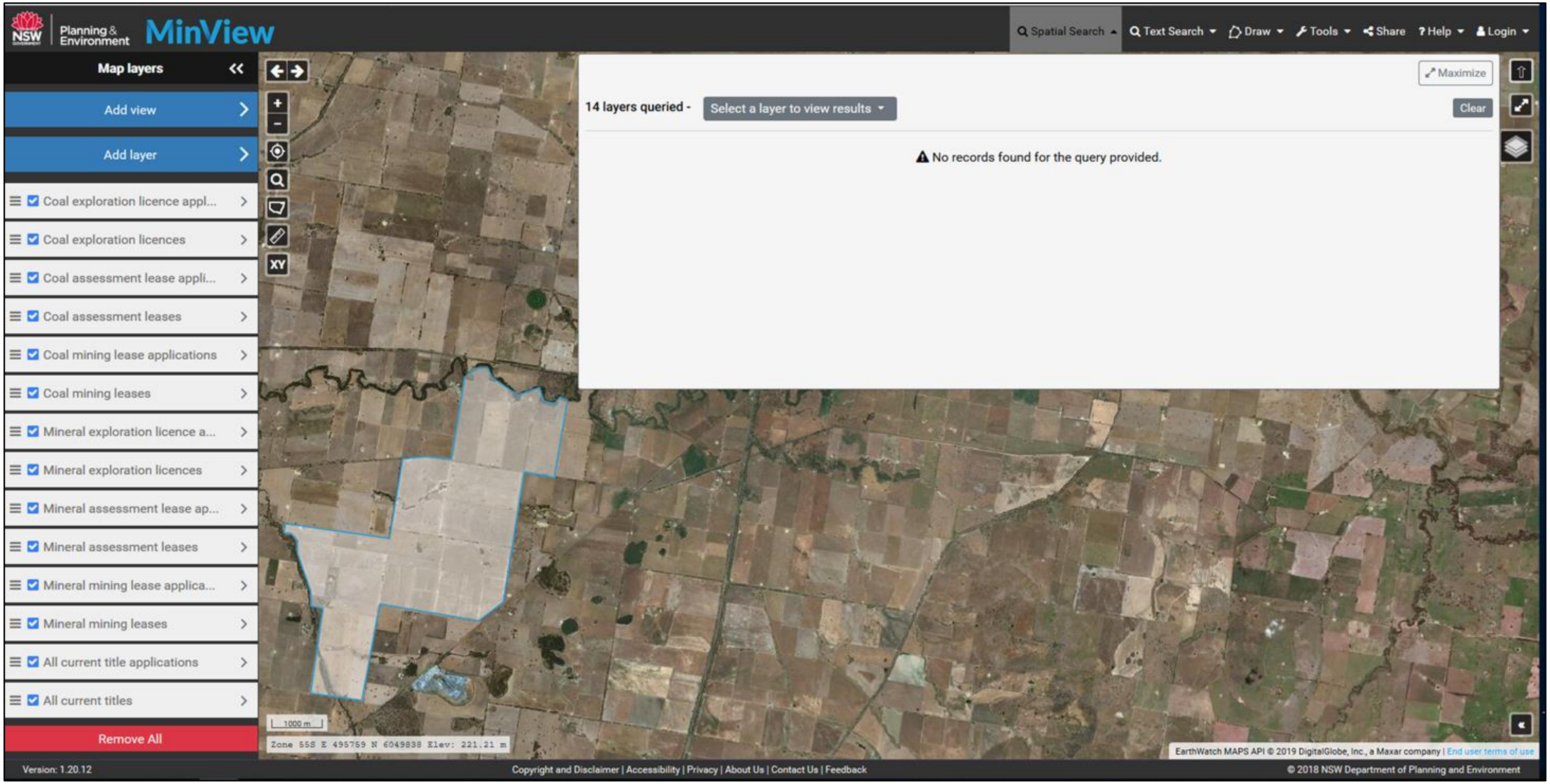

Figure 6-9 Exploration licences for the development site and surrounding land (DPE 2018). _The subject land is outlined in blue_.

Surrounding land uses

Land use activities surrounding the development site are predominantly agriculture with associated rural dwellings. The development site is zoned RU1 (primary production) (Figure 6-10). Surrounding agricultural land generally consists of cropping and grazing. Other land uses in the locality include:

- Benambra National Park is located within 17 km of the development site. It was created in January 2001 and covers an area of 1400 ha (NSW NPWS 2018).
- Lake Hume is located within 25 km of the development site.
- Residential dwellings and associated dwellings.
- Public road network.
- Electricity connection and transmission infrastructure.
- Township of Culcairn within 4 km of the site, comprising retail, health, accommodation and community services (refer to section 6.4).

Geological Survey of NSW (GSNSW) was consulted by email on 16 November 2018 (Appendix C.1) in regard to implications for access and prospective mineralisation. It was discussed with GSNSW that no onsite biodiversity offsets were proposed. The quarry on Hurricane Hill was identified, and no access issues were determined.

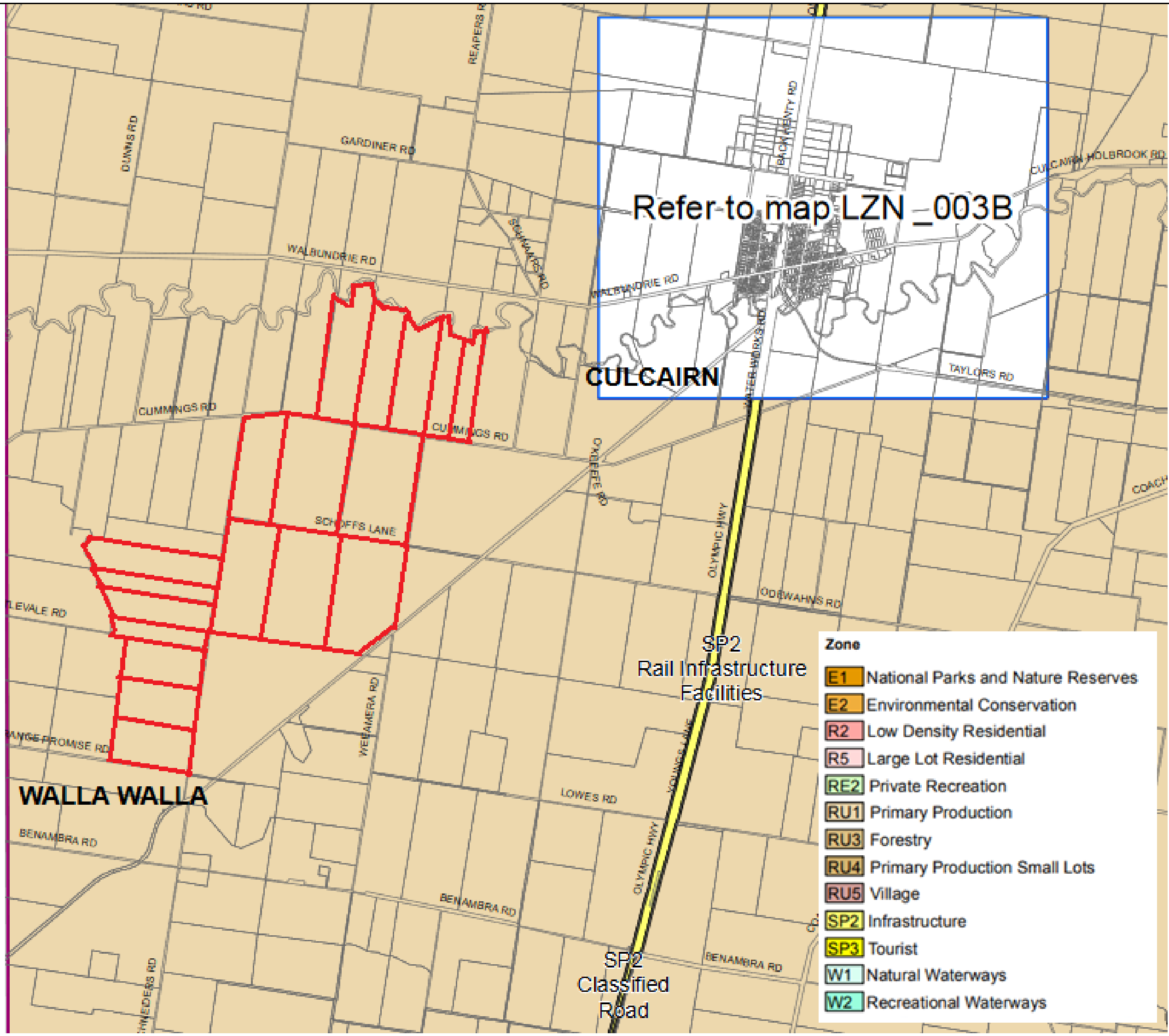

Figure 6-10 Planning zones surrounding the subject land (Greater Hume Shire Council 2012), indicated by the red line.

6.5.2 Potential impacts

Land use conflict risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI 2011). 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 6-48 has been determined using the risk ranking matrix shown in Table 6-47, 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 6-47 Risk ranking matrix (Source: DPI 2011)

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

Table 6-48 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Agricultural land use					
Agricultural spraying (aerial)	D4	5	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	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generated during the construction and decommissioning stages to be managed using water carts when required.	C5	4

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			Dust is not expected to generate a significant land use conflict during operation.		
Fire/ Bush fire	C1	22	Implementation of a Bush Fire Management Plan would significantly reduce the probability of solar farm operation starting a fire or a bush fire damaging the solar farm infrastructure.	D3	9
Visual amenity	C2	20	Screen landscaping along boundaries where identified in section 6.2 would mitigate expected impact on visual amenity.	D4	5
Noise	C3	17	Noise generated during construction and decommissioning stages would be minimised through the implementation of mitigation measures. Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict.	C4	8
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 section6.6.1). Traffic is not expected to generate a land use conflict during operation.	C4	8
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation phases	D4	5
Mining land use					
Resource extraction/exploration	D3	9	It is unlikely there would be an impact on resource extraction or exploration. In the long term (after decommissioning), the solar farm infrastructure would be removed, and the site made available for alternate	D5	2

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
			land uses including for mining purposes, if desirable.		

Construction and operation

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

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

Once construction of the solar farm commences, agricultural activities would cease in the areas involved in access and construction.

There may be some disruption to local traffic during construction due to construction traffic movements, which may impact the operation of surrounding land uses. This would be a temporary impact and could be managed in consultation with local landholders.

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

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

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

LAND AND SOIL CAPABILITY IMPACTS

The proposal is not expected to adversely affect the biophysical nature of the land which determines its capacity. 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. Some soil nutrients are expected to run down over time with the cessation of the crop fertiliser regime. Soil restoration and treatments would be guided by the findings of a pre-works soil survey conducted at the site (refer section7.3).

By maintaining perennial cover, the proposal would positively affect soils at the site by providing many of the benefits of long term fallow, including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving conditions for soil biota. Depending on the results of soil testing, treatment for acidity may be required prior to the establishment of groundcover (refer section7.3). No loss of productive potential is expected to result from the proposal in the long term.

AGRICULTURAL IMPACTS

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

- A reduction in the agricultural uses of the development site. Specifically, broad-acre dry-land cropping would not be possible. This situation will affect land used principally for crop production. However, this opportunity to rest the land would provide a multitude of benefits including returning soil organisms, soil carbon, soil moisture and soil structure to the areas previously cropped and grazed. Diversity in groundcover and perennial species of grasses would be encouraged to increase soil stability, increase organic material and reduce evaporation losses.
- Other agricultural production, particularly sheep grazing, would continue albeit at a reduced capacity. Continuing grazing at a reduced rate would encourage grasses to continue growth, reduce the impact of soil compaction and maintain vegetation height below the panels and around the property.
- One farm is currently family operated. The lessees of the other two farms are family operated. The fulltime equivalent (FTE) employment is estimated to be low, between 1 and 2 per farm. During specific times of the year, contractors are engaged to undertake tasks such as sowing and harvesting. These activities are short in duration and would typically employ several people. A small amount of additional employment is supported through local transportation services and processing (sheep and grain). In an employment context, the loss of jobs associated with the reduction of agricultural activities would be balanced by the creation of new jobs to support solar farm operations at the site. These new jobs would also create diversity in the local job market. The proposal would create ongoing employment for approximately 5 - 10 FTE staff, and up to 6 contractors annually.
- The property owner will be compensated by the Proponent/operator for hosting the solar farm through regular lease payments over the life of the solar farm. When compared with agricultural production, this payment has positive cashflow benefits and creates a diversity of income sources for the property owner. It is not seasonal, nor climate dependent. Lease payments would increase in line with CPI over the agreement period.

Upon decommissioning of the solar farm, the development site would require rehabilitation to restore it to its pre-existing agricultural condition

Resource loss and fragmentation

The proposal would not impact on land identified by the NSW Government as BSAL. Construction works involve only minor excavation with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to section 7.3 and section 0 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 Rural 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 as productive agricultural land.

Furthermore, the proposed subdivision would prevent the potential fragmentation of resource lands that may arise from subdivision should the proposed solar farm not proceed.

Disturbance to farming operations and livestock

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

Should any surrounding land be used for grazing, after a period of time livestock would become accustomed to the solar panels as they are to hundreds of installations currently on farms around the state.

During operation, the solar farm would be fenced for security. Strategic sheep grazing may be used within the development site. The strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent to the solar panels.

The impacts from dust on local and regional air quality and farming operations are expected to be negligible during operation. During regular operation, no vehicles would be present at the site on a permanent basis, with only occasional visits by light vehicles.

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

To assist in the management of weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on Greater Hume Shire Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls.

An Operational Weed Management Plan would also be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the development site and the importation and spread of weeds through vehicle movements. The plan would also focus on weed control techniques including herbicide and grazing pressure.

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

MINING IMPACTS

There are no mineral titles and no mineral applications relevant to the development site indicated in the Minview database (DPE 2017). This was confirmed by a letter from the NSW Division of Resources and Geoscience, stating there are no current mineral, coal or petroleum titles over the site or adjacent lands (Appendix C). It was however noted that the Boral Quarry is located approximately 1.5 km from the proposal, and consideration should be given to any potential impacts.

RESOURCE IMPACTS

The proposal would require approximately 23,000 m^3 of gravel to surface the access road and the internal service track network. Gravel would be required for the hardstands for the inverter / transformer stations, compounds, BESS and substation. Sand may be required for the bedding of underground cables, depending on the electrical design and ground conditions. Concrete would be required to construct the inverter, substation, CCTV, infrared sensors and battery storage 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 62 megalitres (ML) of water would be required during construction, mostly for dust suppression, but also for cleaning, concreting, on-site amenities and landscaping. The precise amount of water used during construction would be heavily affected by prevailing weather conditions and the need for watering to suppress dust generation.

Approximately 2.5 ML of potable water would be imported to the site during the construction period. The requirement for potable water 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 groundcover vegetation, where practical, during operation, the proposal is considered to be highly reversible in terms of preserving the agricultural capability of the development site.

Following decommissioning the site would be rehabilitated to restore it 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 for the recommencement of agricultural activities.

6.5.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 6-49.

Table 6-49 Safeguards and mitigation measures for land use impacts

No.	Safeguards and mitigation measures	C	O	D
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	**C**	**O**	**D**
LU2	Consultation would be undertaken with TransGrid regarding connection to the overhead energy transmission infrastructure.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping.			**D**

No.	Safeguards and mitigation measures	C	O	D
	• Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the solar farm is decommissioned.			
LU4	A Pest and Weed Management Plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Greater Hume Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	C	O	
LU5	The Proponent would consult with GSNSW in relation to biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral resources.	C		D
LU6	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	C	O	D
LU7	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning or removed as necessary to allow restoration of land capability to pre-existing agriculture.	C		
LU8	If possible and practical, managed sheep grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		O	

C: Construction; O: Operation; D: Decommissioning

6.6 TRAFFIC, TRANSPORT AND ROAD SAFETY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Transport – including

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

ROADS AND MARITIME SERVICES REQUIREMENTS

Given the scale and operational characteristics of the proposed development RMS considers that the traffic related issues relevant to the development should be considered and addressed in 2 distinct stages as follows:

- *Construction & Decommission phase – the transport of materials and equipment/components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility;*
- *Operational phase – the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project.*

Roads and Maritime Services emphasises the need to minimise the impacts of any development on the existing road network and maintain the level of safety, efficiency and maintenance along the road network. Given the type and scale of the proposal and assessment of the potential traffic impacts on the surrounding road network due to the development, particularly during the construction phase, should be submitted with the Development Application to allow for an informed assessment of the development proposal. This is consistent with the draft SEARs which refers to the need to address transport issues. The cumulative traffic with the nearby quarry also needs to be addressed particularly through the intersection of Benambra Road with the Olympic Highway. The required contents and detail of the Traffic Impact Assessment (TIA) will depend on the scale of the proposed development, the characteristics of the potential traffic generation and the traffic volumes and other traffic generating influences on the surrounding public road network.

The Traffic Assessment shall detail the potential impacts associated with the construction and operation phases of the development, the measures to be implemented to maintain the standard and safety of the road network, and procedures to monitor and ensure compliance. The workforce traffic to the development site and potential options to minimise traffic generated by the construction workforce to the site and fatigue issues also needs to be addressed.

Given the potential volume of traffic and the need for deliveries of the components to the development site during the construction period the supporting documentation identifies that a Traffic Management Plan is required to be prepared. Details for deliveries of ancillary materials such as gravel and concrete should also be considered as part of the submitted documentation. Where road safety concerns are identified at a specific location along the haulage route/s, the TIA may be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.

*For guidance in the preparation of the TIA the applicant is referred to section 2 of the "*Guide to Traffic Generating Developments*" prepared by the RTA and the Austroads publications, particularly the Austroads* Guide to Traffic Management Part 12: Traffic Impacts of Development *and Austroads* Guide to Traffic Management Part 3 – Traffic Studies and Analysis*. The TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site.*

Given the type and scale of the proposed development and its proximity to the public road network it is considered appropriate that issues relating to potential for distraction of, and for glint/glare impacts on, passing motorist be addressed in the development submission. Consideration could be given to the *establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.*

GREATER HUME SHIRE COUNCIL REQUIREMENTS

Traffic assessment to include cumulative impacts of the possibility of an adjacent large scale solar development being constructed concurrently to this proposal.

DEPARTMENT OF INDUSTRY (WATER) REQUIREMENTS

Suitable traffic movements –

- *Consideration of the route for movements needs to be taken into account so that impacts on sensitive receptors are minimised (e.g. noise, dust, volume of traffic). This should include consideration of Travelling Stock Reserves (TSR) and the movement of livestock or farm vehicles along/across the affected roads.*

6.6.1 Existing environment

Regional road network

Culcairn is located on the Olympic Highway. The Olympic Highway is a regional state highway, generally running in a north-south alignment. It has a carriageway width of 10 m, and one traffic lane of approximately 3.5 m wide in each direction.

Local road network

The proposed construction access is located on Weeamera Road via Benambra Road and the Olympic Highway. The RMS NSW Combined Higher Mass Limits and Restricted Access Vehicle Map (RMS 2018) indicates that Olympic Highway, Benambra Road and Weeamera Road are approved heavy vehicle access routes (25/26 m B-double routes as a maximum) (Appendix H). As such, the major access and transport/haulage route is from east from Olympic Highway, west along Benambra Road and north along Weeamera Road. The major transport route is still subject to further assessment, specialist input and consultation with Greater Hume Shire.

6.6.2 Potential impacts

Proposal requirements

Access requirements can be separated into the following categories:

- Cars – would be required by project management staff and site workers to access the site. Cars would make up the largest proportion of vehicles accessing the site.
- Buses – would 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 articulated 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 (7 am to 6 pm Monday – Friday, 7 am to 1 pm Saturday). Exceptions would occur as staff arrive and leave the site, before and after shifts. Additionally, the delivery of large components may take place outside normal working hours.

Vehicles would travel around the site via constructed access tracks, which would be required to access the following locations:

- Around the perimeter of the solar farm.
- Site office/compound.
- Onsite substation.
- Construction equipment laydown area.
- Transmission line route.

Internal access tracks would remain unsealed but would be re-sheeted with gravel or crushed and compacted soil, to maintain their condition during the construction phase.

Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby receivers.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by 'platooning' of construction traffic.

HAULAGE

While a detailed haulage program has not yet been developed, it is expected that the project's components are most likely to be delivered by road from Sydney and Melbourne. From Sydney, the route would likely include the South Western Motorway (M5), the Hume Highway (M31), Culcairn-Holbrook Road and Olympic Highway (A41). From Melbourne, the route would likely include the Hume Highway (M31), and Olympic Highway (A41).

These roads are of sufficient capacity to accommodate the haulage of components required for the construction of the solar farm and transmission line.

INCREASED VEHICLE NUMBERS

Approximately 40 employees would be required during the first month of construction, rising to 500 employees during the peak construction period (approximately 8-12 months duration). Expected vehicle movements during the peak construction period are detailed in Table 6-50.

Table 6-50 Vehicle movements during peak construction period.

Vehicle Type	Movements per day
Light vehicles / mini buses	300
MRV / HRV / B-Doubles / AV	100

INCREASED COLLISION RISK

The increased collision risk relates primarily to traffic entering and exiting the site from Benambra Road to and from Olympic Highway. This relates to both oncoming traffic and traffic following vehicles that are turning off the Olympic Highway.

Based on a 100 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 Benambra Road / Olympic 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 Olympic 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 Olympic Highway / Benambra Road intersection would likely require monitoring to ensure that the road is maintained in an adequate condition.

Benambra Road and Weeamera Road is already sealed up to the turn to Hurricane Hill, which is the Boral Quarry, off Weeamera Road. From this point to the construction access point directly adjacent to the discontinued railway line, Weeamera Road would require upgrading to accommodate construction traffic. Road upgrade works would meet the requirements of Greater Hume Shire Council. The Proponent would manage construction impacts on Olympic Highway, Benambra Road and Weeamera Road 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, the majority of vehicles would be traveling at low speed. Impacts from dust generated from the proposed activity, including that associated with increased traffic is considered in section 7.1.

The increase in traffic and heavy vehicle movements during construction and decommissioning would result in a minor increase in noise as a result of the proposed works. Olympic Highway is located approximately 4 km east of the project and forms part of the intersection where the concentration of traffic is expected. Olympic Highway already experiences moderate levels of traffic including heavy vehicles. The closest receiver (R14) is located 260 m from Weeamera Road. Weeamera Road construction access point is approximately 600 m from the closest receiver (R14). The traffic noise during construction and decommissioning would be unlikely to be noticeable at the nearest sensitive receiver.

DISRUPTION TO EXISTING SERVICES

Increased traffic along Benambra Road and Olympic Highway during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along the road. Road upgrades along the 1.4 km section of Weeamera Road and the construction of two rural driveway crossing points on Cummings Road may cause disruptions to local traffic. 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 the site and travel within the site during the operational phase (about 30 year period). Up to 10 cars per day would be expected during normal operation of the solar farm. Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure. Operational staff would be confined to designated parking areas and access roads/tracks within the proposal area.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access or be above the background noise levels.

Additional risks to road safety from operational traffic would be minimal.

6.6.3 Potential cumulative impacts

Construction

Peak construction total traffic movements for the proposal are estimated at 400 vehicle movements per day including 100 truck movements. Table 6-51 outlines the worst-case scenario peak construction traffic for both the proposal and the proposed Walla Walla Solar Farm of 750 combined vehicle movements per day using Benambra Road between the Olympic Highway and Weeamera Road.

Table 6-51 Cumulative traffic movements for proposed Culcairn and Walla Walla solar farms.

Vehicle Type	Movements per day – Culcairn Solar Farm	Movements per day – Walla Walla Solar Farm
Light vehicles / mini buses	300	250
MRV / HRV / B-Doubles / AV	100	90

The Traffic Impact Assessment undertaken by Amber (2019) estimates the capacity of Benambra Road at approximately 600 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 Benambra Road is not exceeded.

The condition of Benambra Road between Weeamera Road and Olympic Highway is sealed and approximately 7.5 m wide. The Benambra Road/Olympic Highway intersection already has the capacity for 36 m A-Double trucks and would be able to cater for a traffic flow capacity of approximately 300 vehicles per hour per lane. While this proposal does not propose any upgrades of the transport route from Olympic Highway to Weeamera Road, should the cumulative traffic numbers require upgrades and/or maintenance works, the Proponents would expect to share the cost and responsibility for these works with the proposed Walla Walla Solar farm.

Traffic management plan

The planned construction haulage route for the proposed Walla Walla Solar Farm is likely to be Olympic Highway and west down Benambra Road to the site. The increased traffic movements to the site would be predominantly limited to construction. The additional traffic and dust generation impacts have the potential to impact sensitive receivers along Benambra Road, primarily Receiver 15. A Traffic Management Plan (TMP) would be developed to minimise vehicle movements and dust as much as practical. Should both of these proposed solar farm proposals be approved, the TMP would include scheduling of vehicle movements to ensure congestion along the shared transport route of Benambra Road is minimised.

Generally, adverse cumulative traffic impacts are anticipated to be manageable through:

- reducing light vehicle movements by offering workers transport to and from site via shuttle bus.
- Collaborating with the main users of Benambra Road including Boral Resources, Walla Walla Solar Farm (if approved) and local schools regarding bus routes to coordinate scheduling and avoid road use conflicts.

Operation

Vehicle movements during the operation phase for solar farms is generally restricted to less than 10 light vehicle movements per day. In the event that both the proposed Walla Walla Solar Farm and the proposal become operational, it is anticipated that cumulative impacts on local roads would be negligible.

6.6.4 Safeguards and mitigation measures

Table 6-52 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. • 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 plan would include, but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network to be undertaken in consultation with Council. • Assessment of road condition prior to construction on all local roads that would be utilised. • 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. • Community consultation regarding traffic impacts for nearby residents. • 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 to minimise dust generation through increased traffic use. • Following construction, a post condition survey of the relevant sections of the existing road network to be undertaken to ensure it is of similar condition as prior to construction.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
TT3	Obtain a Section 138 Consent from the relevant council/agency to perform works within relevant road reserves.	C		
TT4	The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards. Weeamera Road north of the Boral quarry would be widened to 6.0 metres and have a light spray seal applied. This would allow two-way movement of heavy vehicles and reduce the impacts of dust on nearby dwellings.	Design Stage		
TT6	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 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER) AND HYDROLOGY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Water – *Including:*

- *an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Back Creek, Billabong Creek, drainage channels, wetlands, riparian land, farm dams, floodplains, key fish habitat, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;*
- *details of water requirements and supply arrangements for construction and operation; and*
- *a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with* Managing Urban Stormwater: Soils & Construction *(Landcom 2004);*

DOI WATER

- *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).*

DOI AGRICULTURE

Suitable and secure water supply –

- *Outline any impacts to water use from agriculture and mitigation measures if required.*

OEH REQUIREMENTS

Flooding –

The EIS should specifically address the attached requirements for flooding and conduct flood modelling for the purposes of appropriately locating infrastructure and for addressing post-development impacts outside the site.

The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:

- *Flood prone land.*
- *Flood planning area, the area below the flood planning level.*
- *Hydraulic categorisation (floodways and flood storage areas).*
- *Flood hazard.*

The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.

The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:

- *Current flood behaviour for a range of design events as identified in 11 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.*

Modelling in the EIS must consider and document:

- *Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.*
- *The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.*
- *Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.*
- *Relevant provisions of the NSW* Floodplain Development Manual 2005.

The EIS must assess the impacts on the proposed development on flood behaviour, including:

- *Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.*
- *Consistency with Council Floodplain Risk Management Plans.*
- *Consistency with any Rural Floodplain Management Plans.*
- *Compatibility with the flood hazard of the land.*
- *Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.*
- *Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.*
- *Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.*
- *Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.*
- *Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.*
- *Emergency management, evacuation and access, and contingency measures for the development considering the full range 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 SES.*
- *Any impacts the development may have on the social and economic costs to the community as consequence of flooding.*

6.7.1 Existing environment

Surface water

The proposal is located approximately 45 km north of the Murray River. Watercourses run through and along the boundary of the development site. These include Billabong Creek to the north and Back Creek to the west located along the boundaries of the proposal. Three unnamed ephemeral drainage lines flowing east-west traverse the site. One is a tributary of Billabong Creek and traverses the northern section of the site. The other two traverse the centre of the development site and are tributaries of Back Creek. These drainages throughout the site are classified as first or second order streams under the Strahler Stream Classification System (DPI 2018). Billabong Creek, classified as a seventh order stream, holds water and is generally flowing all year round. Back Creek, classified as a fifth order stream, and the small unnamed drainage lines are generally dry, experiencing water flow only at times of high rainfall.

Both creeks are identified as Class 2 under the Waterway Classification System (DPI 2018). The drainages that traverse the site are identified as Class 4 under the Waterway Classification System (DPI 2018). This is described as unlikely fish habitat, and/or as a named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or few standing water or pools after rainfall events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present). Aquatic biodiversity is further described in section 6.8.7.

Development is not proposed within the drainage lines, no riparian vegetation would be cleared, and a riparian vegetation zone buffer retained. An extensive network of water diversion channels exists throughout the central area of the development site.

There are 20 farm dams within the subject land and all of these would be retained. The farm dams are not large and they contain only poor to moderate quality aquatic habitat. None of these dams are proposed to be removed, which would result in retaining all aquatic habitat (Figure 6-11).

Figure 6-11 Typical farm dam on the property.

Flooding

The development site is not identified as flood prone land under the Greater Hume LEP. However, the Billabong Creek system has recorded major floods in 1931, 1939, 1956, 1960, 1970, 1974, 1981, 1983 and 1995, with the largest recorded flood in July 1931. The system is subject to the *Billabong Creek Floodplain Management Plan 2006* (DNR 2006). The development site is, however, outside of the critical flow distribution areas detailed within the management plan.

Moderate to major flooding events have also been recorded upstream of Culcairn in 2010, 2011 and 2016. The Culcairn Floodplain Risk Management Study and Plan (WMAwater 2017) does not extend to the boundary of the proposal.

Groundwater

No free groundwater or seepage was observed during pit excavations for the soil survey (refer to section 7.3) The maximum depth of excavations at the site was 1.5 m.

The development site is situated within an outcropped area of the Lachlan Fold Belt MDB Groundwater Source (NSW Government 2011) and falls under the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011 (NSW Government 2011).

The licensed bores located within the development site, access the Billabong Creek Alluvial Groundwater Source (refer to section below for details). The Billabong Creek Alluvial Groundwater Source is part of the Billabong Creek Alluvium (Figure 6-12Figure 6-12), a designated Groundwater Management Area (GWMA) of NSW and is located between the Murrumbidgee and Murray Catchments (Kulatunga 2013).

Groundwater occurs to a depth of around 100 m and includes three main productive aquifers within the alluvial formation. These include the Upper Cowra (10 – 20 m below surface), Lower Cowra (30 – 40 m below surface) and Lachlan (60 – 100 m below surface) (Kulatunga 2013). The most productive aquifer is the deeper Lachlan Formation, which can produce up to around 5 ML/day from a well-constructed bore (Kulatunga 2013).

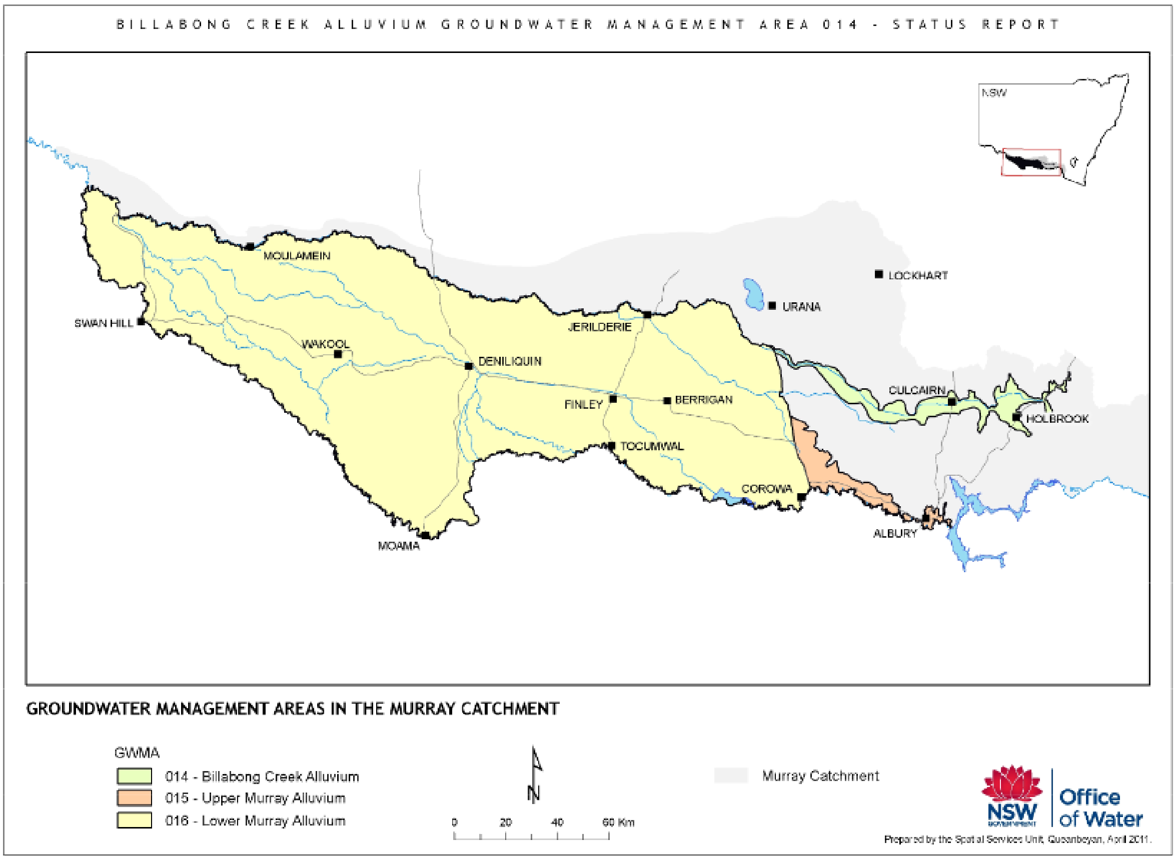

Figure 6-12 Groundwater Management Areas in the Murray Catchment, see 014 - Billabong Creek Alluvium (Kulatunga 2013).

Bores

The NSW DPI database of groundwater sites lists nine groundwater bores located within the development site (Figure 6-13). Table 6-53 provides a summary of these bores. A further 26 bores are located within 1 km of the development site (Figure 6-13). The licensed bores in the development site access the Billabong Creek Alluvial Groundwater Source.

Table 6-53 Summary of groundwater bores located within the development site.

Bore ID	Status	Purpose	Bore Depth (m)	Drill date
GW049688.1.1	Unknown	Water supply	10.70	01/07/1979
GW049482.1.1	Unknown	Water supply	22.20	01/02/1979
GW029504.1.1	Unknown	Stock and domestic	26.50	01/01/1969
GW015056.1.1	Decommissioned	Stock and domestic	26.50	01/11/1956
GW088516.1.1	Proposed	Monitoring	34.00	17/03/1999
GW005333.1.1	Non-functional	Unknown	25.60	Unknown
GW015459.1.1	Unknown	Water supply	24.40	01/12/1956
GW005205.1.1	Unknown	Unknown	50.90	01/05/1911
GW029954.1.1	Unknown	Stock and domestic	27.40	01/01/1968

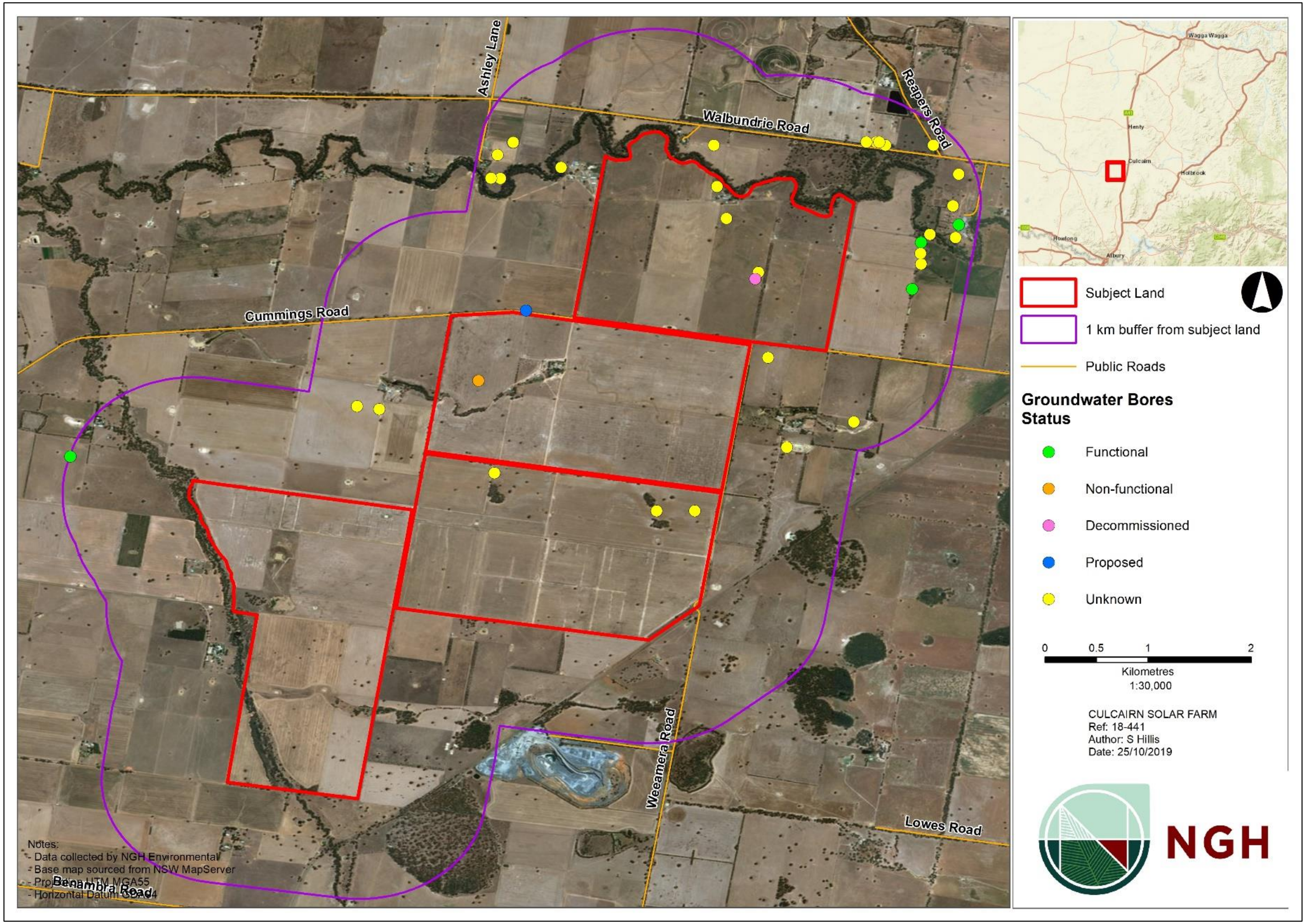

Figure 6-13 Groundwater bores within 1 km of the subject land (*DPI water 2019*).

6.7.2 Potential impacts

Construction and decommissioning

WATER USE

Water demand for the proposal would be relatively small, as construction of the solar farm is not water intensive. 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 62 ML in total. About 2.5 ML of potable water would be required for employees and contractors (Table 6-54). Stock would potentially be watered from retained dams and/or artificial water sources.

Table 6-54 Water requirements during construction

Water quality	Annual construction water requirement	Potential sources	Availability
Potable (drinking)	2.5 ML (for ~12 months)	Bottled water	Available as required – commercial supply
Non-potable	62 ML (for ~12 months)	Truck delivery	Available as required

All non-potable water would be sourced from a Greater Hume Shire Council standpipe and/or the nearby Boral Quarry. The Proponent are currently in consultation with Greater Hume Shire Council and Boral for agreements in principle to access the water, which would be trucked to site. Council would then invoice for water usage per kilolitre.

SURFACE WATER QUALITY

The proposal would not directly affect surface water quality during construction. The farm dams with moderate quality habitat along the drainage channel would be retained. No works would occur within the channels or riparian buffers of Back Creek and Billabong Creek. Works would be avoided within the channel and riparian buffer of the drainage in the north of the development site, which extends south-west from the house south off Cummings Road. Works would also be avoided within the channel and riparian buffer of the drainage in the south of the development site that flows west to its confluence with Back Creek. No riparian vegetation would be removed. Works would be avoided in the River Red Gum swampy woodland wetland located near the south-western boundary of the development site.

Indirectly, the proposed works would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff. This could affect local waterways, including water diversion channels, during rainfall events. These potential impacts are discussed in section 7.3 and are unlikely to significantly impact on water quality.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides, none of which are considered difficult to manage.

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).

GROUNDWATER

It is unlikely that groundwater would be extracted during construction. If required, a licence would be obtained for water extraction. There is no groundwater vulnerability under the Greater Hume LEP (GHS 2012). It is considered that the proposal would have a 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.

Operation

WATER USE

Water use volumes during operation would be minimal, at approximately 1 ML per year. Water would be required for staff amenities at the control and maintenance building and for panel cleaning. Requirements would be extremely minor except for cleaning which is fully dependant on weather. Some solar plants are never cleaned, others require more than two cleanings per year. Should water be required, it would be trucked in from a standpipe and/or the nearby Boral Quarry. About 54 kL of potable water would be required for employees and contractors.

The toilet facilities would be connected to a septic tank installed in line with Greater Hume Shire Council requirements. Approval under Section 68 of the *Local Government Act* is required to operate an onsite sewage management system and to draw water from a council standpipe.

SURFACE WATER QUALITY

Potential for any impact to surface water quality during operation is negligible. Appropriate drainage features would be constructed along internal access roads to minimise the risk of dirty water leaving the site or entering waterways. The site would be largely vegetated, with the exception of internal roads, parking areas and areas around the site office. Risks to water quality impacts during operation would therefore be low.

There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

SITE WATER BALANCE

A site water balance has been calculated for the development site once in operation with the existing drainage lines and remaining farm dams (Appendix J). The development site would remain vegetated except for internal access tracks, the hardstands and gravel compounds. The substation would be a gravelled hardstand area. The runoff coefficient was used from the Wagga Wagga City Council Engineering Guidelines (WWCC 2017) as this information was not available for Greater Hume Council. The engineering guidelines were developed from work for Wagga Wagga, Griffith, Albury, Wodonga and other Councils. The conservative runoff coefficients that have been used are presented in Table 6-55.

Table 6-55 Runoff coefficients for a 2 year average recurrence interval (ARI).

Feature	Fraction impervious	Runoff coefficient
Development site	0.0	0.16
Solar array	0.1	0.22

Feature	Fraction impervious	Runoff coefficient
Compacted gravel hardstands and roads	0.9	0.71

Water balance calculations used the design rainfall event for a 63.2% Annual Exceedance Probability (AEP) for a 24-hour period. The latest 2016 rainfall Intensity Frequency Duration (IFD) data was obtained from the Bureau of Meteorology (BOM). The IFD Design Rainfall Depth for the proposal (-35.6875, 146.9625) for a 63.2% AEP with a 24-hour duration is 43.9 mm. This is the same figure when compared to the average decile 5 (median) rainfall statistic of 43.9 mm sourced from the Albury Airport Automatic Weather Station (site number 072160, 36.07°S, 146.95°E), which has a continuous record for 25 years. Table 6-56 presents the land size, precipitation volume for the design rainfall event and runoff for each feature.

Table 6-56 Site water balance for the operational phase of the proposed Culcairn Solar Farm using a design rainfall event of 63.2% AEP 24-hour duration.

Feature	Fraction impervious	Size (m^2)	63.2% AEP 24 hour (m^3)	Runoff (m^3)	Comment
Development site	0.1	6367417	279530	44725	Vegetated component of development site not including panelled areas, channels, dams, hardstands, roads, inverter and battery hardstands or the substation.
Drainage channels	-	90130	3957	0	It is expected that 100% of the precipitation on to the channel will either leave the site or be contained within the ephemeral channels. Channel widths vary, an average of 10 m width was used.
Wetland and remaining dams	-	16073	706	0	Assuming the dams are near empty, all total volume would be stored. Assuming each dam is approximately 2.5 m deep, the total free volume would be 32,146 m^3 calculated at 2 m depth of remaining storage.

Feature	Fraction impervious	Size (m^2)	63.2% AEP 24 hour (m^3)	Runoff (m^3)	Comment
Solar Panelled Area	0.1	6298000	276482	60826	Assuming 10% imperviousness (WSP 2019 (Appendix I)) and worst-case scenario panelled area, inclusive of areas between rows.
Internal gravel roads	0.9	220000	9658	6857	Calculated with an average road width of 5 m.
Gravel compound areas	0.9	118380	5197	3690	Including hardstand for Operation and Maintenance building.
Inverter and BESS gravel hardstands	0.9	20000	878	623	
Substation	0.9	40000	1756	1247	
Total		13,170,000 m^2	578,164 m^3	**118,674 m^3**	Of which the dams could capture and store around 86,000 m^3 if assumed near empty.

A total of 578 ML of rainfall falls within the boundary of the development site during a 63.2% AEP for a 24-hour duration. Of this volume of rainfall, 20.6% or 119 ML is runoff due to the impervious nature of the compaction of the gravel roads, hardstands, solar panelled area and substation. Some runoff would be directed and captured in one of 20 dams within the development site. The majority of the site would remain vegetated and uncompacted and therefore, remain predominantly pervious.

SURFACE WATER AND FLOODING

A concept stormwater management plan was commissioned by the Proponent from WSP (Appendix I). It describes the natural flow paths across the existing site and identifies the potential impacts of the proposed infrastructure on flood behaviour. It provides a worst-case scenario of potential impacts from flood behaviour for a 5%, 1%, 0.5% and 0.2% Annual Exceedance Probability (AEP) and the Probable Maximum Flood (PMF).

It has assumed that grazing will cease and heights (i.e. roughness) of groundcover would increase. The Manning's roughness coefficient that was used in the modelling reflects this assumption. It should be noted that whilst groundcover would be maintained across the site, it would be managed for fire safety and for the safety of personnel working around infrastructure. Groundcover management would be achieved through grazing or mowing. Infrastructure would remain beyond the riparian boundaries of the creeks and drainage channels.

Increases in impervious areas and cessation of grazing during the operation of the proposal would result in small reductions in peak discharge at most site discharge locations. The decrease in peak discharge would be accompanied by increased flood depth in the order of 5 cm at locations beyond drainages. A maximum increase in flood height of 13 cm could occur in the southern section of the development site during the probable maximum flood (PMF). Flood extents would not change or have a negligible change with proposed infrastructure.

The development would be compatible with any flood hazards identified in the mapping. The requirements of the EIS assessment for flooding are outlined in Table 6-57.

Table 6-57 Impacts of the proposal on flooding.

Potential impact	Assessed by this EIS
Interactions of project elements (such as security fencing, hard stand areas, solar panel piles, footprints of switching room and permanent buildings) and impact upon flood waters.	• The framing used to hold the solar arrays has a very small footprint. It is unlikely they will have an impact on flood behaviour. Flood height would need to exceed 1 m before anything other than the pile is affected by floodwater. The 67 to 75 inverter/transformer units will be installed on concrete footings 0.3 m above gravel hardstands. The BESS units will be installed on concrete footings on the gravel hardstand adjacent to the substation compound, 0.3 m above the ground. • The switch room and storage shed will be built on concrete footings 0.3 m above ground level over a gravel hardstand, adjacent to the substation. • The site office would be erected on concrete footings 0.3 m above a gravel hardstand. • Hardstand areas (e.g. gravel roadways, gravel compound areas and hardstands) are minimal and are unlikely to impact flood behaviour. Stormwater runoff for a 63.2% AEP 24-hour duration would increase by around 2.2% due to the addition of the beforementioned impervious surfaces. • Security fencing would be around 2 m high and surround the perimeter of the proposal and the substation. It is unlikely that this infrastructure would have an impact on floodwater. On-site floodways (two unnamed drainages) and bordering creeks (Back Creek and Billabong Creek) would remain unimpacted and assist in the removal of floodwater.
Location of critical infrastructure in relation to flood storage areas.	• Three unnamed drainages that traverse the development site would act as floodways. Infrastructure would be limited in these areas. • All on-site flood storages would remain within the development footprint post construction.

GROUNDWATER

No operational activities would affect groundwater. There would be no impacts to GDEs during operation.

6.7.3 Safeguards and mitigation measures

Table 6-58 Safeguards and mitigation measures for water quality impacts

No.	Safeguards and mitigation measures	C	O	D
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	C	O	D
WA3	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act). This would include monitoring methodologies of surface and groundwater.	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		

C: Construction; O: Operation; D: Decommissioning

6.8 BIODIVERSITY (FLORA AND FAUNA)

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 OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values;*
- *The BDAR must document the application of the* avoid, minimise and offset *framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and*
- *An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the* Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.*

LOCAL LAND SERVICES REQUIREMENTS

- *Cleared farmland will be deemed Category 1 land, in the absence of a published Native Vegetation Regulatory (NVR) Map.*
- *Remnant areas and scattered trees would be deemed Category 2 land and will generate credits.*
- *Hollow-bearing trees, where dead, will require consideration for potential threatened species impact even though they are not considered native vegetation under the LLS Act.*
- *Removal or minimising impacts to the ecological values within the project area. Remnant native vegetation and the scattered paddock trees to be avoided as far as practicable.*
- *Where retained, vegetation buffers be created to ensure indirect impacts do not occur during construction or operation of the Solar Farm.*
- *Tree Protection Zones to be established on remnant vegetation and scattered trees not approved for clearing (if any), with retained patches of vegetation to be fenced, and operations excluded from them (if required).*
- *A BDAR will be prepared, and OEH must be consulted (as they will have been to date for input to SEARs).*
- *Prior to planning approval being finalised, there must be a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development. Also, a strategy to offset any residual impacts of the development in accordance with the BC Act must be in place.*

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

- *The Scoping Report indicates that remnant vegetation will be largely retained but the layout of the development means numerous paddock trees would be removed. The threatened species habitat value of these trees will need to be determined as part of the EIS process, along with an assessment of indirect impacts to the remnant woodland patches occurring within the proposed solar array. Mitigation measures will include an appropriate buffer between the development footprint and remaining native vegetation.*
- *Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the BC Act using the BAM and documented in a BDAR. The BDAR must include information in the form detailed in the BC Act (s6.12),* Biodiversity Conservation Regulation 2017 *(s6.8) and the BAM, unless OEH and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values.*
- *The BDAR must document the application of the* avoid, minimise and offset *framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.*
- *The BDAR must include details of the measures proposed to address the offset obligation as follows:*
    a. *The total number and classes of biodiversity credits required to be retired for the development/project;*

> b. *The number and classes of like-for-like biodiversity credits proposed to be retired;*
> c. *The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;*
> d. *Any proposal to fund a biodiversity conservation action;*
> e. *Any proposal to make a payment to the Biodiversity Conservation Fund.*
>
> *If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.*
>
> - *The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM.*
> - *The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s.6.10 of the BC Act.*
>
> **DEPARTMENT OF INDUSTRY (AGRICULTURE)**
>
> **Biosecurity –**
>
> - *Include a biosecurity (pests, weeds and disease) risk assessment outlining the likely plant, animal and community risks.*
> - *Develop a biosecurity response plan to deal with identified risks as well as contingency plans for any failures. Including monitoring and mitigation measures in weed, disease and pest management plans.*
> - *Details of adequate fencing to keep livestock out.*

6.8.1 Approach

A specialist Biodiversity Development Assessment Report (BDAR) was prepared by NGH to investigate and assess the potential impacts of the proposal on biodiversity. The proposal includes the development footprint of the solar farm and the road upgrades required along Weeamera Road to the proposed site access. The aims of the report were to address the biodiversity matters raised in the SEARs and to address the requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act). The BDAR also addresses the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It also provides a 'credit requirement' in order that impacts that are not avoided are offset in accordance with the BC Act and Biodiversity Assessment Methodology (BAM).

The full report is included in Appendix E and the report is summarised below.

6.8.2 Existing environment

Landscape features

The topography of the region features low-gradient undulating and hilly ranges, wide valleys and isolated peaks (Goldsmith, Barker & Johnston 1985). The topography of the Culcairn region is comprised of the extensive flat alluvial Back Creek – Billabong Creek floodplains with sparse narrow drainage lines. Local relief is low at <5 m and elevation varies from 200-250 m in height. Hurricane Hill is the most prominent of three hills in the local area which is located 1.5 km north of the proposal area. Within the immediate proposal area, the landscape bears flat to gently undulating gradients with a low hill rising in the western portion of the proposal area. An ephemeral tributary of Billabong Creek traverses the section of the development site north of Cummings Road.

The site is located over the Walbundrie 1:50,000 Topographic Map (Sheet 8226-S) at an elevation range of approximately 200 m to 220 m AHD. The landform of the site consists of extremely low relief and shallow alluvial stream channels forming an alluvial plain. Two widely spaced shallow ephemeral tributaries of Back Creek traverse the site, both are unnamed. Back Creek is ephemeral and flows north along the western boundary of the development site. Back Creek is a tributary of the moderately deep and perennial Billabong Creek which borders the northern extent of the site.

Groundwater and surface water

The Back Creek/Middle Creek catchment extends into a hill range, 6 km east of the Olympic Highway. The upper catchment area drains westwards crossing the Olympic Highway and the adjoining Melbourne-Sydney Railway at multiple culvert structures. The terrain west of the Olympic Highway is flatter, generally draining northwards towards the assessment property.

Five watercourses run through or along the boundary of the development site, Billabong Creek to the north, Back Creek to the west, one unnamed ephemeral tributary of Billabong Creek and two unnamed ephemeral tributaries of Back Creek that flow east-west through the centre of the development site. These creeks are classified as first or second order streams under the Strahler Stream Classification System (DPI 2018).

These creeks are generally dry, experiencing water flow only at times of high rainfall. From the Geoscience Australia hydrogeology dataset, the groundwater beneath the site is described as fractured or fissured, extensive aquifers of low to moderate productivity over the majority of the site with the north eastern corner consisting of porous, extensive highly productive aquifers associated with Billabong Creek.

Native vegetation

The development site is used for cropping and was under crop during survey periods. The site north of Cummings Road contains improved pastures and is currently used for cattle grazing. The vegetation within the development site has been previously cleared, evidenced by remaining paddock trees and remnant woodland vegetation. The groundcover in the landscape surrounding the development site is predominantly open woodland comprised of Blakely’s Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*), Western Grey Box (*Eucalyptus microcarpa*), White Box (*Eucalyptus albens*) and River Red Gum (*Eucalyptus camaldulensis*), and Plains Grass Grassland.

Native scattered paddock trees remain across the site comprised of Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*), White Box (*Eucalyptus albens*) and Blakely’s Red Gum (*Eucalyptus blakelyi*).

About 70.52 ha of native vegetation occurs within the development site. This is comprised of plant community types (PCTs):

- About 20.80 ha of River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion (PCT 5).
- About 14.03 ha of Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion (PCT 74).
- About 4.28 ha of Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT 76).
- About 3.48 ha of River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW (PCT 249).
- About 27.93 ha of Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (PCT 277).

99 paddock trees occur within the development site (Figure 6-14 to Figure 6-20) and would be cleared. These were predominantly a mix of Grey Box, Yellow Box and Blakely’s Red Gum.

Five PCTs occur within the development (Figure 6-21 to Figure 6-27) site including:

- PCT 5 – River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.
- PCT 74 – Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion.
- PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT249 –River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW.
- PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.

Patches of derived grassland communities associated with the above PCTs were also identified in low condition throughout the site.

Cleared areas (Non-indigenous vegetation)

About 4524 ha of the 1500 m buffer area comprises cleared vegetation, predominantly cropped paddocks and occasional roads and residences.

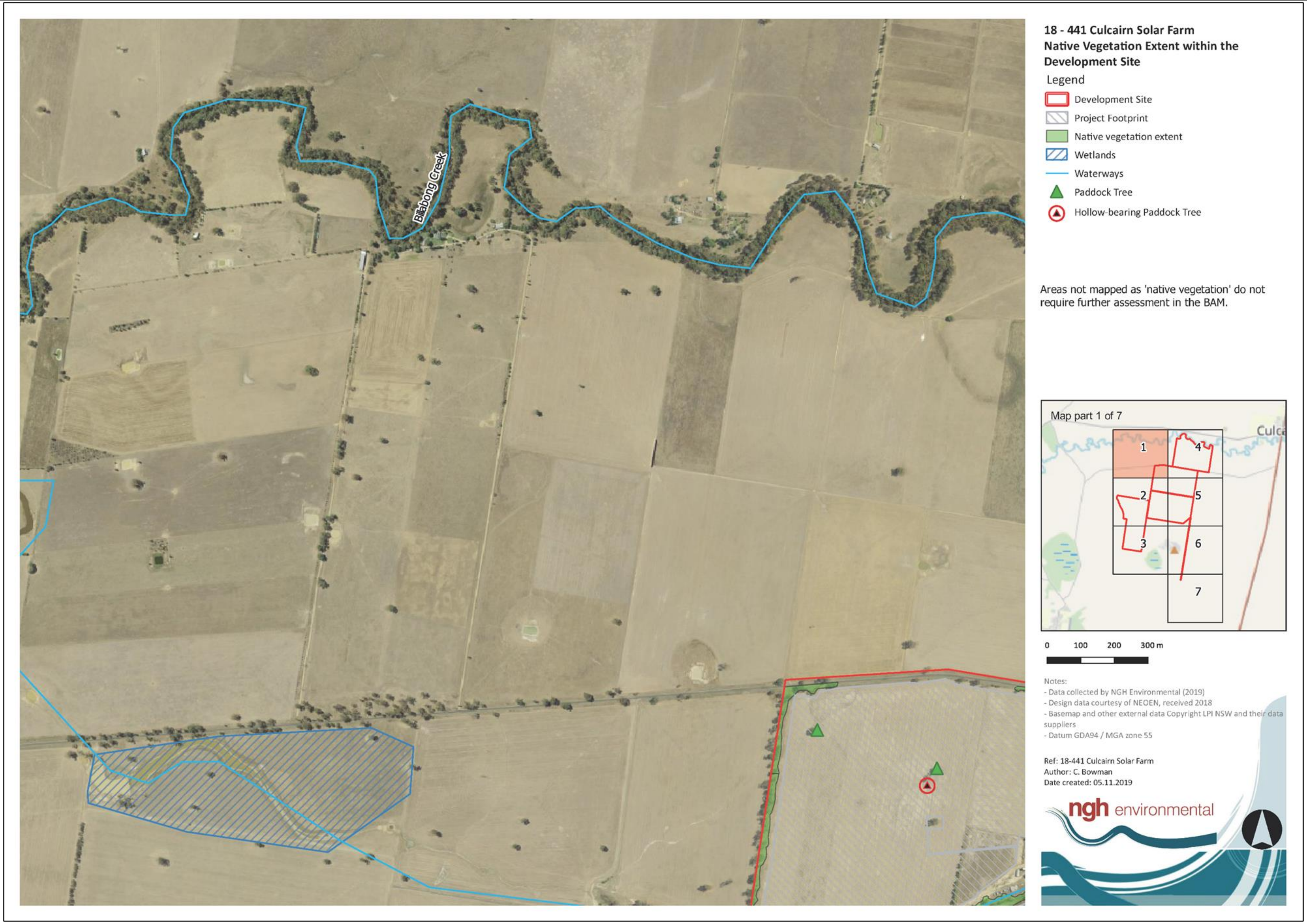

Figure 6-14 Native vegetation extent within the development site.

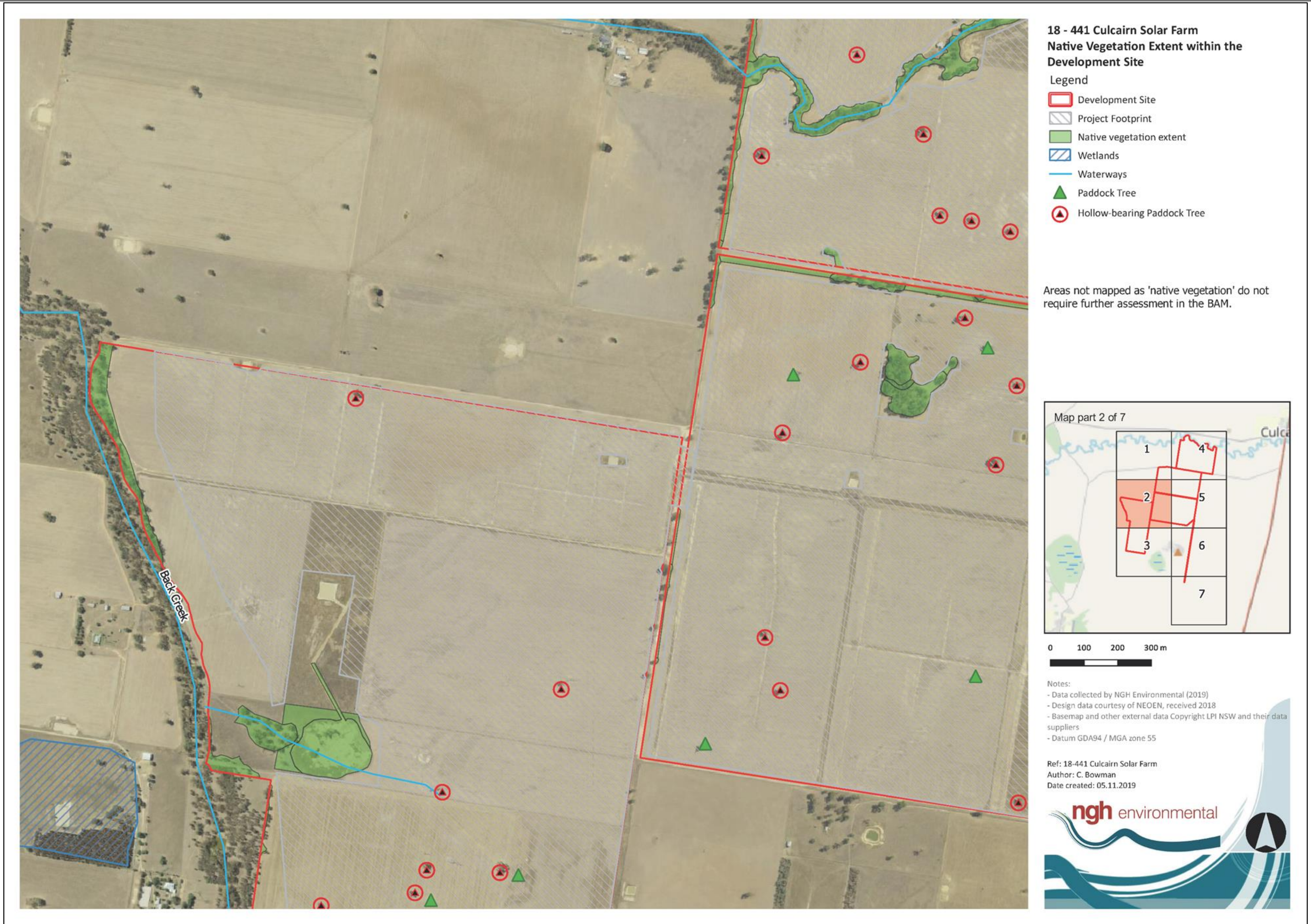

Figure 6-15 Native vegetation extent within the development site.

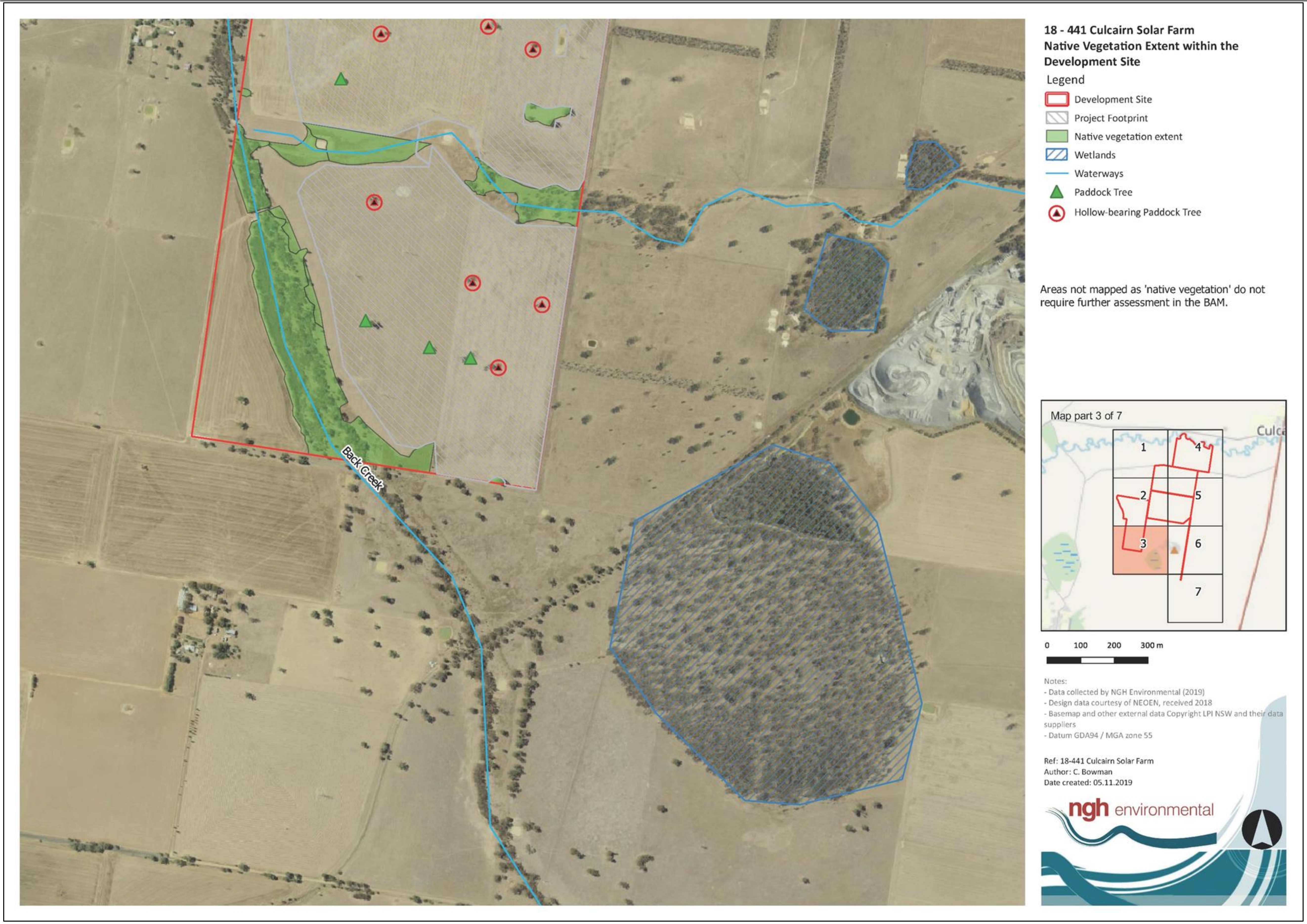

Figure 6-16 Native vegetation extent within the development site.

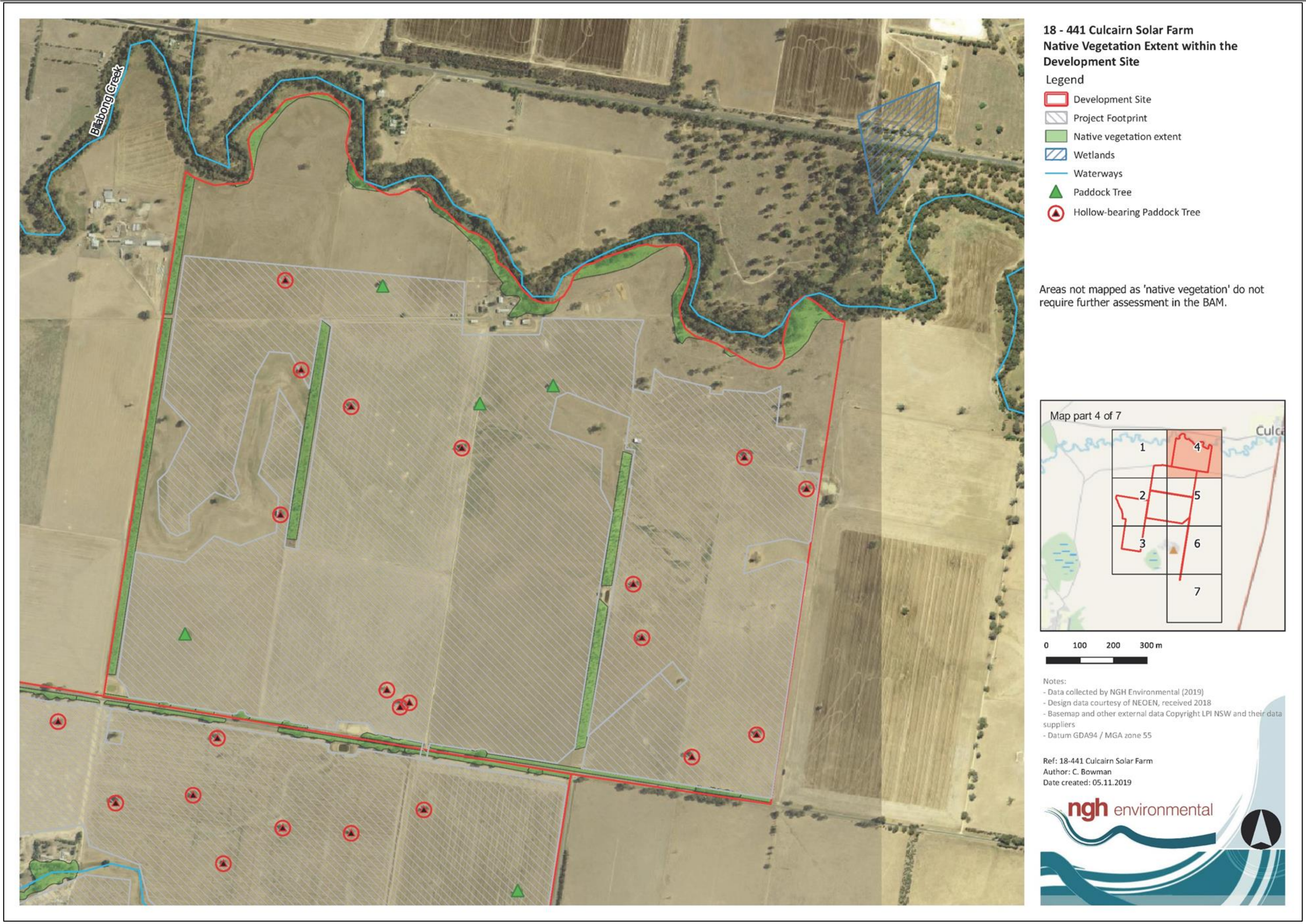

Figure 6-17 Native vegetation extent within the development site.

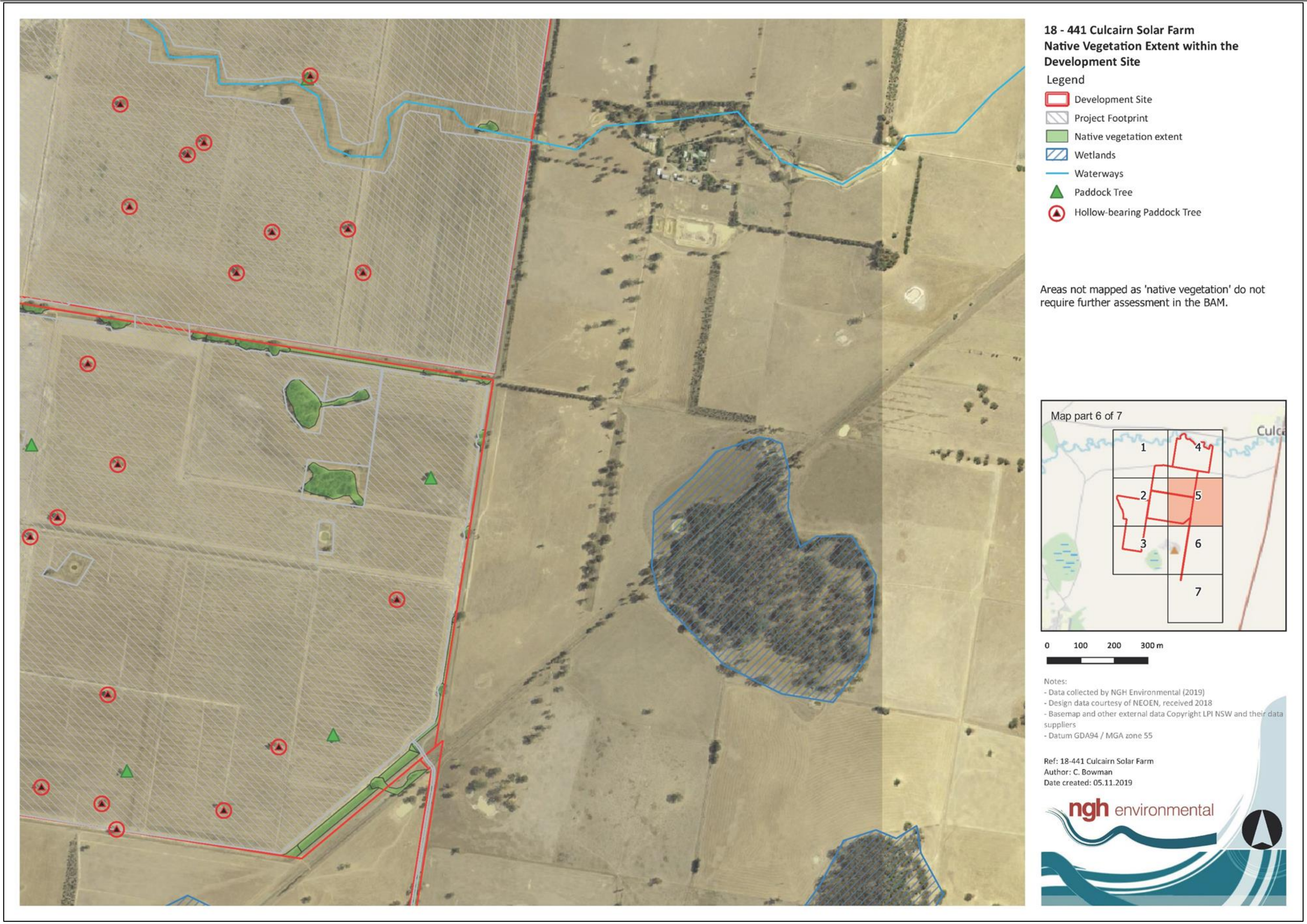

Figure 6-18 Native vegetation extent within the development site.

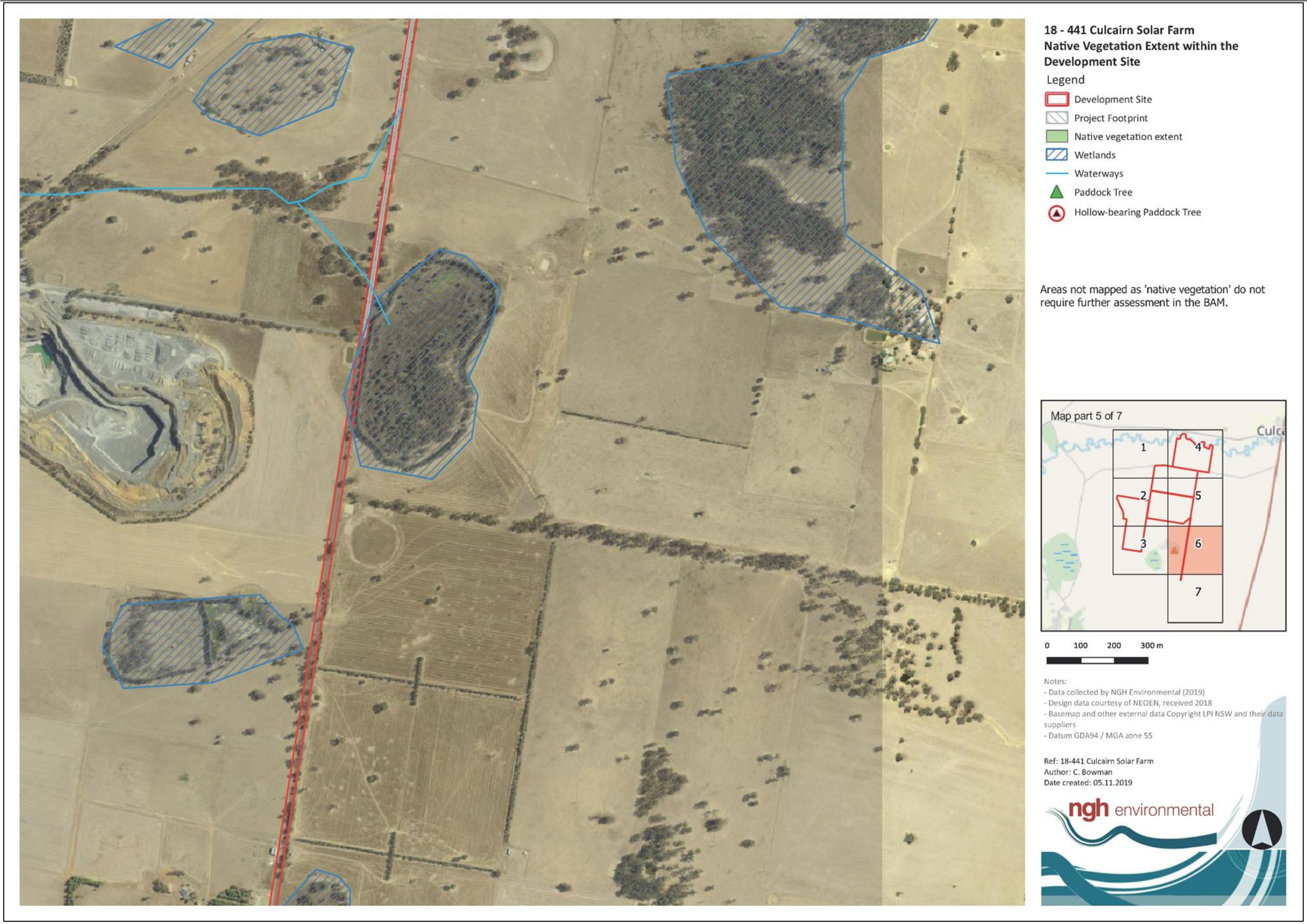

Figure 6-19 Native vegetation extent within the development site.

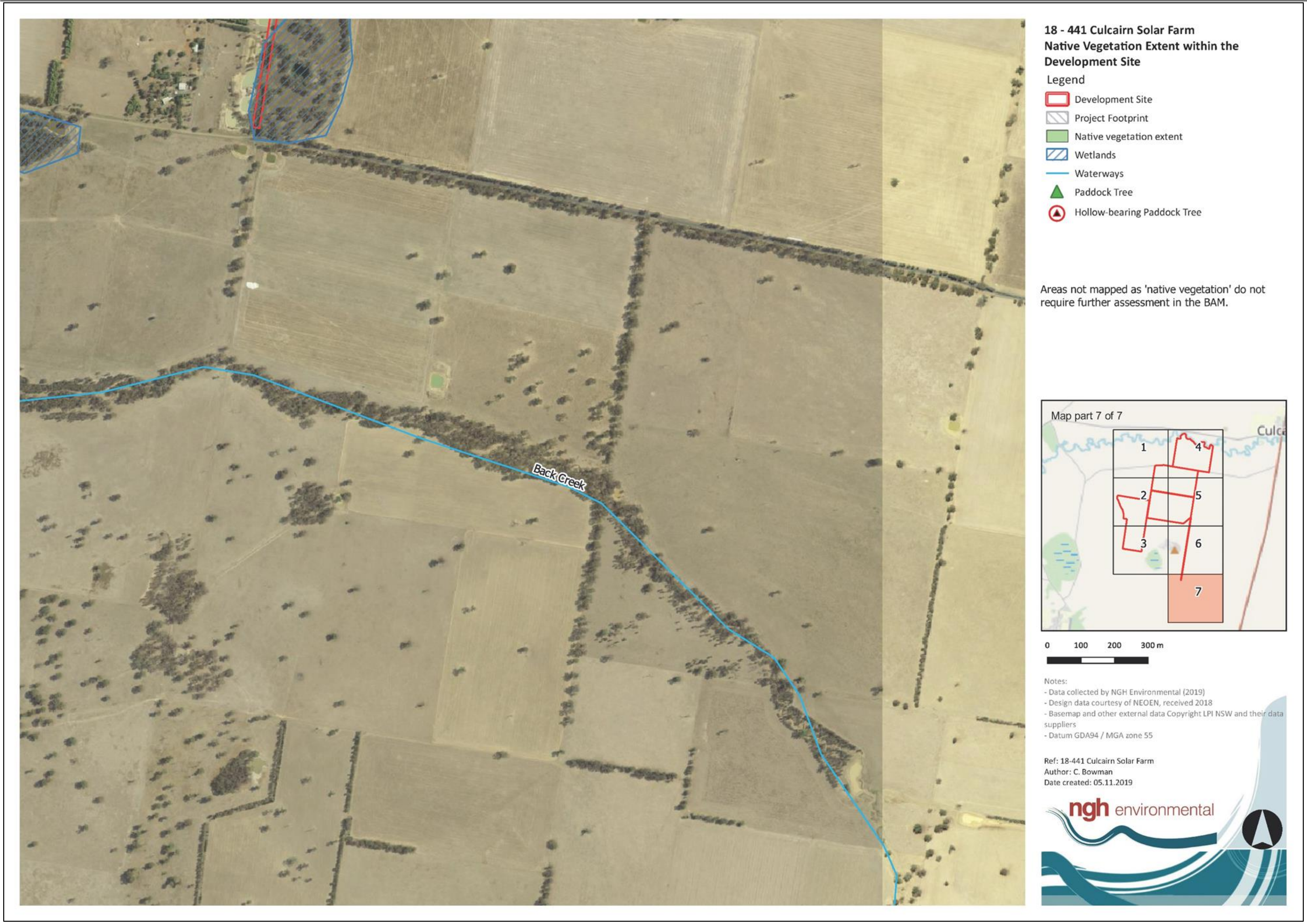

Figure 6-20 Native vegetation extent within the development site.

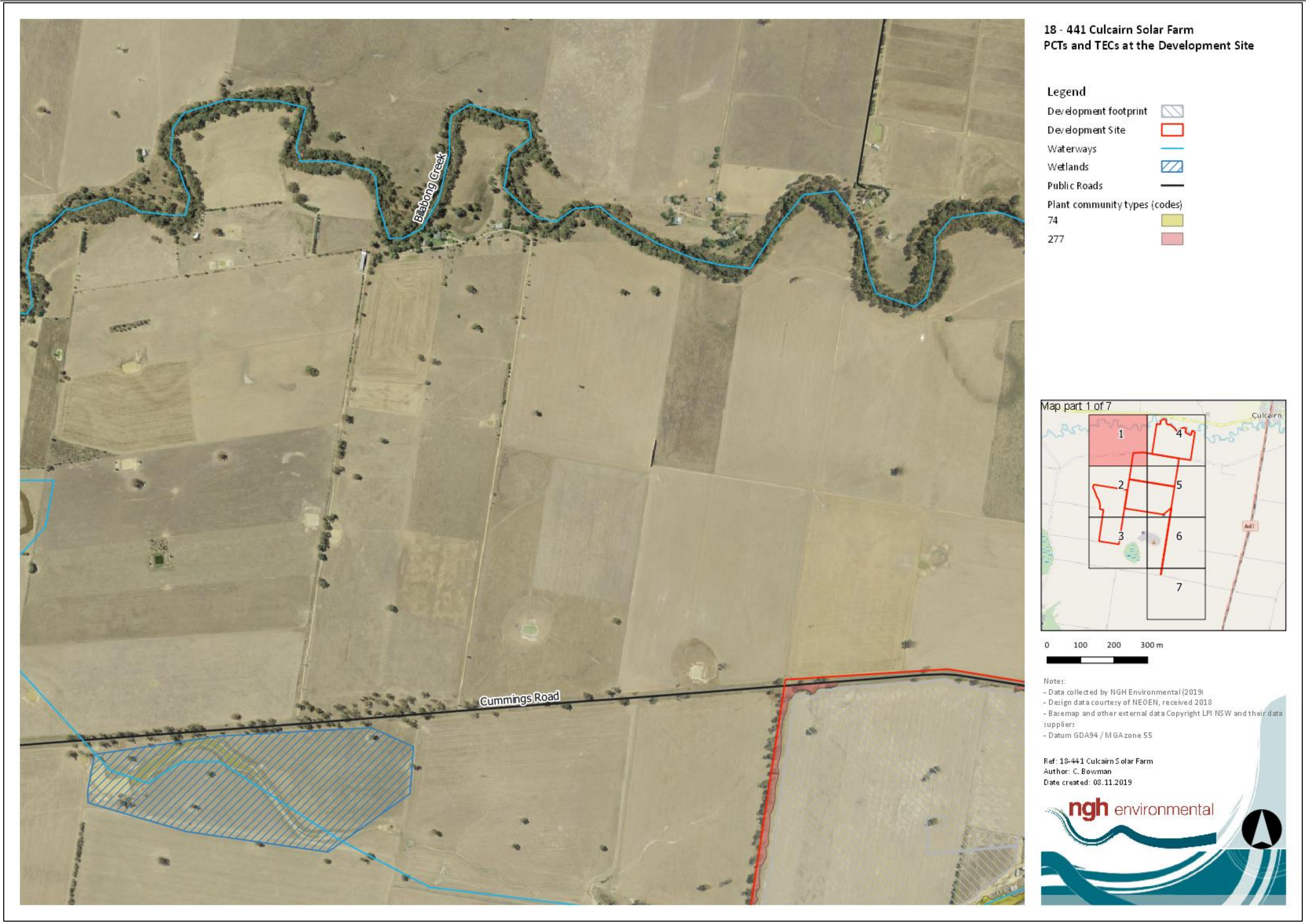

Figure 6-21 PCTs and Threatened Ecological Communities at the development site.

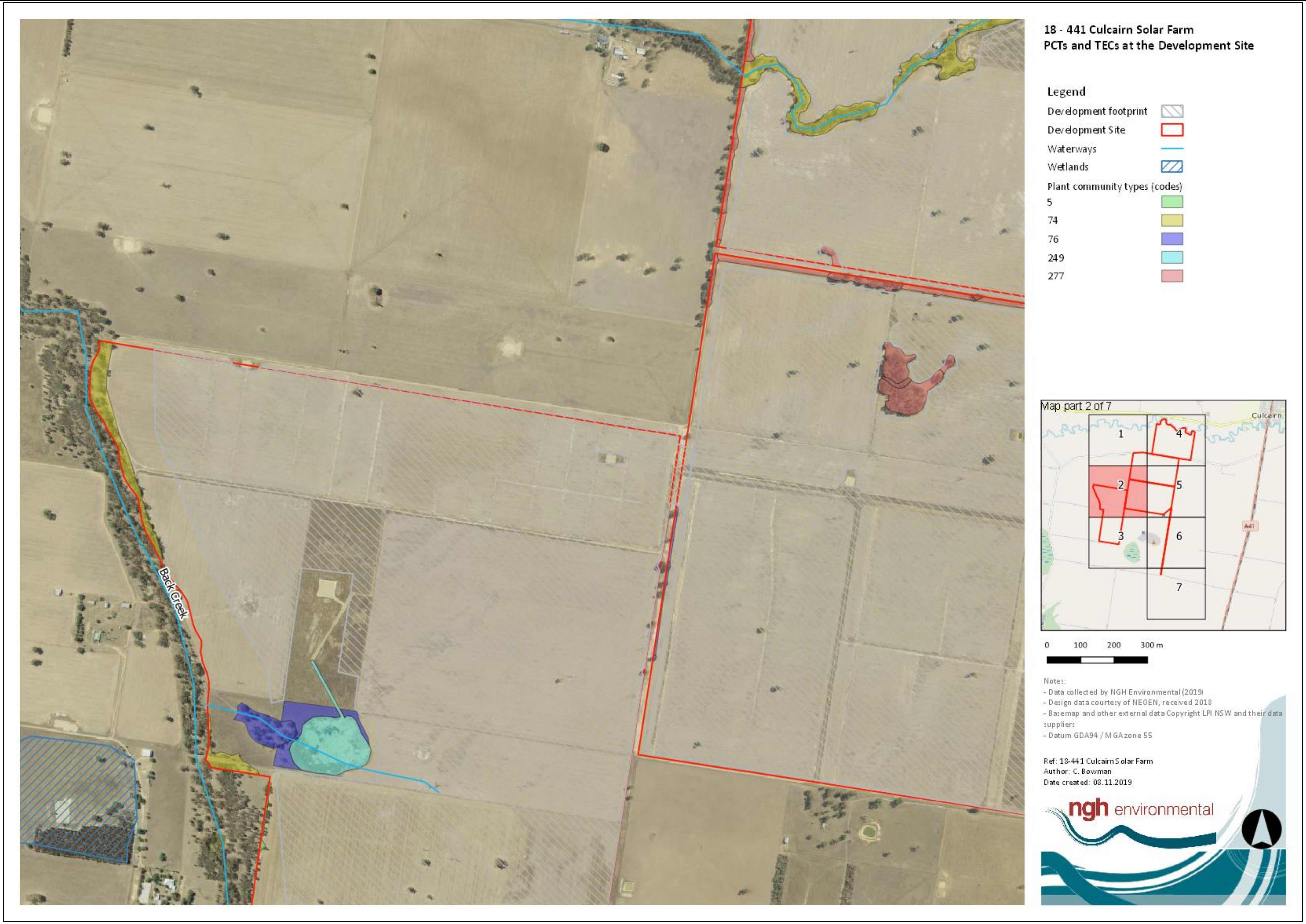

Figure 6-22 PCTs and Threatened Ecological Communities at the development site.

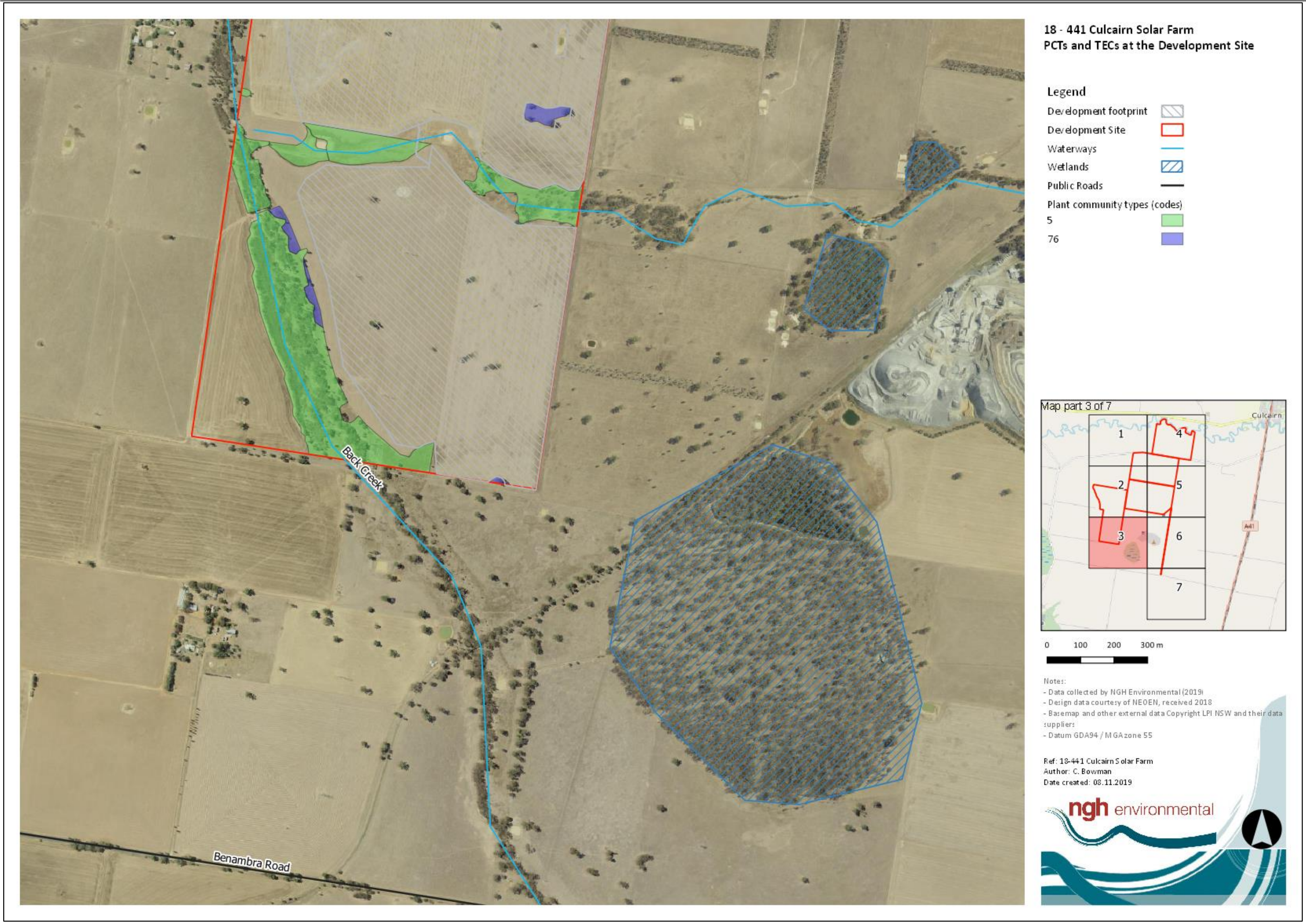

Figure 6-23 PCTs and Threatened Ecological Communities at the development site.

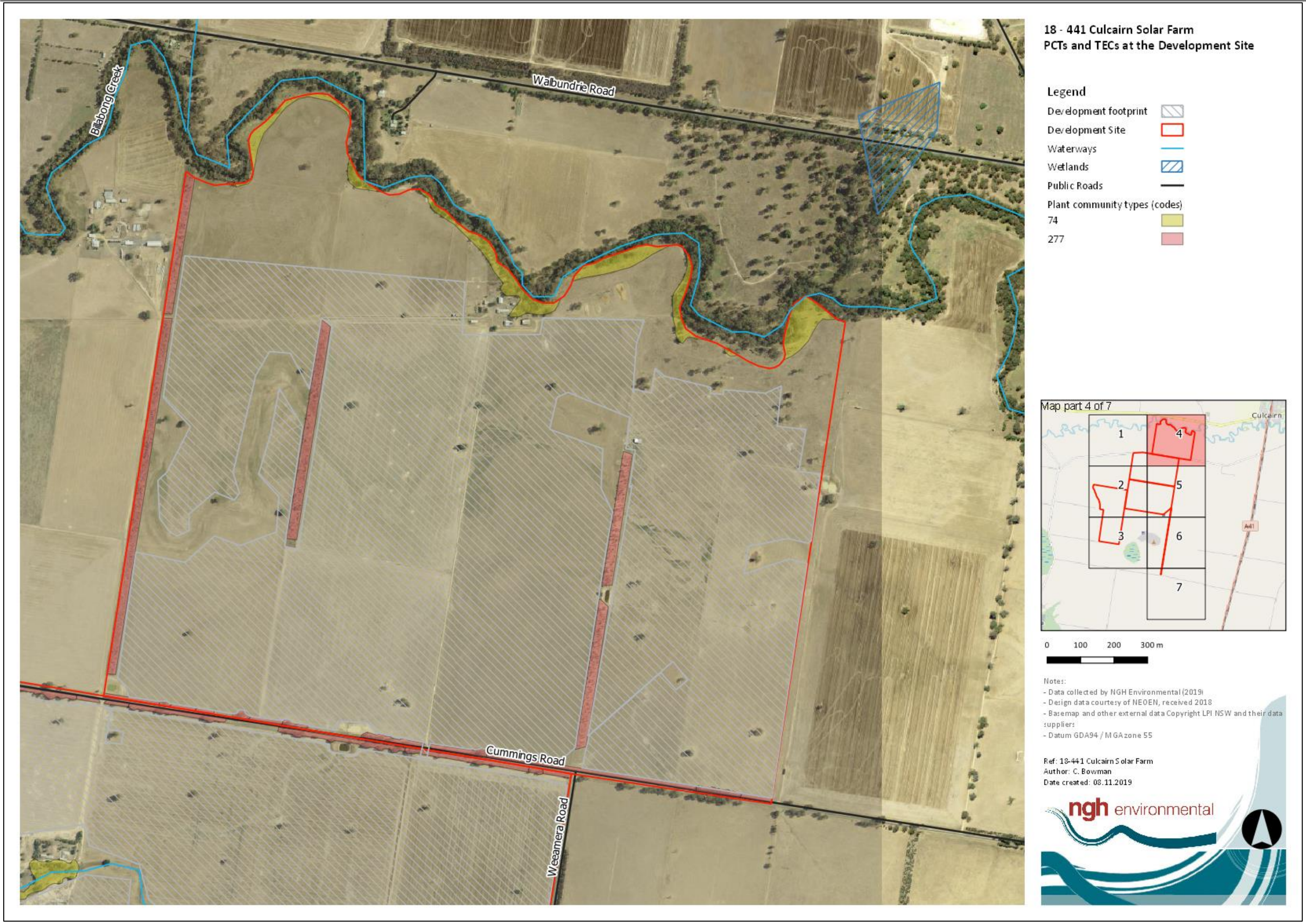

Figure 6-24 PCTs and Threatened Ecological Communities at the development site.

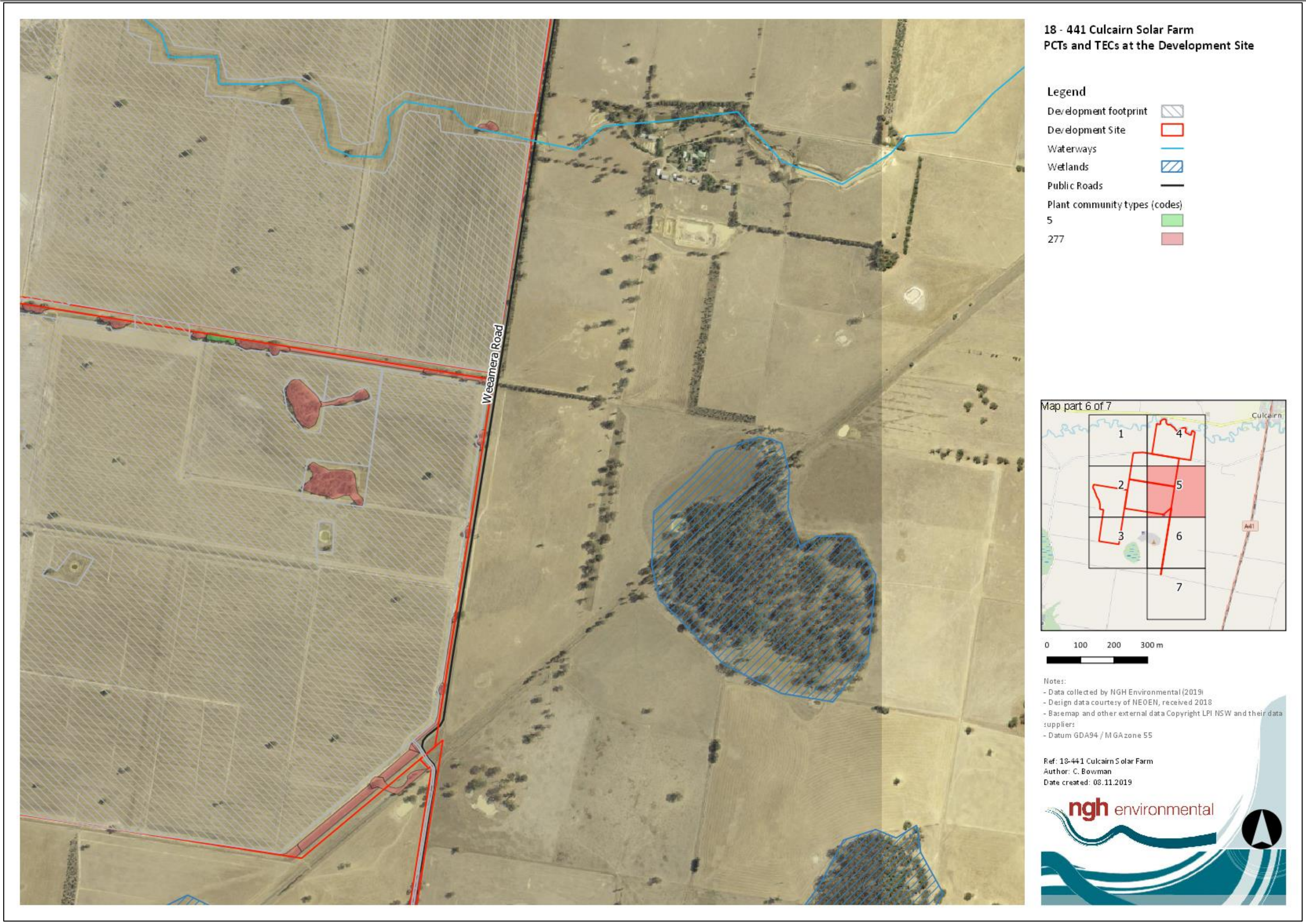

Figure 6-25 PCTs and Threatened Ecological Communities at the development site.

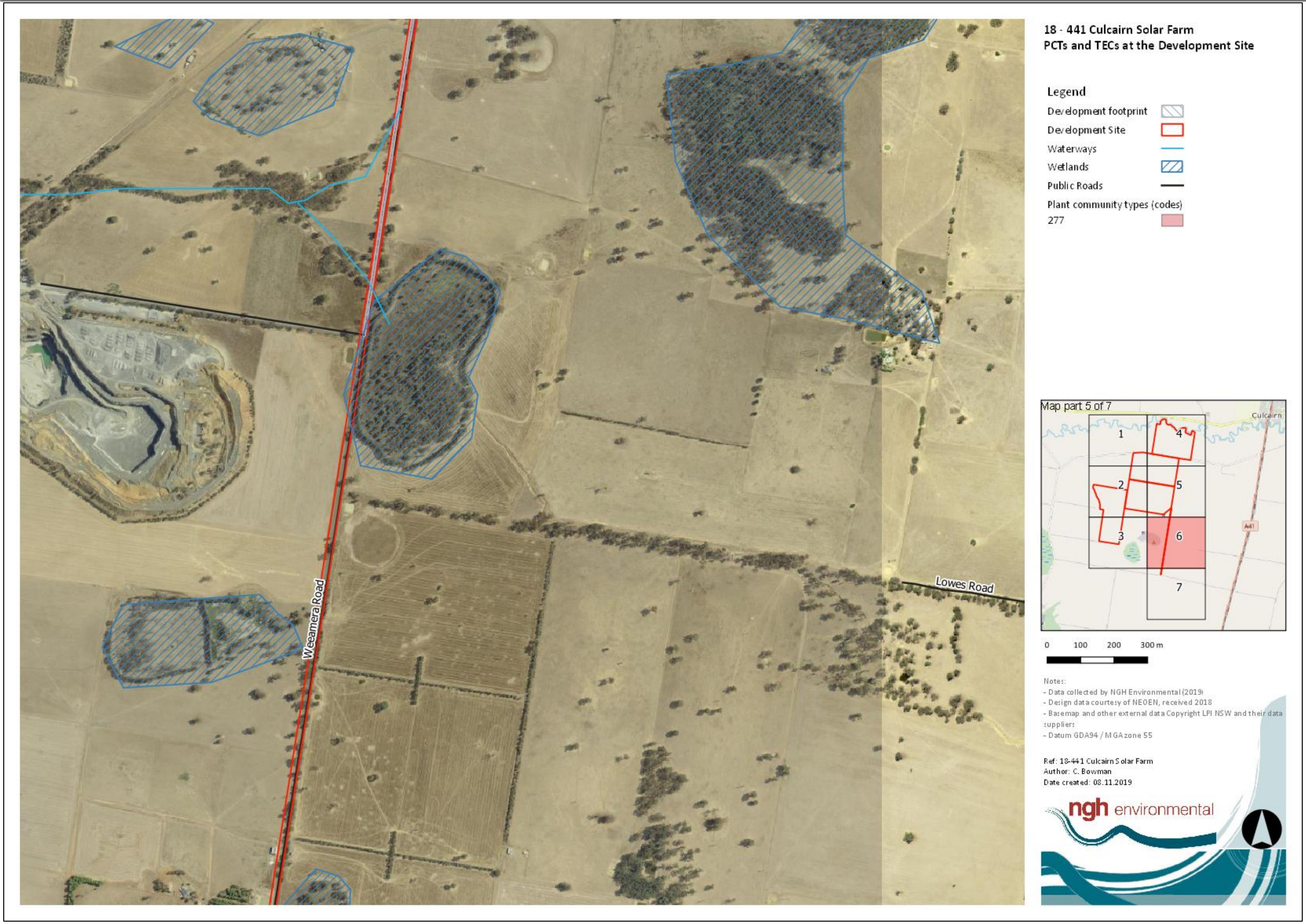

Figure 6-26 PCTs and Threatened Ecological Communities at the development site.

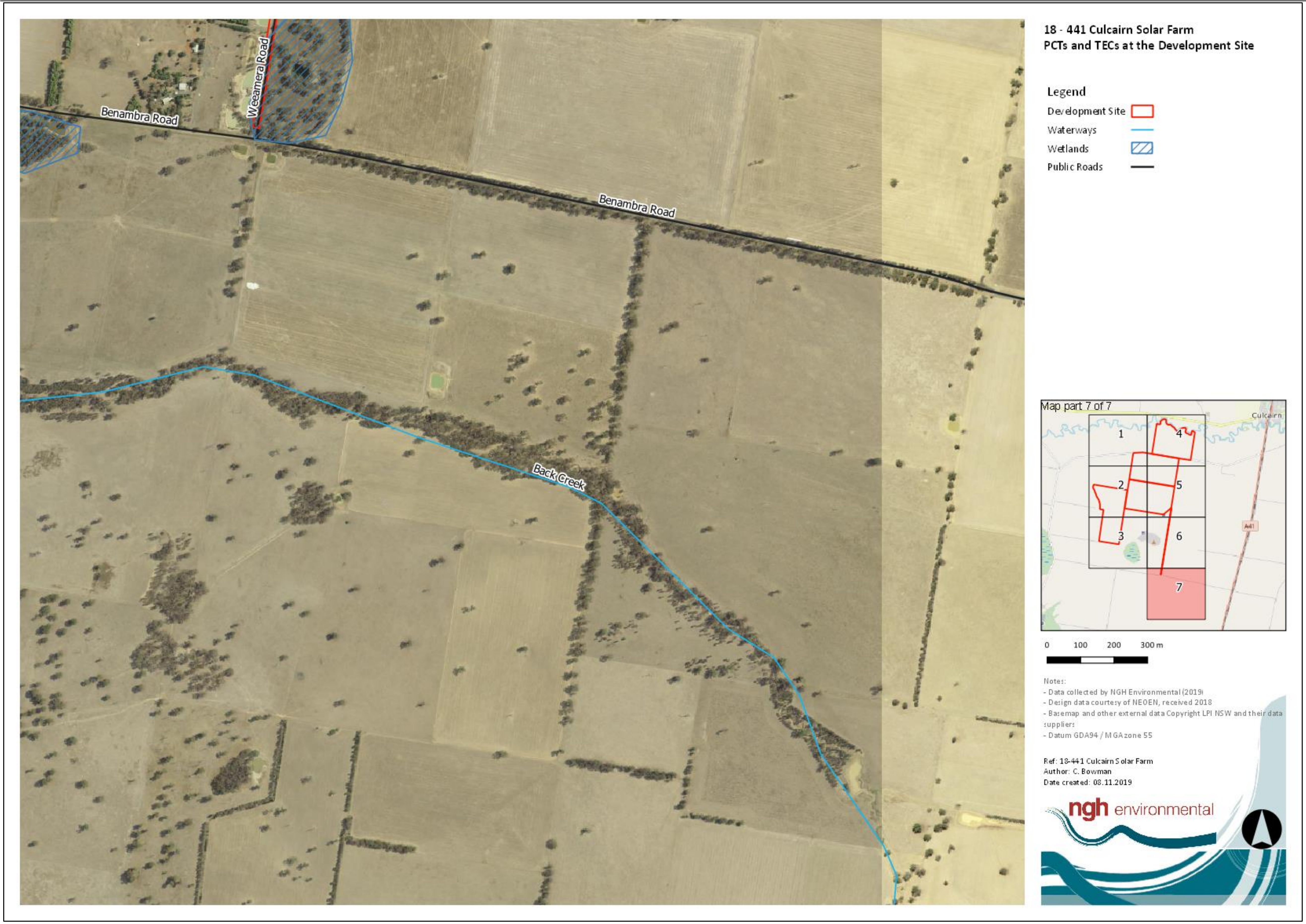

Figure 6-27 PCTs and Threatened Ecological Communities at the development site.

Threatened species

The following ecosystem credit species were returned by the BAM calculator as being associated with the PCTs present on the development site (Table 6-59). These species are assumed to occur on site and contribute to ecosystem credits. No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits. Of these species, the Superb Parrot and Brown Treecreeper were observed on site during the field surveys. Candidate species requiring assessment are included in Table 6-60. Two species were excluded from the assessment based on habitat and geographic restrictions.

Table 6-59 Ecosystem credit species.

Species	Associated PCT	NSW Listing Status	National Listing Status
Fauna			
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Barking Owl *Ninox connivens* (Foraging)	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Brolga *Grus rubicunda*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Spotted Harrier *Circus assimilis*	PCT 76 – Western Grey Box tall grassy woodland	Not listed	Not listed
Diamond Firetail *Stagonopleura guttata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Flame Robin *Petroica phoenicea*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Gang-gang Cockatoo	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
Callocephalon fimbriatum			
Glossy Black Cockatoo *Calyptorhynchus lathami*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey Falcon *Falco hypoleucos*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Grey-headed Flying-fox *Pteropus poliocephalus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Vulnerable
Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Koala *Phascolarctos cinereus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Little Lorikeet *Glossopsitta pusilla*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Little Pied Bat *Chalinolobus picatus*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Little Eagle *Hieraaetus morphnoides*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Masked Owl *Tyto novaehollandiae*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
Major Mitchell's Cockatoo *Lophochroa leadbeateri* (Foraging)	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Painted Honeyeater *Grantiella picta*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Regent Honeyeater *Anthochaera phrygia*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Critically Endangered	Critically Endangered
Scarlet Robin *Petroica boodang*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Speckled Warbler *Chthonicola sagittata*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Spotted Harrier *Circus assimilis*	PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Square-tailed Kite Lophoictinia isura	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Superb Parrot *Polytelis swainsonii*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Vulnerable
Swift Parrot *Lathamus discolor*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Endangered	Critically Endangered
Turquoise Parrot *Neophema pulchella*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed
Varied Sittella *Daphoenositta chrysoptera*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland	Vulnerable	Not listed

Species	Associated PCT	NSW Listing Status	National Listing Status
	PCT 76 – Western Grey Box tall grassy woodland		
White-bellied Sea-eagle *Haliaeetus leucogaster*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland PCT 76 – Western Grey Box tall grassy woodland	Vulnerable	Not listed

Table 6-60 Credit species requiring assessment.

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Fauna					
Bush Stone-curlew _Burhinus grallarius_	Open forests and woodlands with a sparse, grassy ground layer and fallen timber. Known in subregion.	High	Endangered	Lot listed	Included
Eastern Pygmy-possum _Cercartetus nanus_	Broad range of habitat from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath preferred. Known in subregion.	High	Vulnerable	Not listed	Included
Gang-gang Cockatoo _Callocephalon fimbriatum_	In spring and summer, tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages. Known in subregion.	High (breeding) / Moderate (foraging)	Vulnerable	Not listed	Included
Grey-headed Flying-fox _Pteropus poliocephalus_	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water, including lakes, rivers, and coastlines. Known to roost in locality.	High	Vulnerable	Vulnerable	Included
Koala _Phascolarctos cinereus_	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species that are particularly abundant on fertile clay soils. Known in subregion.	High	Vulnerable	Vulnerable	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Little Eagle *Hieraaetus morphnoides* (Breeding)	Open eucalypt forest, woodland, or open woodland, and Sheoak or Acacia woodlands and riparian woodlands in interior NSW, where they nest in tall living trees within a remnant patch. Known in subregion.	Moderate	Vulnerable	Not listed	Included
Large-eared Pied Bat *Chalinolobus dwyeri*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves. Found in well timbered areas containing gullies.	Very High	Vulnerable	Vulnerable	Excluded
Masked Owl *Tyto novaehollandiae* (Breeding)	Dry eucalypt forests and woodlands from sea levels to 1100 m. Hunts along the edges of forests, including roadsides. Known in subregion.	High	Vulnerable	Not listed	Included
Pink-tailed Legless Lizard *Aprasia parapulchella*	Inhabits sloping, open woodland areas with predominantly native grassy groundcover, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks	High	Vulnerable	Vulnerable	Excluded
Regent Honeyeater *Anthochaera phrygia* (Breeding)	Temperate woodlands and open forests of the inland slopes of south-east Australia, in particular dry open forest, woodland, Box-Ironbark woodland, and riparian forests of River Sheoak.	High	Critically Endangered	Critically Endangered	Included

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Square-tailed Kite *Lophoictina isura*	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. Known in subregion.	Moderate	Vulnerable	Not listed	Included
Squirrel Glider *Petaurus norfolcensis*	Old growth box, box-ironbark woodlands, and River Red Gum forests west of the Great Dividing Range. Abundant tree hollows required for refuge and nesting. Known in subregion.	High	Vulnerable	Not listed	Included
Superb Parrot *Polytelis swainsonii* (Breeding)	Box-Gum, Box-Cypress, and Boree Woodlands and River Red Gum Forests. They nest in hollows of large trees in tall open forest or woodland. Recorded on site during survey.	High (breeding) / Moderate (foraging	Vulnerable	Vulnerable	Included
Swift Parrot *Lathamus discolor*	On the coast and southwest slopes in areas with abundant flowering eucalypts or lerp. Feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Known in subregion.	Moderate	Endangered	Critically Endangered	Included
White-bellied Sea-Eagle *Haliaeetus morphnoides* (Breeding)	Large areas of open water including larger rivers, swamps, lakes, and the sea. Coastal dunes, tidal flats, grassland, heathland, woodland, and forest. Breeding habitat mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Known in subregion.	High	Vulnerable	Not listed	Included
Flora					

Credit species	Habitat and geographic restrictions	Sensitivity to gain class	NSW listing status	National listing status	Included or Excluded
Ausfeld's Wattle *Acacia ausfeldii*	Associated species include Eucalyptus albens, E. blakelyi and Callitris spp., with an understorey dominated by Cassinia spp. and grasses. Known in subregion.	High	Vulnerable	Not listed	Included
Small Scurf-pea *Cullen parvum*	Found in grassland, river Red Gum Woodland or Box-gum Woodland, sometimes on grazed land and usually on table drains or adjacent to drainage lines or watercourses.	High	Endangered	Not Listed	Included
Small Purple-pea *Swainsona recta*	Predominantly grassy woodlands, but sometimes extends into grassy open forest, usually with tree cover including Blakely's Red Gum, Yellow Box, and White Box. Known in subregion.	Moderate	Not listed	Endangered	Included
Silky Swainson-pea *Swainsona sericea*	Box-gum woodland in southern tablelands and South West Slopes. Sometimes in association with cypress pines. Known in subregion.	High	Vulnerable	Not listed	Included

6.8.3 Site surveys

Targeted threatened fauna diurnal and nocturnal surveys and targeted threatened flora surveys were undertaken during 2018 and 2019. General PCT, biodiversity and plot surveys were undertaken during the site visits.

Diurnal birds

- Woodland bird surveys were conducted using 20-minute point surveys. Opportunistic surveys were undertaken by vehicle and foot. Paddock trees and remnant trees were surveyed for evidence of raptor stick nests.
- Targeted surveys for the Glossy Black Cockatoo, Little Eagle, and Swift Parrot were undertaken and included diurnal bird surveys and evening stag watching.

Nocturnal mammals

- Targeted surveys for Koalas were undertaken with a spotlight search.
- Targeted spotlighting surveys for Grey-headed Flying-foxes were undertaken with canopy of trees observed for roosting bats.
- Targeted spotlighting surveys for arboreal mammals were undertaken above the canopy for approximately 4 hours per night.
- Targeted spotlighting surveys for Squirrel Gliders were undertaken and involved call surveys.
- Anabats were deployed for 4 nights for Southern Myotis.

Frogs

- Targeted surveys for Booroolong Frogs and Southern Bell Frogs were undertaken during the nights of the 18 and 19 December 2018 for approximately 4 hours per night. Survey included call playback and nocturnal survey of dams.
- Targeted surveys for Sloane's Froglets were undertaken on the nights of 12 and 13 August 2019. Survey included call playback and nocturnal survey of dams.

Nocturnal Birds

- Targeted surveys for Barking Owl and Bush Stone Curlew were undertaken for approximately 4 hours per night and included call playback.
- Targeted surveys for Masked Owl were undertaken and included call playback and spotlighting.

Threatened flora

- Suitable habitat for Ausfelds Wattle was surveyed throughout the site.
- Targeted flora transects for Small Purple Pea, Silky Swainson-pea, A spear-grass, Yass Daisy, Small Scurf-pea, Leafless Indigo, Austral Pilwort, and Euphrasia arguta were undertaken in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016).
- Targeted survey for Tarengo Leek Orchid were undertaken during the survey period for this species.

Note: Surveys for the Pine Donkey Orchid and the Sandhill Spider Orchid were unable to be undertaken during the appropriate periods. Both these have been assumed to be present where native understorey is sufficient.

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

6.8.4 Survey results

Table 6-61 summarises all fauna species found on-site.

No karsts, caves, crevices or cliffs occur within the development site. No surface rocks or rocky outcrops occur within the development site. No human made structures that could be used by threatened species occur within the development site. Non-native vegetation within the development site is predominantly crops. No threatened species are considered to rely on the non-native vegetation within the development site. Native animals benefiting cleared exotic vegetation environments have ample suitable habitat surrounding the site. Therefore, only minimal impact on threatened species is anticipated.

The development site is located on mostly flat, low-lying land. The Back Creek catchment extends 6 km east of the Olympic Highway into a hill range. Back Creek flows north to Billabong Creek and borders the western boundary of the development site. Three ephemeral tributaries flow west through the development site to either Billabong Creek or Back Creek. These have been excluded from the development footprint.

A vegetated riparian corridor following Billabong Creek runs along the northern boundary of the site.

Twenty dams exist within the development site. Six of these dams are nearby to vegetated natural drainage lines. No dams will be impacted as a result of the proposal.

Table 6-61 Fauna identified on-site through survey effort

Scientific Name	Common Name	Habitat	Coordinates
Pelicanus conspicillatus	Australian Pelican	Farm dam	
Microcarbo melanoleucos	Little Pied Cormorant (in vicinity)	Farm dam	
Charadrius ruficapillus	Red-capped Plover	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Elseyornis melanops	Black-fronted Dotterel	Mudflats around farm dam	E 494973 N 6048587 GDA94 Z55
Vanellus miles	Spur-winged Plover	Mudflats around farm dam	
Chenonetta jubata	Australian Wood Duck	Farm dams	
Anas gracilis	Grey Teal	Farm dams	
Anas superciliosa	Pacific Black Duck	Farm dams	
Egretta novaehollandiae	White-faced Heron	Drainage channel	
Platalea flavipes	Yellow-billed Spoonbill (in vicinity)	Farm dam	
Threskiornis spinicollis	Straw-necked Ibis	Farmland	
Aquila audax	Wedge-tailed Eagle	At height over farmland	E498738 N6051889 GDA94 Z55
Falco cenchroides	Nankeen Kestrel	At height over farmland	
Podargus strigoides	Tawny Frogmouth	Remnant roadside woodland	
Eolophus roseicapilla	Galah	Farmland and woodland	
Cacatua galerita	Sulphur-crested Cockatoo	Farmland	
Platycercus eximius	Eastern Rosella	Farmland and woodland	
Psephotus haematonotus	Red-rumped Parrot	Farmland	
Ocyphaps lophotes	Crested Pigeon	Remnant roadside woodland	
Dacelo novaeguineae	Laughing Kookaburra	Remnant riparian woodland	
***Hirundo neoxena*Welcome SwallowFarm sheds*Petrochelidon* sp.**	Martin sp.	Remnant riparian woodland	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Farmland	
Malurus cyaneus	Superb Blue Wren	Farmland and woodland	
Ptilotula penicillata	White-plumed Honeyeater	Farmland and woodland	
Manorina melanocephala	Noisy Miner	Remnant roadside woodland	
Cormobates leucophaea	White-throated Treecreeper	Remnant riparian woodland	E495077 N6046645

Scientific Name	Common Name	Habitat	Coordinates
			GDA94 Z55
Climacteris picumnus	Brown Treecreeper	Remnant riparian and roadside woodland	E498198 N6046934 GDA94 Z55 1 heard E494770 N6047911 GDA94 Z55 1 heard
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Remnant riparian woodland	
Strepera graculina	Pied Currawong	Farmland	
Cracticus nigrogularis	Pied Butcherbird	Farmland	
Cracticus tibicen	Australian Magpie	Farmland	
Corcorax melanorhamphos	White-winged Chough	Remnant roadside woodland	
Corvus coronoides	Australian Raven	Farmland	
Corvus mellori	Little Raven	Farmland	
Grallina cyanoleuca	Peewee	Farmland	
Myiagra inquieta	Restless Flycatcher	Remnant riparian woodland	E494952 N6046934 GDA94 Z55
Rhipidura leucophrys	Willie Wagtail	Farmland	
Petroica phoenicea	Flame Robin	Farmland	E495913 N6047771 GDA94 Z55 2 M 1 F E498363 N 6048147 GDA94 Z55 1 M 1 F E498967 N6051586 GDA94 Z55
Colluricincla harmonica	Grey Shrike-thrush	Remnant riparian woodland	
Cincloramphus cruralis	Brown Songlark	Farmland	E 494973 N 6048587 GDA94 Z55
Anthus australis	Australian Pipit	Farmland	

Scientific Name	Common Name	Habitat	Coordinates
Sturnus vulgaris	*Common Starling	Farmland	
Trichosurus vulpecula	Common Brushtail Possum	Remnant riparian woodland	
Pseudocheirus peregrinus	Common Ringtail Possum	Remnant riparian woodland	
Macropus giganteus	Eastern Grey Kangaroo	Farmland	
Vulpes vulpes	*Red Fox	Farmland	
Austronomus australis	White-striped Mastiff-bat	Farmland	
Crinia parinsignifera	Eastern Sign-bearing Froglet	Farm dams	

6.8.5 Potential impacts

Direct impacts

The construction and operational phases of the proposal have the potential to impact biodiversity values at the site. These cannot be entirely avoided. This would occur through direct impacts such as habitat clearance and installation and operational effects of installed infrastructure as detailed in Table 6-62.

Table 6-62 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)	Approximately 0.61 ha of PCT 227 to be impacted by development	Once	Construction	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Removal of paddock trees	99 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
Injury or death of fauna	Unknown	Regular	Construction Phase: Long Term	• Direct loss of native fauna • Decline in local fauna populations

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Removal of habitat features e.g. HBTs	71 HBTs	Regular	Construction Phase: Long Term	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	787.5 ha (70% of solar array)	Regular	Operational Phase: Long-term	• Modification of native fauna habitat • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure (Fencing, array infrastructure).	Total of 1126 ha	Regular	Operational Phase: Long-Term	• Modification of habitat beneath array (mostly non-native) • Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats (fencing).

Indirect impacts

Indirect impacts of the proposal include soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise during construction or operation of the proposal. Table 6-63 below details the type, intensity, duration and consequence of the indirect impacts that may occur as a consequence of the proposal.

Table 6-63 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)				
Inadvertent impacts on adjacent habitat or vegetation	Possible – Clearing may inadvertently extend into retained vegetation patches	Construction Phase: Short-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Direct loss of native flora and fauna habitat; • Injury and mortality of fauna during clearing of fauna habitat and habitat trees; • Disturbance to stags, fallen timber; and Increased edge effects.
Reduced viability of adjacent habitat due to edge effects	Possible- Most retained vegetation is contiguous with vegetation adjacent to the proposal	Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea Small Scurf-pea	• Loss of connectivity between remnant 277 within and around development footprint; and • Reduced genetic diversity within isolated populations
Reduced viability of adjacent habitat due to noise, dust, heat or light spill	Possible – construction works may impact on habitat quality in retained vegetation	Operational Phase: Short-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• May alter fauna activities and/or movements; • Loss of foraging or breeding habitat; and Inhibit the function of plant species, soils and dams.
Possible – may be brought in soils or unclean machinery	Construction & Operational Phase: Long-term	Possible – may be brought in soils or unclean machinery	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Degradation of community biodiversity and integrity; a • Weed encroachment (remnant veg); and • Movement of weeds by water to downstream habitats.

Nature of impact	Extent	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Increased risk of starvation, exposure and loss of shade or shelter	Unlikely – Food sources still available	n/a	• n/a	• n/a
Loss of breeding habitats	71 HBT	Construction Phase: Long-Term	Hollow-dependent fauna	• Loss of potential breeding habitat including fallen and hollow logs at height •
Earthworks and mobilisation of sediments	Possible - loss of groundcover during construction may increase mobilisation of sediments.	Construction Phase – Short Term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland • Silky Swainson Pea • Small Purple-pea • Small Scurf-pea	• Erosion and sediment deposition pollution on downstream habitats; and • Alternation of surface watercourses (isolating high biodiversity value communities).
Trampling of threatened flora species	Unlikely – no known threatened flora species in adjacent vegetation	n/a	n/a	• n/a
Inhibition of nitrogen fixation and increased soil salinity	Unlikely – Ground water table unlikely to change. Majority of site is currently under cropping rotation.	n/a	n/a	n/a
Fertiliser drift	Unlikely – Fertilisers unlikely to be applied.	n/a	• n/a	• n/a
Rubbish Dumping	Unlikely – Development site will be fenced.	n/a	• n/a	• n/a

Nature of impact	Extent	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Wood Collection	Unlikely – Development site will be fenced.	n/a	• n/a	• n/a
Bush rock removal and disturbance	Unlikely – No bush Rock in development site.	n/a	• n/a	• n/a
Increase in predatory species populations	Possible – additional shelter habitat for predatory invasive species.	Construction & Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland	• Injury and mortality of fauna from predatory species
Increase in pest animal populations	Possible - additional shelter habitat for invasive species.	Construction & Operational Phase: Long-term	• PCT 277 – Blakely's Red Gum-Yellow Box grassy tall woodland	• Injury and mortality of fauna from predatory species • Disturbance to native flora and fauna • Loss of foraging or breeding habitat
Increased risk of fire	Unlikely – No battery storage in proposal	n/a	• n/a	• n/a
Disturbance to specialist breeding and foraging habitat.	Unlikely – No specialist breeding or foraging habitat.	n/a	• n/a	• n/a

Prescribed impacts

The following prescribed biodiversity impacts are relevant to the proposal:

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

Impacts to matters of national environmental significance

The *Terrestrial Biodiversity Map of the Greater Hume LEP 2012* indicates that no wetlands of international importance occur within the development site and therefore none would be impacted by the development.

Three threatened ecological communities were returned from the EPBC Protected Matters report, including:

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregion, Endangered under the BC Act.
- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions.
- White Box Yellow Box Blakely's Red Gum Woodland, endangered under the BC Act and Critically Endangered under the EPBC Act.

Four plant community types were identified within the development site.

PCT 249 within the development site is not within an area featuring natural springs from the Great Artesian Basin and does not feature any endemic species restricted to such springs. As such, PCT 249 within the development site does not form part of the federally listed TEC.

PCTs 277 and 74 within the development site do not meet the condition thresholds for White Box Yellow Box Blakely's Red Gum Woodland. In particular, the patches do not have a predominately native understorey and there are less than 12 native understorey species present. As such, PCTs 277 and 74 do not form part of the federally listed TEC.

PCT 76 within the development site does not meet the condition thresholds for Western Grey Box tall grassy woodland on alluvial loam and clay soils. In particular, less than 50% of the vegetative cover in the ground layer comprises perennial native species at any time of the year and there are less than 8 perennial native species in the mid and ground layers. As such, PCT 76 does not form part of the federally listed TEC.

As no federally listed TECs are present within the development site, no AoS have been prepared.

Nine (9) federally listed species were identified to potentially occur in the development site. These are:

- Superb Parrot (*Polytelis swainsonii*). - V
- Painted Honeyeater (*Grantiella picta*). – V
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – V
- White-throated Needletail (*Hirundapus caudacutus*) – V

- Small Purple-pea *(Swainsona recta)* - E
- Swift Parrot (*Lathamus discolor*). - CE
- Regent Honeyeater (*Anthochaera phrygia*). - CE
- Koala (*Phascolarctos cinereus*) -V
- Sloane's Froglet (*Crinia sloanei*) - E

The Superb Parrot, Painted Honeyeater, Corben's Long-eared Bat and White-throated Needletail are listed as vulnerable under the EPBC Act. Suitable Woodland habitat for these species is present in the development site, however they were not detected during surveys. It is considered these species may forage in the development site on occasion. EPBC Assessments of Significance (AoS) were completed for these species and concluded that a significant impact was unlikely.

The Swift Parrot and the Regent Honeyeater are listed as critically endangered under the EPBC Act. Suitable Woodland habitat for these species is present in the development site, however they were not detected during surveys. It is considered these species may forage in the development site on occasion. EPBC Assessments of Significance (AoS) were completed for these species and concluded that a significant impact was unlikely.

Suitable habitat for the Sloane's Froglet occurs in the farm dams throughout the development site. Surveys for Sloane's Froglet were undertaken at each of the dams in August 2019 using call playback. This species was not detected and it is not considered to occur within the development site.

No EPBC listed flora species were recorded during the surveys, however one EPBC-listed endangered species, the small purple pea was assumed present based on suitable habitat. Habitat for this species within the development site is primarily limited to areas with native understorey, approximately 0.61 ha of the development footprint. EPBC Assessments of Significance (AoS) were completed for the Small Purple Pea and concluded that a significant impact was unlikely.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist the Proponent in determining if a proposal may impact on habitat critical to the survival of the Koala. The assessment resulted in a score of 3 and as such habitat within the study area is not considered to be critical to the survival of the Koala. An assessment of significant impact is not required.

Based on a habitat assessment, the development site contains habitat that could be potentially used by two federally listed migratory species, the Fork-tailed Swift (*Apus pacificus*) and the White-throated Needletail (*Hirundapus caudacutus*). EPBC Assessments of Significance (AoS) were completed for these species and concluded that a significant impact was unlikely.

6.8.6 Impacts Requiring Offsets

Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) A vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community;
b) A vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community; or
c) A vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required for the proposal are documented in Table 6-64.

Table 6-64 PCTs and vegetation zones that require offsets

Zone ID	PCT ID	Zone	Impact area (ha)	Vegetation integrity score	Ecosystem credits required
277_native_understory277_derived_grassland	277	0.01	26.1	26.1	1
277_exotic_understory	277	0.59	32.3	32.3	10
277_native_understory	277	0.01	48.1	48.1	1
				TOTAL:	**12**

Paddock Tree Credits

Offsets are required for the clearing of Class 2 and Class 3 Paddock trees. 99 Class 3 paddock trees would be removed by the proposal. The paddock trees are considered to form part of PCT 76: Western Grey Box tall grassy Woodland on alluvial loam and clay soils in the NSW South Western Slopes Bioregion and PCT277 Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. Ecosystem credits are calculated as per the streamlined assessment defined in the BAM. The ecosystem credits are documented in Table 6-65. Ninety-two (92) ecosystem credits are required for the clearing of paddock trees for the proposal.

Table 6-65 Paddock Trees that require offsets

Class of Paddock Tree being cleared	PCT	Number of Trees with hollows	Number of Paddock Trees to be cleared	Ecosystem credits required
Class 2 **(>20cm DBH and < 50cm DBH)**	**277**	**0**	**0**	**0**
Class 2 **(>20cm DBH and < 50cm DBH)**	**76**	0	0	0
Class 3 **>50cm DBH**	**277**	58	79	74
Class 3 **>50cm DBH**	**76**	13	20	18
	TOTAL	71	**99**	**92**

Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 6-66.

Table 6-66 Species credit species that require offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost	Species credits required
Small Scurf-pea _Cullen parvum_	2	0.61	10
Small Purple-pea _Swainsona recta_	2	0.61	10

Silky Swainson-pea *Swainsona sericea*	2	0.61	10
		TOTAL	**30**

Offsets required under the EPBC Act

No species listed on the EPBC Act have been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

6.8.7 Aquatic Biodiversity

Aquatic Biodiversity

Species that could potentially be impacted under the *Fisheries Management Act 1994 (FM Act)* were assessed in Table 6-67. It was determined that there would be no impact to aquatic biodiversity as a result of the proposed works. No works would occur within the waterways and no riparian vegetation would be impacted. No dams would be filled in as a result of the proposal. However, these dams are permanently disconnected from natural watercourses, shallow, heavily trampled by livestock and lack riparian vegetation. These dams are thus unlikely to support aquatic biodiversity protected under the FM Act.

GROUNDWATER DEPENDENT ECOSYSTEMS (GDES)

Moderate potential for aquatic Groundwater Dependant Ecosystems (GDE) is shown along Billabong Creek north of the proposal, with low to high potential for terrestrial GDE across the site (Figure 6-28 and Figure 6-29). Most of these areas are located within proposed retained vegetation. As such, there is a low potential for groundwater to be encountered during excavations and earthwork for the construction. This is likely to be highly localised and no inception of groundwater is considered.

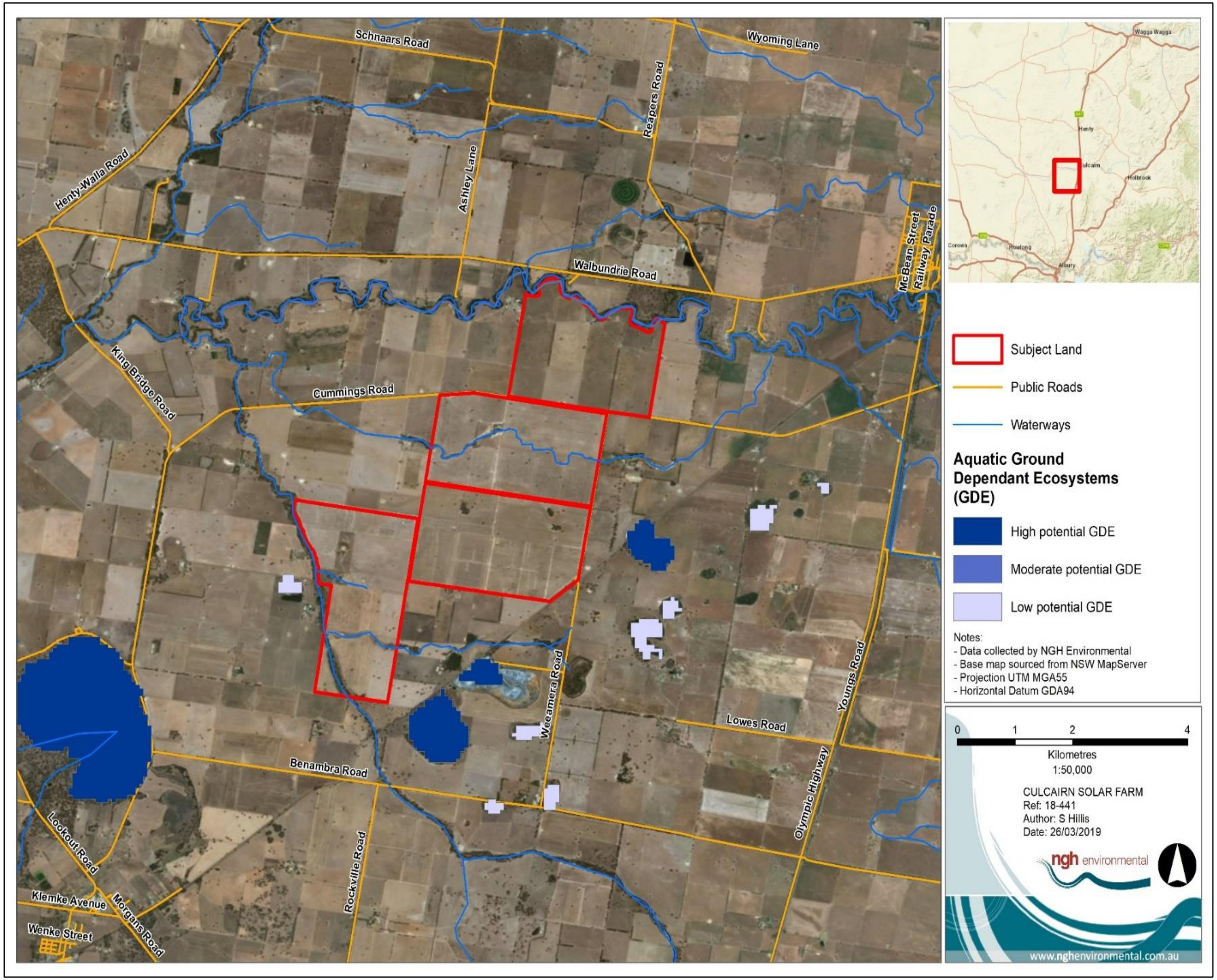

Figure 6-28 Aquatic GDEs in proximity to the development site.

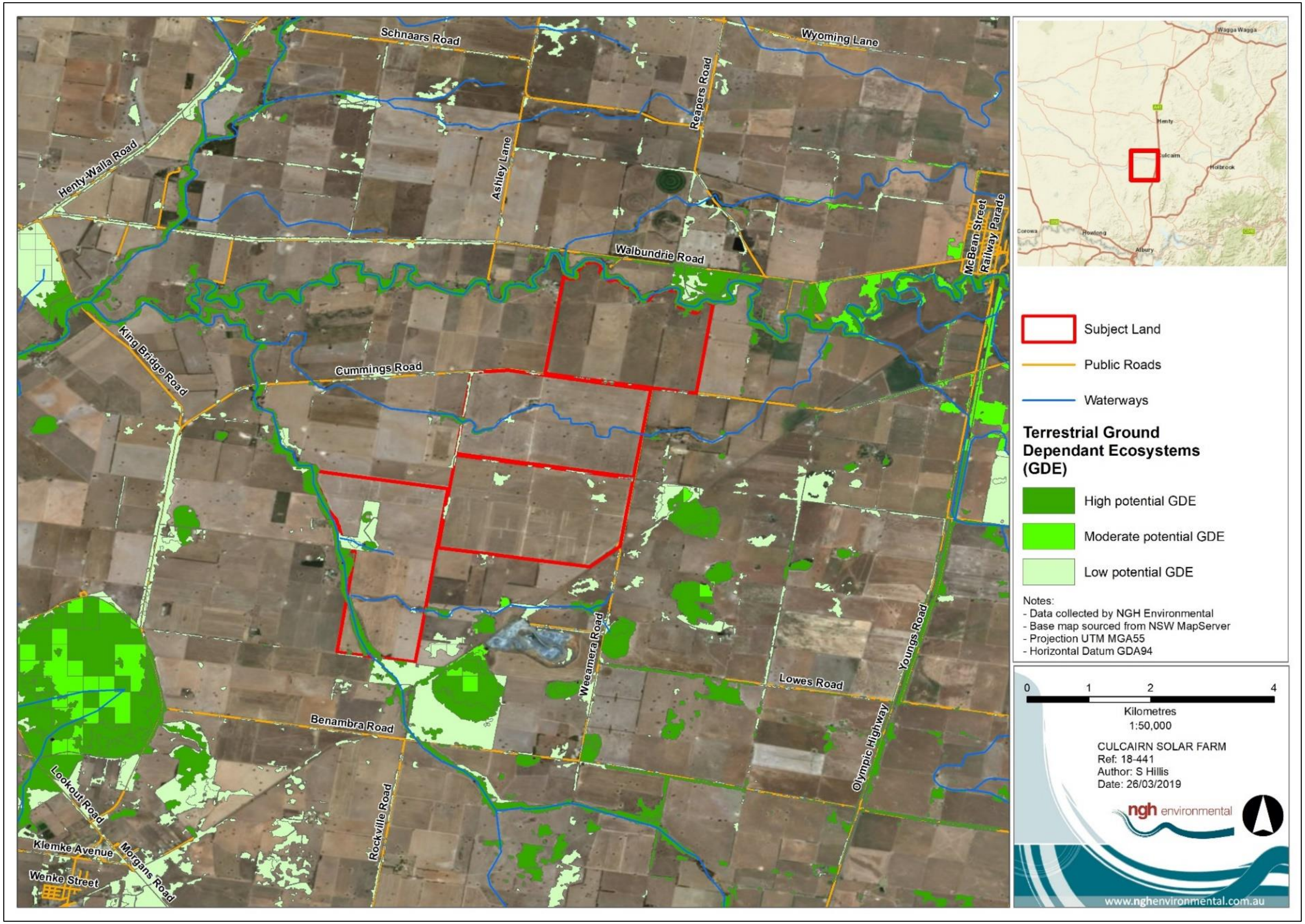

Figure 6-29 Terrestrial GDEs within and surrounding the development site.

Table 6-67 Habitat assessment for threatened species listed under the *Fisheries Management Act 1994.*

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Fish				
Flathead Galaxias *Galaxius rostratus* CE EPBC CE FM	Below 150 m in altitude. Billabongs, lakes, swamps, and rivers, with preference for still or slow-flowing waters.	**No** No suitable permanent water above 150 m in altitude.	**Unlikely** Within species distribution.	**No** No suitable habitat in development site.
Murray Hardyhead *Craterocephalus fluviatilis* CE FM	Mostly recorded in saline lakes that are moderately acidic to highly alkaline and have relatively low turbidity. Margins of lakes, wetlands, backwaters, and billabongs. Open water, shallow, slow-flowing or still habitats, with sand or silt substrates. Also, deeper habitats with dense aquatic vegetation.	**No** No lakes, backwaters, billabongs with deep water.	**Unlikely** Within historic species distribution.	**No** No suitable habitat in development site.
Stocky Galaxias *Galaxias tantangara* CE FM	Small, cold, clear and fast-flowing alpine creek, flowing through open forest of eucalypts, low shrubs and tussock grass.	**No** No alpine creeks.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Australian Grayling *Prototrocetes marena* E FM	Migrates between rivers, estuaries and coastal seas. Mostly in freshwater rivers and streams, usually in cool, clear waters with gravel substrate and alternating pool and riffle zones.	**No** No coastal habitat.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.

[4] Information sourced from species profiles on NSW DPI species list or the Australian Government's *Species Profiles and Threats* database (SPRAT) unless otherwise stated.

OEH threatened species database: https://www.dpi.nsw.gov.au/fishing/species-protection/conservation/what-current

SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Eastern Freshwater Cod *Maccullochella ikei* E FM	Clear flowing rivers with rocky substrate and large amounts of in-stream cover.	**No** No flowing rivers.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Oxleyan Pygmy Perch *Nannoperca oxleyana* E FM	Coastal lowlands, mostly coastal floodplains in swamps, creeks and lakes of coastal Banksia heath.	**No** No coastal habitat.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Southern Pygmy Perch *Nannoperca australis* E FM	Slow-flowing waters and still, vegetated habitats in small streams, lakes, billabongs and wetlands.	**No** No flowing or suitable permanent water.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Southern Purple Spotted Gudgeon *Mogurnda adspersa* E FM	Rivers, creeks, and billabongs with slow-flowing or still waters or in streams with low turbidity. Cover in the form of aquatic or overhanging vegetation, leaf litter, rocks or snags.	**No** No suitable slow-flowing or still permanent water.	**Unlikely** Outside current known species distribution.	**No** No suitable habitat in development site.
Troud Cod *Maccullochella macquariensis* E FM	Areas with large in-stream woody debris.	**No** No suitable permanent water with large woody debris.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Murray Cod *Maccullochella peelii* V EPBC	Slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs.	**No** No deep, slow-flowing streams or rivers.	**Unlikely** Within species distribution.	**No** No suitable habitat in development site.

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Macquarie Perch *Macquaria australasica* E EPBC E FM	Rivers, in clear, deep, rocky holes with plenty of cover including aquatic vegetation, large boulders, large woody debris, and overhanging banks.	**No** No deep water with plenty of cover.	**Unlikely** Within species distribution.	**No** No suitable habitat in development site.
Silver Perch *Bidyanus bidyanus* V FM	Faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin.	**No** No fast-flowing water.	**Unlikely** Within species distribution.	**No** No suitable habitat in development site.
Darling River Hardyhead population in the Hunter River catchment *Craterocephalus amniculus* EP FM	North-east part of the Murray-Darling Basin, especially MacIntyre, Namoi and other border rivers. The Hunter River population is the only known occurrence in an eastward flowing river.	**No** Outside Hunter River catchment.	**No** Outside population distribution.	**No** Population not in development site.
Murray-Darling Basin population of Eel-tailed Catfish *Tandanus tandanus* EP FM	Diverse range of freshwater environments including rivers, creeks, lakes, billabongs and lagoons. Clear, sluggish or still waters, but also found in flowing streams with turbid waters. Substrates range from mud to gravel and rock.	**Possible** Small freshwater dams with sand/mud substrate.	**Unlikely** Not recorded in locality.	**No** Species not recorded in locality.
Snowy River population of River Blackfish *Gadopsis marmoratus* EP FM	Clear flowing streams with good instream cover such as woody debris, aquatic vegetation and undercut banks.	**No** Outside Snowy River catchment.	**No** Outside population distribution.	**No** Population not in development site.

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Western population of Olive Perchlet *Ambassis agassizii* EP FM	Western (Murray-Darling) population is limited to a few localities in Darling drainage upstream from Bourke.	**No** Outside Darling drainage system upstream from Bourke.	**No** Outside population distribution.	**No** Population not in development site.
Grey Nurse Shark *Carcharias taurus* CE FM	Inshore coastal waters along coast of NSW and southern Queensland.	**No** No coastal habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Scalloped Hammerhead Shark *Sphyrna lewini* E FM	Tropical and warm temperate seas between 45°N and 34°S, inshore and over continental shelf and in adjacent deep water from surface to at least 275 m depth.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Great Hammerhead Shark *Sphyrna mokarran* V FM	Occurs along coastlines, continental shelves and adjacent drop-offs to about 80 m depth.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
White Shark *Carcharodon carcharias* V FM	Inshore habitats to outer continental shelf and slope areas.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Southern Bluefin Tuna *Thunnus maccoyii* E FM	Oceanic waters on seaward side of continental shelf.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Black Rockcod *Epinephelus daemelii* V FM	Caves, gutters and beneath bommies on rocky reefs, from near shore environments to depths of at least 50 m.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Invertebrates				
Darling River Snail *Notopala sublineata* CE FM	Darling River and its tributaries. Artificially introduced hard surfaces including irrigation pipelines.	**No** No artificial surfaces in waterways.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Hanley's River Snail *Notopala hanleyi* CE FM	Artificially introduced hard surfaces including irrigation pipelines.	**No** No artificial surfaces in waterways.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Fitzroy Falls Spiny Crayfish *Euastachus dharawalus* CE FM	Creates burrows in soft stream bed below waterline.	**No** No suitable permanent streams.	**Unlikely** Outside species distribution.	**No** No suitable habitat in development site.
Murray Crayfish *Euastachus armatus* V FM	Lotic waters of southern Murray-Darling Basin. Habitats ranging from pasture to sclerophyll forest, large and small streams. Deep flowing water proximal to clay banks, wood or rock cover.	**No** No permanent lotic habitat.	**Possible** Within species distribution.	**No** No suitable habitat in development site.
Marine Slug *Smeagol hilaris* CE FM	Small isolated location at Merry Beach, south of Ulladulla, NSW.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Adams Emerald Dragonfly *Archaeophya adamsi* E FM	Narrow, shaded riffle zones with moss and abundant riparian vegetation in small to moderate sized creeks with gravel or sandy bottoms.	**No** No suitable narrow, shaded riffle zones.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Sydney Hawk Dragonfly *Austrocordulia leonardi* E FM	Deep river pools with cooler water and permanent flow.	**No** No deep water or permanent flow.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Alpine Redspot Dragonfly *Austropetalia tonyana* V FM	Amongst rocks, logs and moss within the splash zone of waterfalls or in the nearby stream edge.	**No** No waterfalls or rocky streams.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Bousfield Marsh Hopper *Microrchestia bousfieldi* V FM	Mangrove swamps and salt marshes in eastern Australia.	**No** No coastal habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Buchanans Fairy Shrimp *Branchinella buchananensis* V FM	Lake Buchanan in southwest Queensland, and Gidgee and Burkanoko Lakes in northwest NSW.	**No** No lake habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Plants				

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Marine Brown Alga *Nereia lophocladia* CE FM	Port Phillip Heads in Victoria and Muttonbird Island, Coffs Harbour in NSW.	**No** No coastal habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Posidonia australis seagrass, Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations EP FM	Coarse sandy to fine silty sediments between the low tide and approximately 10 m in depth.	**No** No marine habitat.	**No** Outside species distribution.	**No** No suitable habitat in development site.
Endangered Ecological Community				
Lowland Darling River aquatic ecological community EEC FM	Natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within NSW, including Menindee Lakes and Barwon River.	**No** Not in Darling River catchment.	**No** Outside community distribution.	**No** No suitable habitat in development site.
Lowland Lachlan River aquatic ecological community EEC FM	Natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, floodrunners, effluent streams (those that flow away from the river) and the floodplains of the Lachlan River within NSW, including Lake Brewster, Lake Cargelligo and Lake Cowal.	**No** Not in Lachlan River catchment.	**No** Outside community distribution.	**No** No suitable habitat in development site.

Species and Status	Description of habitat[4]	Presence of habitat	Likelihood of occurrence	Potential for impact?
Lowland Murray River aquatic ecological community EEC FM	Natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River (also known as the River Murray) downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries anabranches and effluents including Billabong Creek, Yanco Creek, Colombo Creek, and their tributaries, the Edward River and the Wakool River and their tributaries, anabranches and effluents, Frenchmans Creek, the Rufus River and Lake Victoria.	**Yes** Billabong Creek, Back Creek and unnamed drainage are tributaries of Murrumbidgee River.	**Possible** Within community distribution.	**No** No riparian vegetation impacted.
Snowy River aquatic ecological community EEC FM	Rivers, creeks and streams of the Snowy River catchment. This includes Snowy, Eucumbene, Thredbo (or Crackenback), Gungarlin Mowamba, Bombala, McLaughlin, Delegate, Pinch and Jacobs Rivers and their tributaries.	**No** Not in Snowy River catchment.	**No** Outside community distribution.	**No** No suitable habitat in development site.

CE FM = listed as Critically Endangered under Schedule 4A of the NSW *Fisheries Management Act 1994.*

E FM = listed as Endangered under Schedule 4 of the NSW *Fisheries Management Act 1994.*

V FM = listed as Vulnerable under Schedule 5 of the NSW *Fisheries Management Act 1994.*

EP = listed as an Endangered Population under Schedule 4 of the NSW *Fisheries Management Act 1994.*

EEC = listed as an Endangered Ecological Community under Schedule 4 of the NSW *Fisheries Management Act 1994.*

6.8.8 Safeguards and mitigation measures

Table 6-68 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
BD1	The following plans are to be prepared and approved by the relevant authorities: • Biodiversity Management Plan. • Construction and Operational Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. The plans should include but not be limited to the relevant commitments below.	Pre-construction	Pre-operations	
BD2	Timing works to avoid critical life cycle events such as breeding or nursing: • Hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts on all hollow-dependent fauna. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.	C		
BD3	Implement clearing protocols including pre-clearing surveys, daily surveys and staged clearing, with a trained ecological or licensed wildlife handler present during clearing events, including: • Pre-clearing checklist. • Tree clearing procedure.	C		
BD4	Relocation of habitat features (fallen timber, hollow logs) from within the development site. Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	Pre - construction		
BD5	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed: • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.	C		
BD6	Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise. Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C	O	D
BD7	Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill:	C	O	D

No.	Safeguards and mitigation measures	C	O	D
	• Avoid Night Works. • Direct lights away from vegetation.			
BD8	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operational activities. • Construction would cease if dust observed being blown from site until control measures were implemented. • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.	**C**		**D**
BD9	• Temporary fencing to protect significant environmental features such as riparian zones.	**C**		**D**
BD10	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Pest and Weed Management Plan.	**C**	**O**	
BD11	Staff training and site briefing to communicate environmental features to be protected and measures to be implemented: • Site induction. • Toolbox talks. • Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	**C**	**O**	
BD12	Preparation of a Vegetation Management Plan to regulate activity in vegetation: • Protection of native vegetation to be retained. • Best practice removal and disposal of vegetation. • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. • Weed management. • Unexpected threatened species finds. • Rehabilitation of disturbed areas.	**C**		
BD13	Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment: • An erosion and sediment control plan would be prepared and implemented in conjunction with the final design. • Spill management procedures would be implemented.	**C**		
BD14	Appropriate landscape plantings of local indigenous species derived from local native plant communities.	**Design Stage**		

6.9 ABORIGINAL HERITAGE

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues.

Heritage –

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

Appendix B of the Scoping Report provides the result of a basic AHIMS search undertaken 13 November 2018 that identified 13 sites in, or near, the subject site. Where a basic AHIMS search has shown that there are Aboriginal sites or places recorded within the search area an extensive AHIMS search must be undertaken. We note that Appendix B of the Scoping Report also provides results from an extensive AHIMS search, however these results appear to pertain to a different site at least 22 km further south of the proposed activity. Different parameters have been applied (i.e. coordinates), the search only identifies six known sites, and it is dated 2 August 2018, which is three months earlier than the basic AHIMS search. We recommend that the EIS provide more current AHIMS results and that extensive search results relate to the basic search.

Based on OEH records and the archaeological context of the subject site, as detailed by the scoping report, we concur that an Aboriginal cultural heritage assessment of the development footprint should be undertaken. This is to be undertaken in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW *(OEH 2010), inclusive of consultation with relevant Aboriginal stakeholders.*

While there is no requirement to obtain an Aboriginal Heritage Impact Permit (AHIP) for State Significant Developments, the Proponent must comply with all other legislative requirements under Part 6 of the National Parks and Wildlife Act 1974.

Aboriginal cultural heritage –

1. *The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that would be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010}, and be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with OEH regional 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 EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.*
4. *The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the ACHAR.*
5. *The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts.*
6. *The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.*

NGH prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The proposal area included the subject land and the development footprint of Weeamera Road. The full report is provided in Appendix G and is summarised below.

The ACHAR was prepared in line with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010a); and
- *Aboriginal cultural heritage consultation requirements for Proponents 2010* (OEH 2010b).

Consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010,* following the consultation steps outlined in the (ACHCRP) guide provided by OEH.

6.9.1 Background

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

Most archaeological surveys are conducted in a situation where there is topographic variation, and this can lead to differences in the assessment of archaeological potential and site modelling for the location of Aboriginal archaeological sites. Within the Culcairn region areas directly associated with water and/or elevated ground appear to have the greatest potential for identification of Aboriginal cultural material. The development area has limited topographic variation, where the development area comprises primarily cleared and cropped paddocks that have been subject to farming activities.

Visibility within the proposal area was variable however, as a whole it generally had excellent visibility averaging 60% overall. The effective visibility in the paddocks ranged from 60 to 95%.

The results of previous archaeological surveys in the Culcairn region demonstrate that there is a strong, complex and varied pattern of human use and movement through the landscape. This behaviour is recorded as a range of artefact and site types distributed and concentrated in specific landforms.

Three small unnamed drainage lines traverse the development site in an east-west direction. Twenty farm dams occur within the development site. These are the only hydrological features within the proposal area.

Database searches and consultation

A search of the AHIMS database was conducted over an area approximately 20 km east-west by 20 km north-south and centred on the proposal area on the 19th November 2018. The AHIMS Client Service Number was 383450. The search area extended from Lat, Long: -35.8269, 146.7923 to Lat, Long: -35.5503, 147.231 with a 50 m buffer zone. There were 99 Aboriginal sites and no declared Aboriginal Places recorded in the search area. Figure 6-30 shows the locations of the AHIMS sites in relation to the assessment area. Table 6-69 shows a breakdown of the site types recorded on AHIMS from the search.

Table 6-69 Breakdown of previously recorded Aboriginal sites in the region.

Site Type	Number
Artefact (1 or more)	62
Modified Tree (Carved or Scarred)	37
TOTAL	**99**

There were no sites recorded within the proposal area prior to this assessment. Three sites are located within close proximity to the proposal area (Figure 6-31). These are AHIMS #55-6-0032, AHIMS #55-6-0033 and AHIMS #55-6-0028. These three sites are artefact scatters records. Given the extended timeframe between the initial AHIMS search and the completion of the ACHAR a new AHIMS search was undertaken on the 21st of October 2019 centred on the proposal area. The AHIMS Client Service Number was 458827. The search area extended from Lat, Long -35.7511, 146.9043 to Lat, Long -35.6591, 147.0502 with a buffer zone of 50 m. There were 62 Aboriginal sites and no declared Aboriginal Places recorded in the search area. The AHIMS sites include 18 modified trees and 44 sites with artefacts (one or more). No new sites were recorded within or adjacent to the proposal area beyond those submitted by the Aboriginal representative Mark Saddler during the survey for the Culcairn Solar Farm. There is a high proportion (37%) of scarred trees recorded in proximity to the proposal area, especially in areas where there are patches of remnant native vegetation.

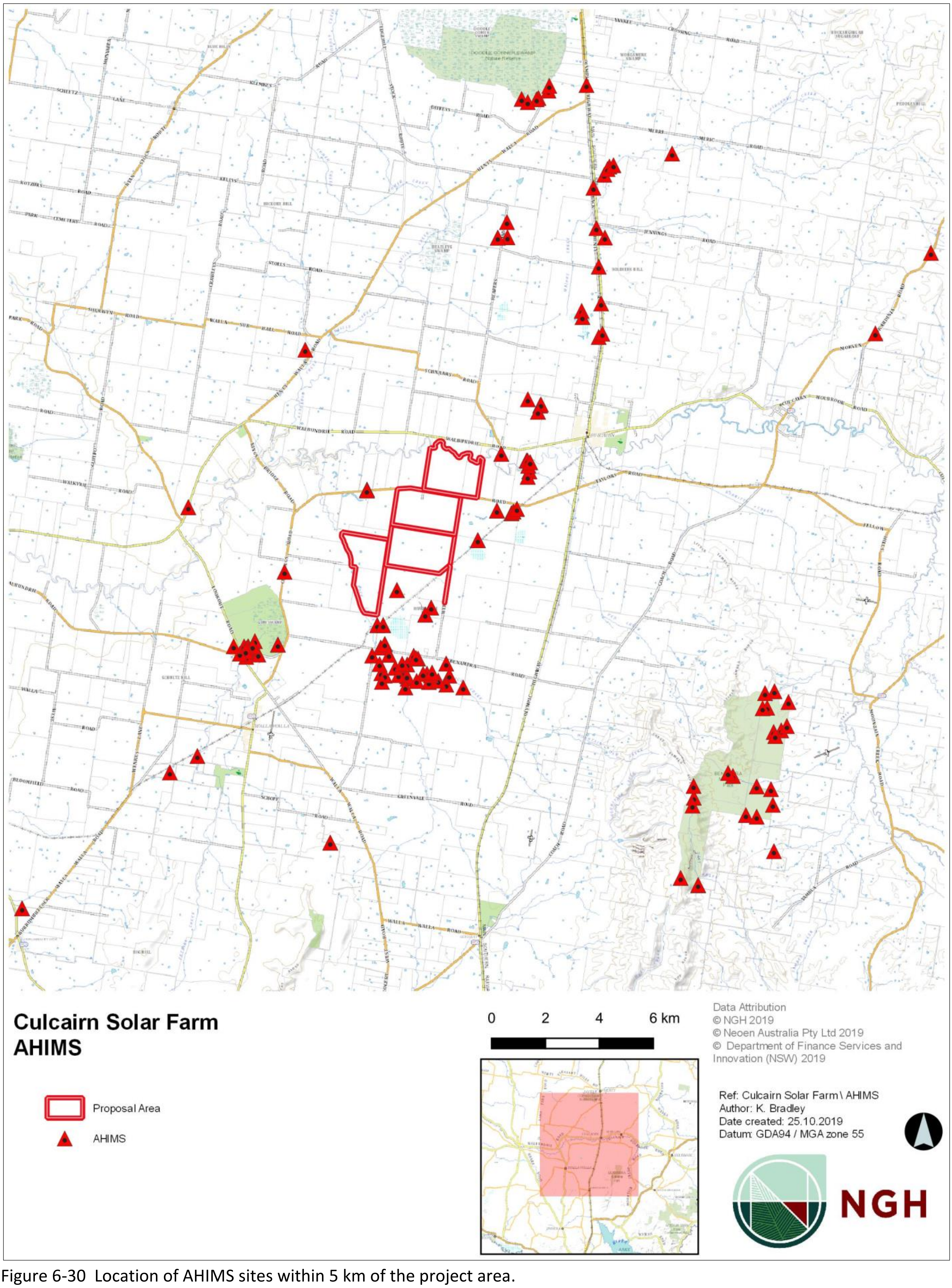

Figure 6-30 Location of AHIMS sites within 5 km of the project area.

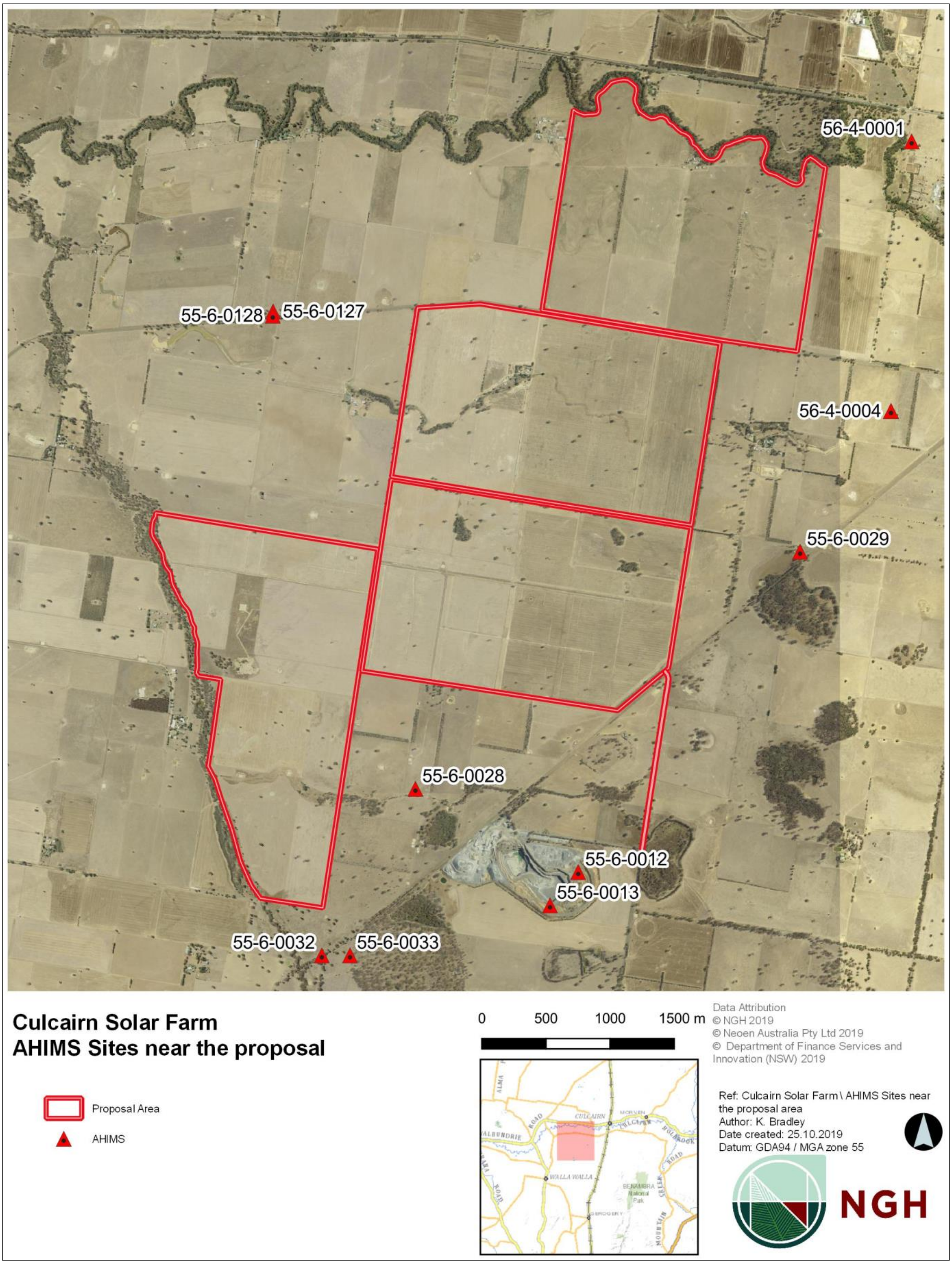

Figure 6-31 AHIMS sites near the proposal.

6.9.2 Site survey

Methodology

The proposal area was divided into two soil landforms:

- Quaternary Alluvial Flats
- Cenozoic Shepparton Formation Flats

The survey was undertaken by five to seven people including three archaeologists from NGH and representatives of the Aboriginal community from the 4th till the 11th of February 2019. Notes were made about visibility, photographs were taken, and any possible Aboriginal features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

The survey method was to walk a series of transects across the landscape to achieve maximum coverage. Because the proposal area was generally cleared paddocks, transects were spaced evenly with the survey team spread apart at 30 m intervals, walking in parallel lines. A total of 68 test pits were excavated across the PAD areas investigated. The survey team size allowed for a 150 to 210 m wide tract of the proposal area, depending on the number of survey participants. At the end of each transect, the team would reposition along a new transect line at the same spacing and walk back on the same compass bearing.

Over the course of the field survey, approximately 100 km of transects were walked across the proposal area by the participants, equating to 5.4% of the proposal area effectively examined. It is considered that the survey of the Culcairn Solar Farm proposal area had efficient and effective survey coverage given the high ground surface visibility. The survey technique is considered effective to identify the presence of Aboriginal occupation and area concentration due to the discovery of a number of Aboriginal sites.

Discussions were held in the field between the archaeologists and Aboriginal community representatives to ensure all were satisfied and agreed with the spacing, coverage and methodology.

Results and conclusions

Despite the variable visibility encountered during the survey a total of 26 isolated finds, 16 artefact scatters, 5 cultural tree sites, 3 modified trees and a single cultural stone site were recorded. Several areas of PAD were also identified adjacent to Back Creek, Billabong Creek and a paleochannel. Of the 68 test pits excavated only 13 contained stone artefacts. The Aboriginal community representatives identified the cultural sites which were unable to be unequivocally determined to be Aboriginal in origin by the NGH archaeologist but deemed to have cultural value by the Aboriginal community representatives. These locations are shown in Figure 6-32 with more detailed view in Figures Figure 6-33 to Figure 6-35.

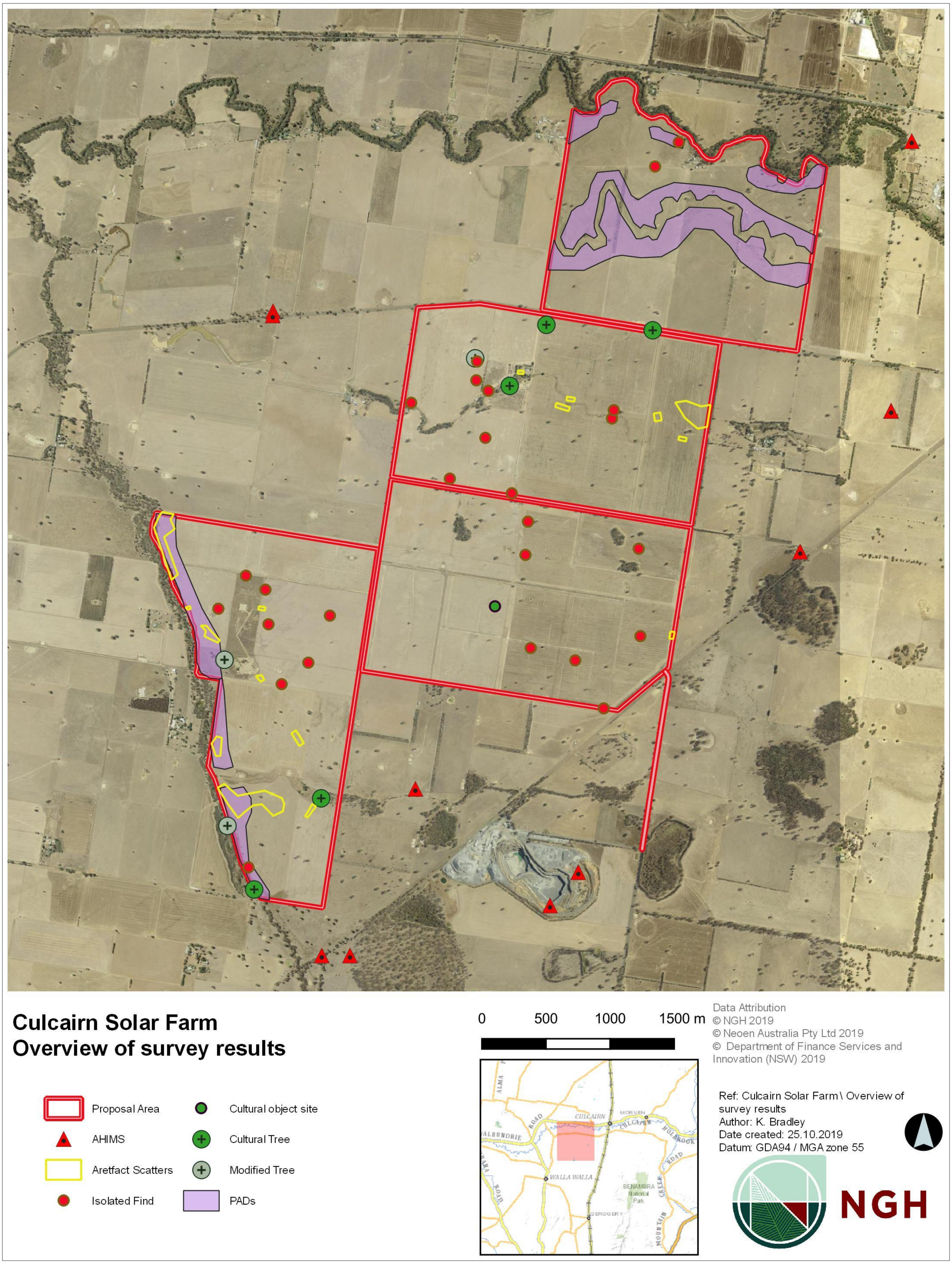

Figure 6-32 Location of recorded sites

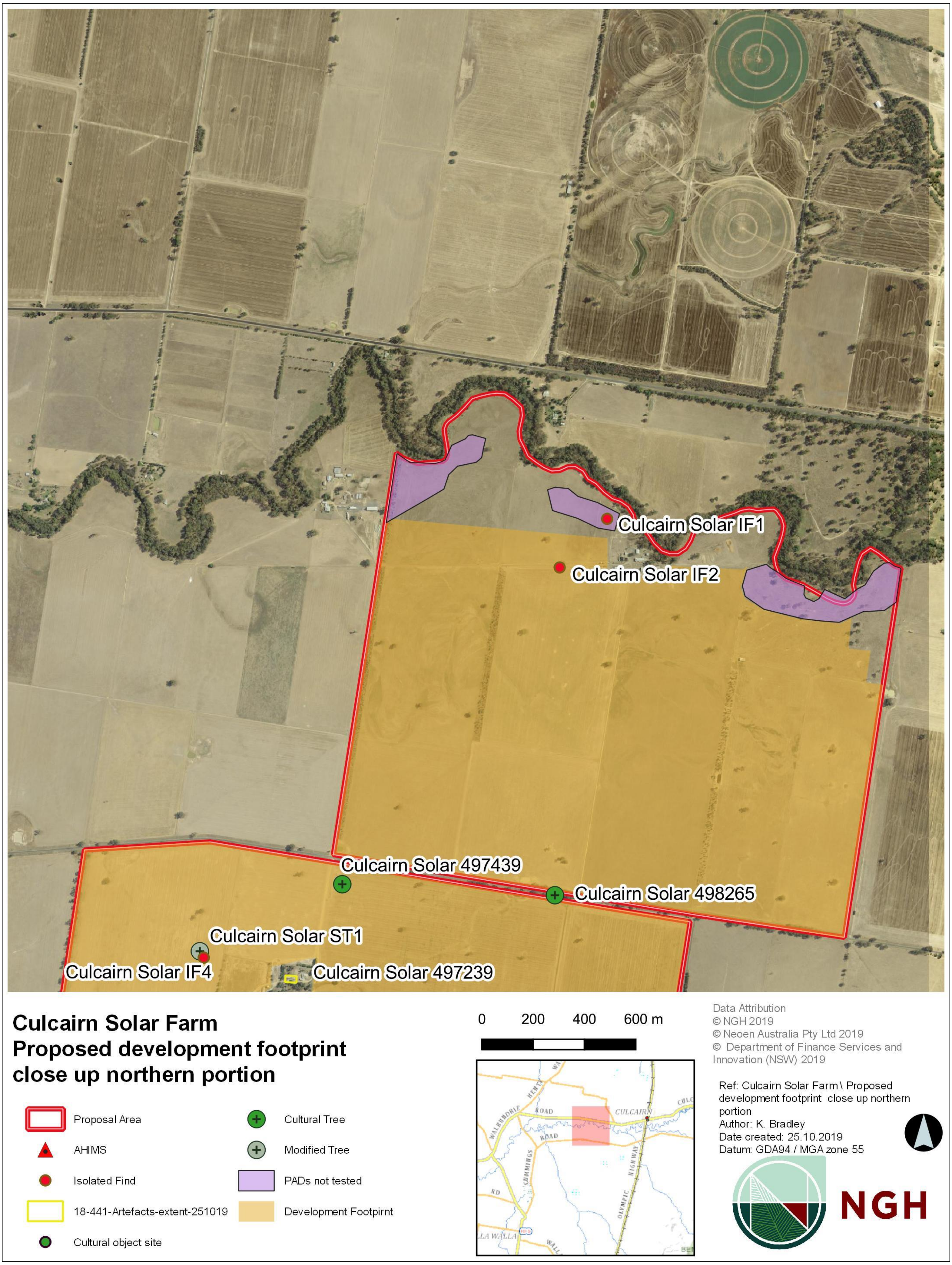

Figure 6-33 Archaeological and cultural sites within the northern portion of the proposed development footprint.

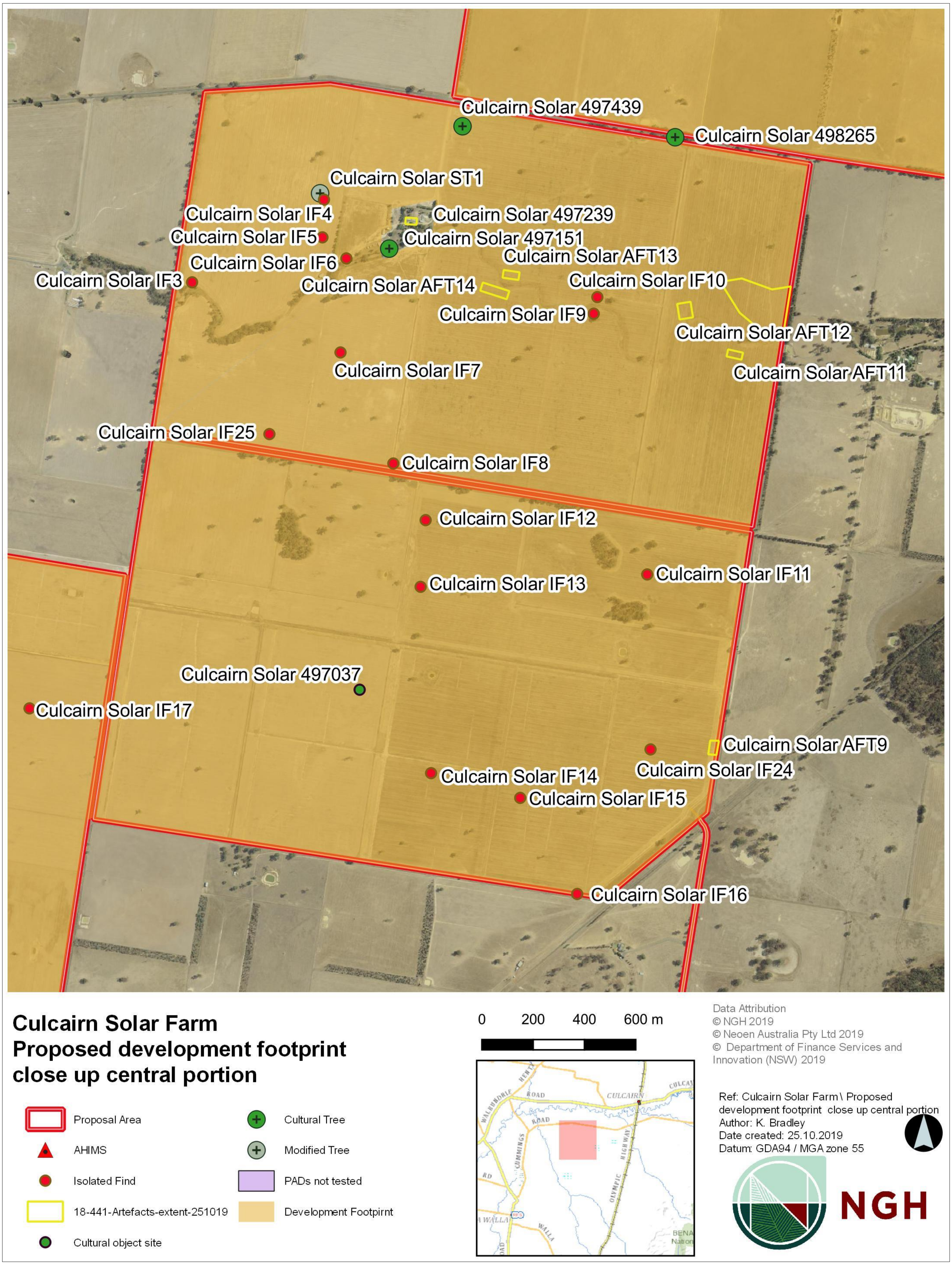

Figure 6-34 Archaeological and cultural sites within the central portion of the proposed development footprint.

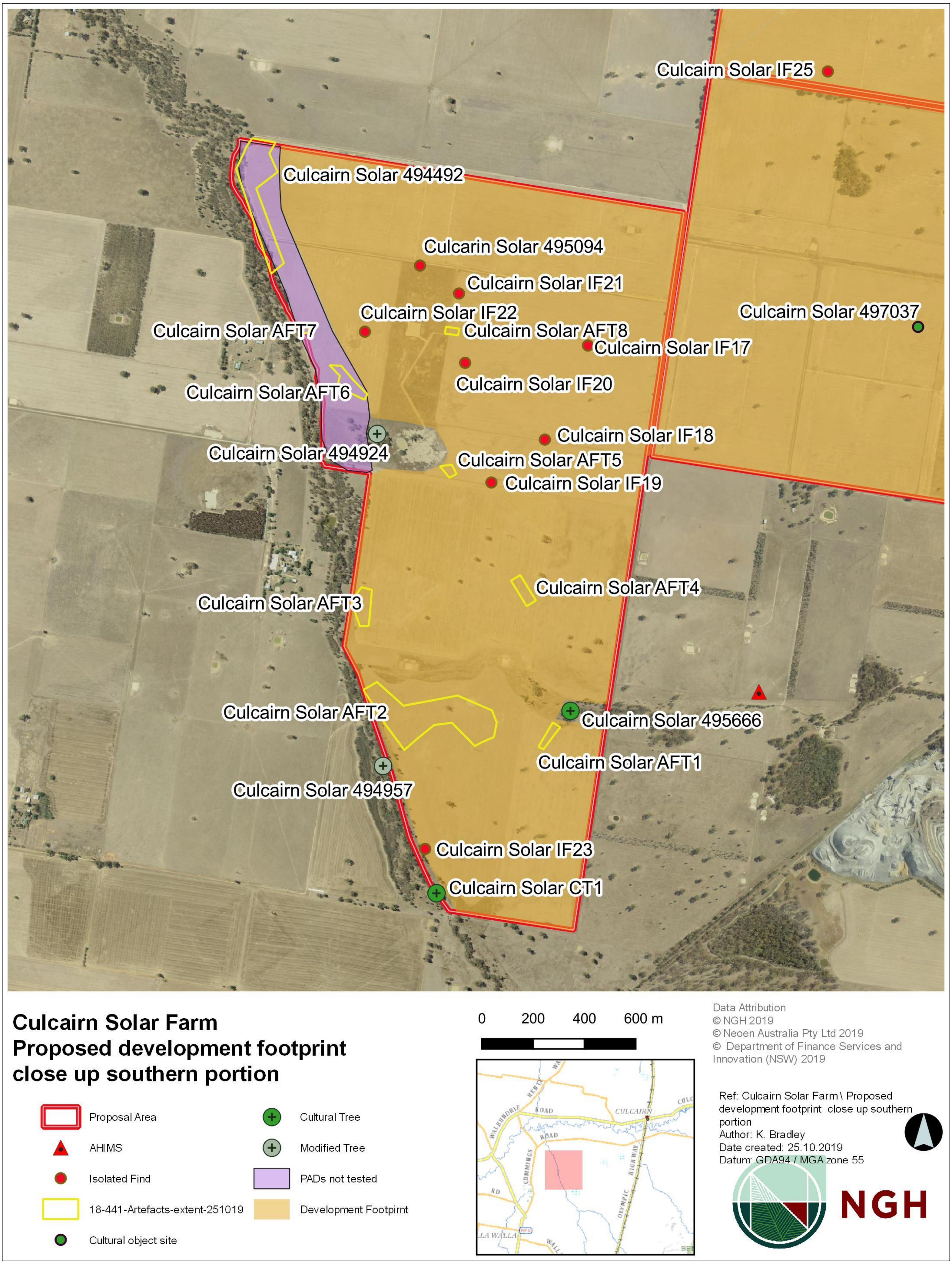

Figure 6-35 Archaeological and cultural sites within the southern portion of the proposed development footprint.

It should be noted that the Aboriginal representative Mark Saddler independently assigned his own naming convention to a number of sites he identified, particularly those unable to be unequivocally determined to be Aboriginal in origin by the NGH archaeologist. Mark Saddler also submitted his own AHIMS site cards and provided NGH with a report on his participation in the survey. Table 6-70 provides a summary of sites to be impacted and avoided while Table 6-71 details the degree of harm and the consequence of that harm upon the heritage value of each site resulting from the proposed works. Figure 6-32 also shows the location of the sites and the proposed development footprint.

It has been noted above that historically the Culcairn Solar Farm proposal area has been impacted through land use practices, in particular clearing, ploughing and grazing. The implications for this activity are that the archaeological record has been compromised in terms of the potential for scarred trees to remain outside the areas of remnant vegetation. The implication for stone artefacts is that they may have been damaged or moved but they are likely to be present and remain in the general area they were discarded by Aboriginal people. Despite these impacts, Aboriginal artefacts and cultural material remain in the area, indicating the presence of past Aboriginal people and providing indications of their use of this landscape.

Given that there is Aboriginal archaeological material present within the solar farm proposal area there are likely to be other artefacts present as well, although in similar low densities within the proposed development footprint. The proposed level of disturbance for the construction of the solar farm will likely impact the stone artefacts recorded during the field survey and others that may be present within other areas of the development site.

Of the 26 isolated finds, 19 artefact scatters (with surface and/or subsurface artefacts), five cultural tree sites, three modified trees and a single cultural stone site recorded within the proposal area, 25 isolated finds (96.2%), 15 artefact scatters with surface and/or subsurface artefacts (78.9%) and a single cultural stone site (100%) are situated within the area of the proposed solar arrays, tracks, fencing and associated infrastructure. These 41 sites would be impacted by the proposed development (see Figure 6-32). The impact to these 41 sites with stone artefacts is likely to be most extensive where earthworks occur such as the installation of cabling and the transmission line poles, which may involve the removal, breakage or displacement of artefacts. This is considered a direct impact on the sites and the Aboriginal objects by the development in its present form.

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

The PAD around associated with the paleochannel north of Cummings Road would remain largely intact. The indicative infrastructure layout shows there would be some impact from piles of solar infrastructure along the northern and southern edges of the PAD. The PAD area was subject to a subsurface testing program and the low-density archaeological material recovered indicated that the PAD associated with the paleochannel north of Cummings Road did not warrant any further mitigation measures.

The cultural stone site (item 497037) is located in the middle of a paddock where indicative solar infrastructure would be located. The site integrity is poor as the area has been used for more than 100 years of agricultural and pastoral use. The scientific significance of the site is low, and the type of harm is considered low (Table 6-71). Additionally, the Registered Aboriginal Parties (RAPs) have only requested that the cultural stone site is subject to mitigation via surface collection salvage prior to any construction works being undertaken for the project. This cultural value of this site has not been identified to be of high enough value to warrant avoidance by the RAPs.

The remaining five sites with stone artefacts, three modified trees, five cultural tree sites, the PADs adjacent to Billabong Creek and the PAD along the northern portion of Back Creek will not be impacted by the proposed development.

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

Table 6-70 Summary of sites to be impacted and avoided by the proposal

Sites impacted	Sites avoided
Culcairn Solar AFT 1 to Culcairn Solar AFT5	Culcairn Solar 497239 (artefact scatter)
Culcairn Solar AFT 8 to Culcairn Solar AFT 17	Culcairn Solar 494492 (artefact scatter)
Culcairn Solar IF 1 to Culcairn Solar IF 6	Culcairn Solar AFT 6 (artefact scatter)
Culcairn Solar IF 8 to Culcairn Solar 25	Culcairn Solar AFT 7 (artefact scatter)
Culcairn Solar 494492 (artefact scatter)	Culcairn Solar IF7 (isolated find)
Culcairn Solar 497037 (cultural stone site)	Culcairn Solar 494957 (modified tree)
	Culcairn Solar 494924 (modified tree)
	Culcairn Solar ST1 (modified tree)
	Culcairn Solar 497151 (cultural tree site)
	Culcairn Solar 497439 (cultural tree site)
	Culcairn Solar 498265 (cultural tree site)
	Culcairn Solar 495666 (cultural tree site)
	Culcairn Solar CT1 (cultural tree site)

Table 6-71 Identified risk to known sites and recommendations

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0199	Culcairn Solar AFT1	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT2	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 3	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 4	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 5	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 6	Poor – 100+ year history of agricultural and pastoral use.	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 5m buffer around site
	Culcairn Solar AFT 7	Poor – 100+ year history of agricultural and pastoral use.	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 5m buffer around site
	Culcairn Solar AFT 8	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 9	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
	Culcairn Solar AFT 10	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 11	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 12	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 13	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 14	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar AFT 15	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Rebury artefacts recovered from the testing program onsite. No further salvage required.
	Culcairn Solar AFT 16	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Rebury artefacts recovered from the testing program onsite. No further salvage required.
	Culcairn Solar AFT 17	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Rebury artefacts recovered from the testing program onsite. No further salvage required.
55-6-0139	Culcairn Solar 497239	Poor – 100+ year history of agricultural and pastoral use.	Low to moderate	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 5m buffer around site
55-6-0135	Culcairn Solar 494492	Poor – 100+ year history of agricultural and pastoral use.	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 5m buffer around site

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0136	Culcairn Solar 495094	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF1	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF2	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF3	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF4	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF5	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF6	Poor – 100+ year history of agricultural and pastoral use.	Low	Direct	Total	Total loss of value	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF7	Poor – 100+ year history of agricultural and pastoral use.	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 5m buffer around site
	Culcairn Solar IF8	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF9	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
	Culcairn Solar IF10	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF11	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF12	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF13	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF14	Poor – 100+ year history of agricultural and pastoral use.	Low to moderate	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF15	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF16	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF17	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF18	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF19	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
	Culcairn Solar IF20	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF21	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF22	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF23	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF24	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
	Culcairn Solar IF25	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
55-6-0130	Culcairn Solar 494957	Good – *in situ* dying tree	Low to Moderate	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
55-6-0137	Culcairn Solar 494924	Good – *in situ* dying tree	Low to Moderate	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
	Culcairn Solar ST1	Good – *in situ* living tree	Low to Moderate	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
55-6-0132	Culcairn Solar 495666	Good – *in situ* living tree	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site

AHMIS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
55-6-0133	Culcairn Solar 498265	Good – *in situ* living tree	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
55-6-0134	Culcairn Solar 497439	Good – *in situ* living tree	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
55-6-0140	Culcairn Solar 497151	Good – *in situ* living tree	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
	Culcairn Solar CT1	Good – *in situ* living tree	Low	None-– outside of development footprint	None	None	Site will be avoided by proposed development. Ensure avoidance with 10m buffer around site
55-6-0138	Culcairn Solar 497037	Poor – 100+ year history of agricultural and pastoral use.	Low	Low	Direct	Total	Salvage surface objects prior to development of proposal area.
N/A	PAD along Back Creek	Unknown	Unknown	None-– outside of development footprint	None	None	PAD area will be avoided by the proposed development footprint.
N/A	PADs adjacent to Billabong Creek	Unknown	Unknown	None-– outside of development footprint	None	None	PAD area will be avoided by the proposed development footprint.

6.9.3 Potential impacts

Construction

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

The proposed level of disturbance for the construction of the solar farm could impact the stone artefacts recorded during the field survey and others that may be present within other areas of the development site. The impact is likely to be most extensive where earthworks occur and would involve the removal, breakage or displacement of artefacts. A mitigation strategy has been developed for each site recorded (Table 6-71 above) and forms a commitment of the project (included in Table 6-72 above).

Operation

During operation, it is unlikely the proposal would impact any further on Aboriginal archaeology. Social and cultural values attributed to the artefacts and the sites by the local Aboriginal community may be impacted by the development. The extent to which the loss of the sites or parts of the sites would impact on the community is only something the Aboriginal community can articulate.

The overall scientific impact is considered low. No other values have been identified that would be affected by the development proposal. We estimate that while the current development proposal will impact the majority of the stone artefact sites identified, the overall cumulative impact on the archaeological record for the region is likely to be minimal, assuming a similar density of artefact sites remain across the wider region. Therefore, it is argued that the cumulative impacts of the proposal are not enough to reject outright the development proposal.

No mitigation is required during operation.

6.9.4 Safeguards and mitigation measures

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

Table 6-72 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 Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	C		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	C		
AH3	If complete avoidance of any of the 26 isolated find sites, 16 artefact scatters and single cultural stone site recorded within the proposal area is not possible the surface stone artefacts and cultural stone site within	C		

No.	Safeguards and mitigation measures	C	O	D
	the development footprint must be salvaged. The surface collection salvage of these stone artefacts and cultural stone object must occur prior to the proposed construction works commencing for the Culcairn Solar Farm. Until surface collection salvage has occurred a minimum 5 m buffer must be observed around all stone artefact sites and the cultural stone site.			
AH4	The development avoids the three modified trees and five cultural tree sites. A minimum 10 m buffer should be in place around each modified tree and cultural tree site to prevent any inadvertent impacts to the canopy and root system.	C		
AH5	All artefacts recovered from the subsurface testing programme undertaken within the Culcairn Solar Farm proposal are currently in temporary care at the NGH Canberra office must be reburied in line with Requirement 26 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales and in an appropriate location within the proposal area that will not be subject to any ground disturbance.			
AH6	All objects salvaged, including those recovered from the subsurface testing program, must have their reburial location submitted to the AHIMS database. An Aboriginal Site Impact Recording Form must be completed and submitted to AHIMS following harm for each site collected or destroyed from salvage and/or construction works.			
AH7	If the proposed development footprint is changed and the areas of PAD along Back Creek and Billabong Creek will be impacted, a limited subsurface testing program must be conducted at the PADs not subject to the subsurface testing program undertaken during the current assessment. Excavated material may need to be analysed off site and this is most likely to be undertaken in NGH offices, where the material will be analysed and then subsequently returned to site for reburial.			
AH8	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the Code of practice for Archaeological Investigation of Aboriginal Objects in New South Wales. A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database.	C		
AH9	A minimum 5m buffer should be observed around all stone artefact sites that cannot be avoided, including those outside the development footprint.	C		
AH10	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

7.1.1 Existing environment

Climate

The Greater Hume LGA is part of the NSW South Western Slopes Bioregion, Lower Slopes subregion. This bioregion is dominated by a sub-humid climate that generally experiences hot summers and cool wet winters (OEH 2016). The BOM (2019b) temperature records available from the nearest long-term climate station at Albury Airport (station no. 072160) indicate a mean summer maximum of 32.3 °C (January) and a mean winter maximum of 13.2 °C (July) (Figure 7-1). The BOM (2019b) rainfall records from the same station show a mean annual rainfall of 614.6 mm, and that rainfall is generally greatest over winter and spring, with the average monthly maximum occurring in August (66.5 mm).

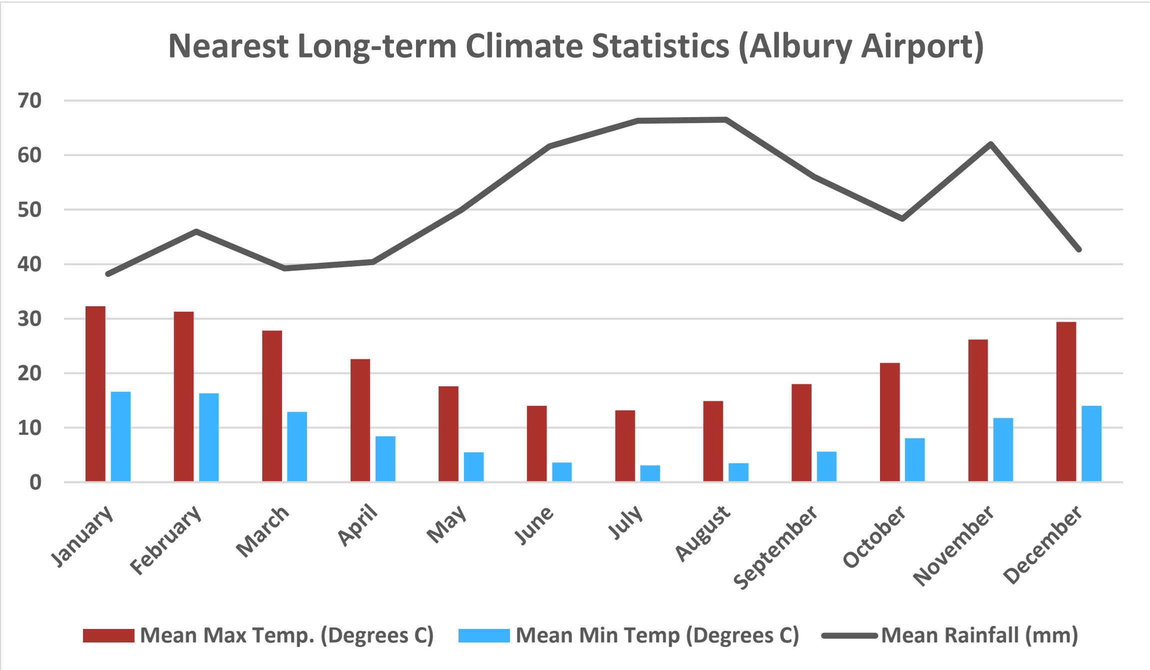

Figure 7-1 Climate statistics for Albury Airport (BOM 2019b).

Local air quality

Air quality in the study area is typical of the surrounding rural region. In general, air quality is high. However, raised dust during the drier months contributes to sporadic reductions in air quality. During autumn the level of particulate matter in the air increases due to the burning of agricultural residues and soil cultivation for cropping. In winter the burning of wood in solid fuel fires contributes to elevated levels of particulate matter in the atmosphere.

Existing sources of air pollution for the development site include:

- Vehicle emissions.
- Dust from nearby unsealed roads.
- Agricultural activities including sowing, lime application, burning of paddocks or earth moving.

A search of the National Pollutant Inventory (Australian Government 2018) identified five substance emissions facilities located within the Greater Hume LGA, which include:

- Albury Galvanizing Pty Ltd, Culcairn;
- APT Management Services Pty Ltd, Culcairn;
- Boral CSR Bricks Pty Ltd, Culcairn;
- Boral Resources (Country) Pty Ltd, Culcairn; and
- Rivalea (Australia) Pty Ltd, Bungowannah.

Adjoining land uses include grazing and cropping for agriculture. Topography of the development site is undulating to flat and there is minimal vegetation screening the development site.

CRITERIA

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m^2/month are also specified by the EPA.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases (GHGs) in the atmosphere. GHG's include carbon dioxide, methane and water vapour. Climate change projections for Australia include 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 drought affected (DPI 2019).

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. Dust generation would also occur during the upgrade of the 1.4 km section of Weeamera Road. 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 between 16 and 18 months, with a peak period lasting approximately 8 - 12 months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (bus) transport, (up to 500 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in section 6.6.2).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. The construction of the solar arrays uses a piling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be less than 0.1% of the development site based on a pile area of 20 cm x 20 cm and the NexTracker system.

Additional disturbance and earthworks will be associated with trenching for cables, the construction of concrete footings for infrastructure and internal access tracks.

Two dwellings are located within 120 m of the subject land boundary and are the key receivers for adverse air quality impacts. One of these is unoccupied. Existing mature vegetation occurs between some receivers and the development site. Dust impacts would be mitigated using dust suppression methods; refer to section 7.1.3.

In accordance with good international practice, the assessment of sensitive receivers should consider up to 500 m from the site boundary for both human and ecological receptors (Holman *et al*. 2014), due to the typical distance of dust dispersion. The assessment of other pollutants (e.g. gaseous exhaust fumes) would require a smaller area of assessment (~ 200 m) as suggested by Bignal, K. *et al*. (2004) before emissions are indistinguishable from background concentrations. Dust impacts would be mitigated using dust suppression methods; refer to section 7.1.3.

Fourteen residential dwellings are located within 1 km of the proposal who are not associated landholders. Three associated landholders are located within 1 km of the proposal. Dust and emissions would be expected to dissipate readily over this distance, with substantive air quality impacts not anticipated for these dwellings. With the minor earthworks involved and implementation of mitigation measures, air quality issues are considered manageable.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. However, construction will be responsive to local conditions to ensure impacts are managed. Haulage traffic, plant and equipment would generate emissions; however, the short duration of the work, the scale of the proposal and mitigation strategies in place suggest this contribution would be negligible in a local or regional context.

Operation

AIR QUALITY

The generation of solar energy during the operation of the proposal would generate negligible air quality impacts and emissions. The operation of the solar farm would produce minimal CO_2 emissions when compared to conventional coal and gas fired powered stations (Table 7-1). As discussed in section 2.2, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 800,000 MWh per annum, the proposal would offset the brown coal equivalent of more than 2,268 tonnes per annum of CO_2 emissions and power the equivalent of about 189,800 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)
Combined cycle gas turbine	400	Alsema *et al*. (2006)

Maintenance activities during operation would result in some minor, localised vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads. The impacts on local and regional air quality are expected to be negligible during operation. During regular operation, only two or three vehicles would be present at the site on a permanent basis. Less than 10 light vehicles would visit the site on a daily basis. During major maintenance activities, this number could increase to 20-30 vehicles at any one time for a limited period.

There is a risk that unsealed access tracks may create dust during windy conditions. However, the access tracks will be regularly maintained. Dust creation is expected to be no more than the existing unsealed access roads that surround the site. As such, a noticeable increase in dust creation is unlikely.

Reduction of dust causing agricultural activities will also temporarily cease over the development area, with groundcover maintained to reduce erosion and dust. As such, overall dust creation on the subject land will decrease.

Limited amounts of fuel would be required for maintenance vehicles during operation of the solar farm and for temporary power generation in the event of an unplanned outage. During operation, the proposal would have a significantly positive impact on global climate by assisting to reduce Australia's reliance on fossil fuels for electricity generation (discussed in section 2.2).

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is not expected to be significant. Cumulative impacts are discussed further in section 7.6.

HEAT ISLAND EFFECT

A number of studies have shown that Photovoltaic (PV) panels can alter the airflow and temperature profiles within and adjacent to the panels. This is referred to as the Photovoltaic Heat Island (PVHI) Effect. Whether such changes may subsequently affect the thermal environment of near-by populations of humans and other species has been questioned (Fthenakis & Yu, 2013). To date there are limited empirical studies on the potential for a heat island effect in utility scale solar plants.

Published papers relevant to this issue include:

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

The issue has also been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton for solar farms proposed by the Proponent 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). The Proponent, 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 2016.

Studies completed show results that can be seen as contradictory, as they are so site and project specific. Some studies suggest that PV systems can actually cause a cooling effect on the local environment, depending on the efficiency and placement of the PV panels while others demonstrate a warming effect (Barron-Gafford, Minor, Allen, Cronin, Brooks, & Pavao-Zuckerman, 2016). Other studies conclude that whilst air temperatures may increase within the solar plant itself, they rapidly decrease to the ambient temperature beyond the perimeter of the solar plant (Fthenakis & Yu, 2013).

Armstrong et al (2016) focussed on microclimate and ecosystem processes directly under the panels. They found:

- PV arrays caused seasonal and diurnal variation in air and soil microclimate. These varied between summer (cooling of up to 5.2^{0}C) and winter (cooling up to 1.7^{0}C).
- Drying occurred under the PV arrays compared with gap and control areas.
- Differences in the above ground plant biomass and species diversity, with both lower under the PV array.
- Photosynthesis and net ecosystem exchange in spring and winter were also lower under the PV array.

Yang et al. (2017) looked at air and soil temperature within a solar farm and at a control site without PV. They found that at a height of 2 m in the two sites studied the daytime temperature was essentially the same during winter, while during the other seasons the daytime air temperature in the PV array is higher than that in the control without PV, with the maximum difference appearing in summer. At a height of 2m, the night-time air temperatures during the four seasons in the solar farm are higher than the control outside of the PV array. It also found that the annual range of soil temperatures at depths of 5–180 cm in the solar farm was larger than that in the region without PV. The soil temperature at different depths during winter at the solar farm was clearly lower than that in the region without PV, indicating that the PV farm is a cooling system.

Fthenakis and Yu (2013) undertook an analysis of the potential for large solar plants to generate a PVHI effect and increase air temperature within the solar plant area. The study found at the centre of the solar plant the annual average air temperature at a height of 2.5m increased by up to 1.9^{0}C. However, this increase in temperature dissipated at a height of 5m. Additionally, the solar plant completely cooled overnight, so the effect was limited in duration.

Barron-Gafford (2016) in his Statement of Evidence (SoE) to the Victorian Planning Panel included results on the radius of the measured heat effects. This identified that the PVHI effect was indistinguishable from air temperatures over native vegetation when measured at a distance of 30 m from the edge of the PV array (Figure 7-2). In his SoE he states that *'this pattern held true for both daytime and night-time conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstorey" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the PVHI quickly dissipates'*.

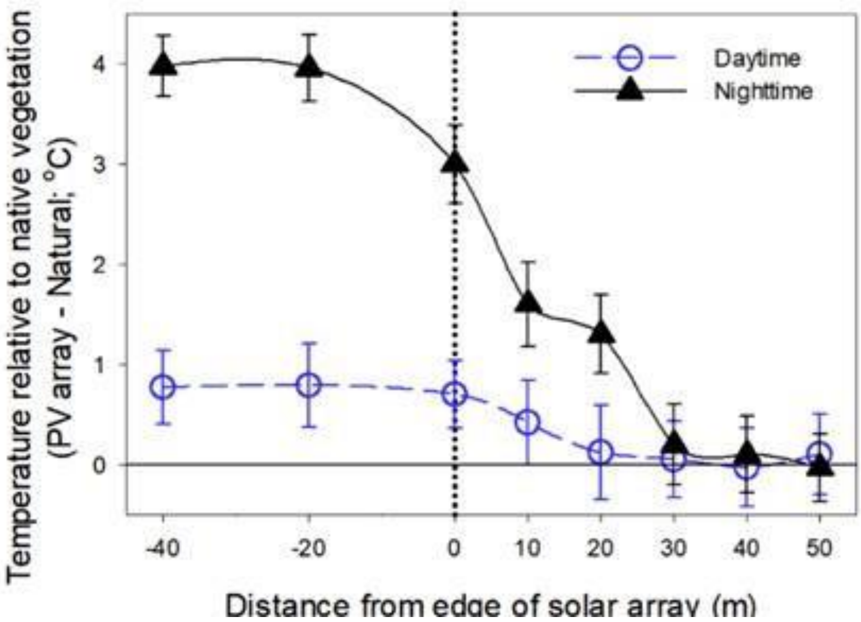

Figure 7-2 Measures of air temperature within and outside of the PV array (source:- Barron-Gafford 2016)

In conclusion of the Victorian Planning Panel Report (Panel Report 2018), the panel accepted that solar arrays will affect air and soil temperatures within the solar array perimeter, and that in relation to outside of the solar array perimeter a heat island effect is unlikely to occur. It identified that any temperature increases within the solar array would be marginal and recommended a 30 m distance setback from the development site boundary.

The research indicates a small potential effect on climate within the solar plant site. This effect may actually enhance retention of ground cover in very cold or hot conditions onsite. Negligible impacts on adjacent properties and agricultural activities such as plant growth and health of cattle would occur. It is also unlikely that the heat would be carried offsite by the wind. Where sensitive land use occurs adjacent to solar panels, consideration to maintaining a 30 m setback to infrastructure could be made.

The proposal mostly adheres to the Victorian Planning Panel Report recommendation, with minimum 30 m setback from the edge of the closest panel to the neighbouring property boundary for the majority of properties. The exceptions are involved receivers L02 and L03 where the distance from the edge of the closest panel to the residence is approximately 76 m for both.

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	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	**C**	**O**	**D**
AQ2	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	**C**	**O**	**D**
AQ3	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**
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	**C**		
AQ5	Fires and material burning are prohibited on the development site.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.2 HISTORIC HERITAGE

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage *including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:*

- *Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996);*
- *Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria);*
- *Include a statement of heritage impact for all heritage items (including significance assessment);*
- *Consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant;, and*
- *Where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.*

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 Greater Hume LGA on 7 November 2018.

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the development site. Greater Hume LGA was used in the search as the development site is situated within the Greater Hume Shire. Heritage databases searched as part of this assessment included:

- The NSW State Heritage Inventory (SHI) (includes items on the State Heritage Register and items listed by state agencies and local government) to identify any items currently listed within or adjacent to the development site. The area searched was Greater Hume LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the development site.
- The Environmental Heritage (Schedule 5) of Greater Hume LEP 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 Results

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 Greater Hume LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	0
NSW State Heritage Register	4
State Agency Heritage Register	12
Greater Hume LEP 2012	172

State Heritage Register

A search of the NSW heritage Register on 31 July 2018 for the Greater Hume LGA identified 4 items under the NSW Heritage Act and 61 items listed under the Greater Hume LEP and by state agencies. None of the items listed in the State Heritage Search were located within 3 km of the development site.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register for the Greater Hume LGA indicated 12 listings. These include:

- Bethanga Bridge over the Murray River, Riverina Highway (SH 20), Albury;
- Culcairn Police Station and Official Residence, 33 Balfour Street, Culcairn;
- Culcairn Railway Precinct, Melville Street, Culcairn;
- Gerogery Gatekeeper's Residence, Main Street, Gerogery;
- Henty Police Station and Official Residence, 41 Sladen Street, Henty;
- Henty Railway Precinct, Railway Parade, Henty;
- Holbrook Courthouse and Residence, Albury Street, Holbrook;
- Holbrook Police Station and Lockup Keeper's Residence, 64 Albury Street Holbrook;
- Ten Mile Creek Bridge, Hume Highway, Holbrook;
- Union Bridge over Murray River, Hume Highway (SH2), Albury;
- Vokins Creek Bridge, Little Billabong Road, 54.4 km west of Tumbarumba; and
- Wymah Ferry Crossing on the Murray River, Main Road 282, Wymah.

The above items are listed by State Agencies under s.170 of the *Heritage Act 1977*. None of the above items are located within or in close proximity to the development site.

Local Heritage Schedule

A search of the Greater Hume LEP (NSW Government 2012) indicated 172 local heritage items listed in the LGA. None of these items are located in the development site (Figure 7-3). The nearest listed heritage item is located 3.4 km NE of the development site, Culcairn Court House and Police Building (I41).

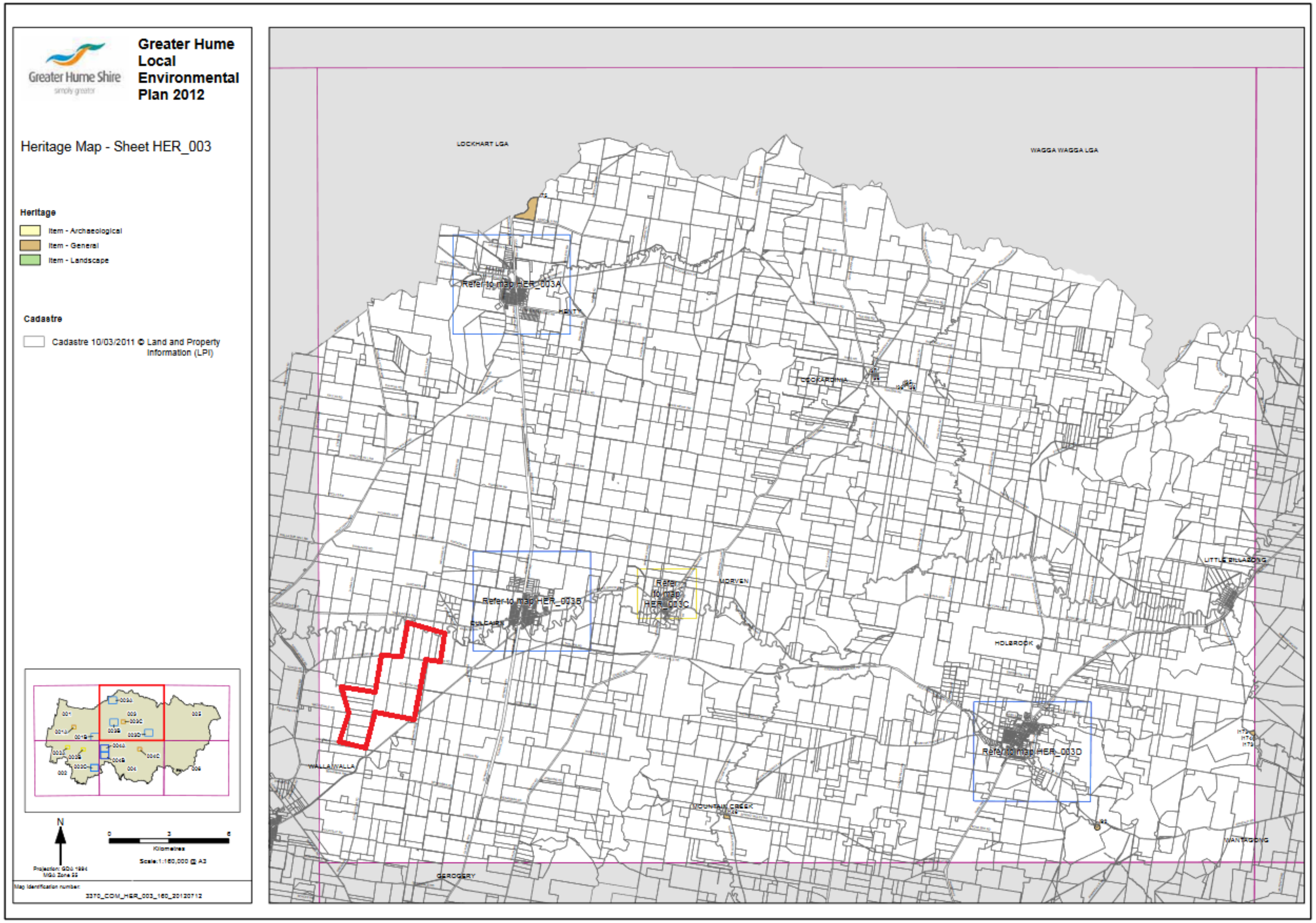

Figure 7-3 Greater Hume LEP (2012) Heritage Map results for the Culcairn Solar Farm (NSW Government 2012). *Red boundary indicates the proposed solar farm.*

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 Culcairn and other towns and villages. None of these items occur near the development site.

The proposal is not considered likely to have a significant impact on heritage values in accordance with the *NSW Heritage Act 1977*, the EP&A Act, and the EPBC Act.

7.2.4 Safeguards and mitigation measures

Table 7-4 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.3 SOIL

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

***Land –** including*

- *An assessment of the impact of the development on agricultural land (including possible cumulative impacts on agricultural enterprises and landholders) and flood prone land, an assessment of any impacts to Crown lands, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and biosecurity risk) during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivision; and*
- *Measures to remediate the land following decommissioning in accordance with* State Environmental Planning Policy No 55 – Remediation of Land.

***Water –** Including*

- *a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with* Managing Urban Stormwater: Soils & Construction *(Landcom 2004).*

DEPARTMENT OF INDUSTRY (AGRICULTURE)

*DPE's Large Scale Solar Energy Guideline for State Significant Developments, highlights areas of constraint for site selection as being "*important agricultural lands, including Strategic Agricultural Land (both critical industry clusters and biophysical strategic agricultural land), and land with soil capability classes 1, 2 and 3*". DPI Agriculture notes that the land that is subject to this proposal is classified as soil capability class 4 and thus is not constrained.*

A baseline soil conditions report should be included in the EIS so that rehabilitation plans and performance measures can be developed to inform the Proponent when decommissioning occurs.

Land stewardship met –

- *If any earthworks are proposed, an assessment of the overall footprint where the natural contours of the land will be modified, the total amount of material involved, how any stockpiled material will be managed and outline of how this material will or will not be used for agricultural rehabilitation purposes.*
- *A full soil survey to be undertaken prior to works commencing as a benchmark for agricultural land rehabilitation.*
- *Develop a Rehabilitation and Decommissioning/Closure Management Plan that outlines the rehabilitation objectives and strategies to return the land to its pre-project status. This includes, but is not limited to removing all above and below ground infrastructure, describing the design criteria of the final land use and landform, indicators to be used to guide the return of the land back to agricultural production, along with the expected timeline for the rehabilitation program.*
- *Measures to remediate the land following decommissioning in accordance with* State Environmental Planning Policy No. 55 – Remediation of Land.
- *Outline monitoring and mitigation measures to be adopted for rehabilitation remedial actions.*
- *Any land with a cropping history or land with a capability of category 3 or better as per the* Land and soil capability assessment scheme: second approximation (OEH), *all cables/pipes to be buried at a depth > 500 mm to allow greater opportunity for agricultural activities to continue over the top.*
- *Trenching through sodic soils during construction must include soil amendment with Gypsum at a minimum rate of 10 t/ha. Actual rates to be determined following soil testing (Clay content, ECEC and EC).*

7.3.1 Approach

A soil field survey was undertaken of 30 representative survey sites by DM McMahon Pty Ltd (Appendix K). The soil was analysed for topsoil and subsoil pH, electrical conductivity (EC), dispersion, nutrients and cations. The soil sampling sites are shown in Figure 7-4. The resultant Soil Assessment provides an analysis and evaluation of landforms and soil types as identified on subject land. Limitations and management actions are provided for the soil landscapes that have been identified on site.

Sampling and classification of in situ soils was carried out as per the Australian Soil and Land Survey Field Handbook (NCST 2009) and The Australian Soil Classification (Isbell 1996). Density of investigation boreholes was determined via the Guidelines for Surveying Soil and Land Resources (McKenzie *et al*. 2008), where selection of a 'Moderately High (Detailed)' intensity level was deemed appropriate for satisfying the objectives for detailed project planning.

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

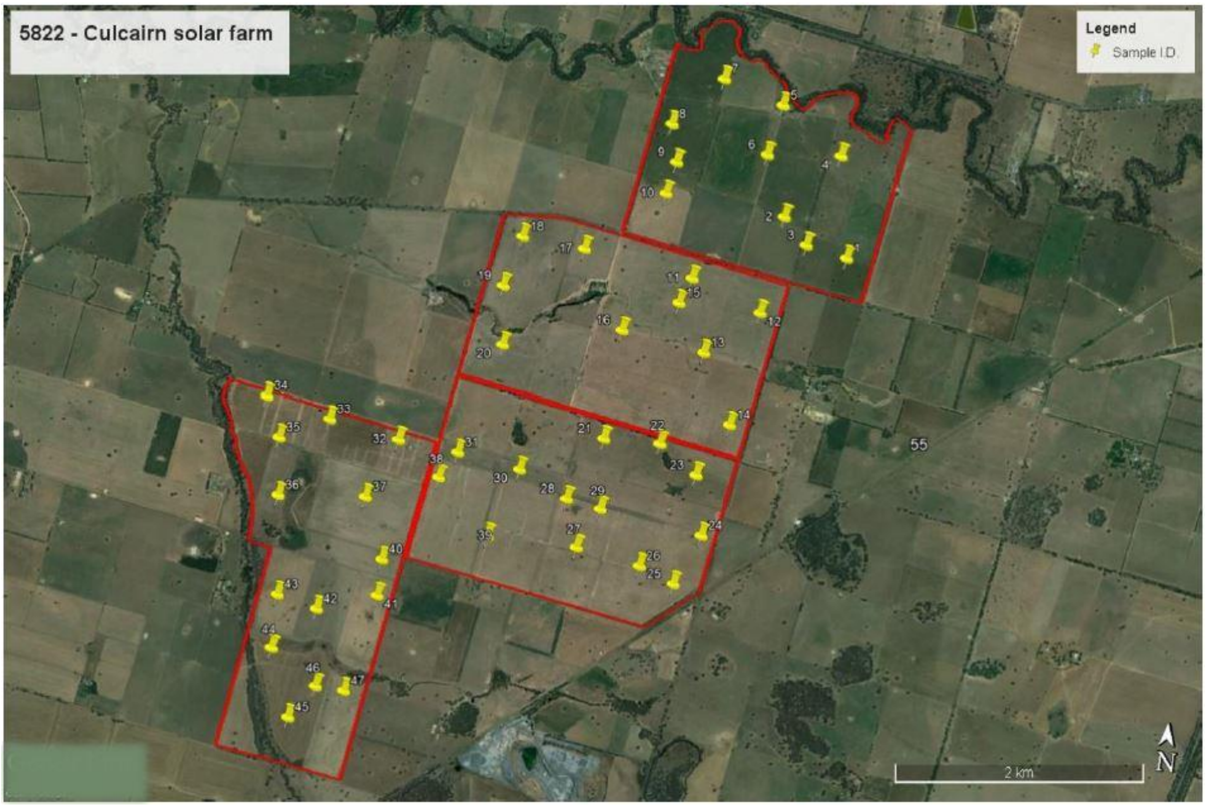

Figure 7-4 Soil survey investigation pit locations

7.3.2 Existing environment

Topography and geology

The site is located at an approximate elevation of 200 m – 220 m AHD. The site is classed as level to very gently inclining with shallow alluvial stream channels forming an alluvial plain. There is a crest formation with an associated simple slope towards the northern boundary of the property, in a west – east direction. Three widely spaced shallow ephemeral drainages traverse the site, one north of Cummings Road is a tributary of Billabong Creek and the other two are tributaries of Back Creek. All are unnamed. All drainages run into the moderately deep and perennial Billabong Creek, which borders the northern extent of the site. Geology of the site is largely comprised of unconsolidated sedimentary rock of the Shepparton Formation.

Potential contamination

A search of the NSW EPA contaminated land public record (NSW Government 2018) was undertaken for contaminated sites within the Greater Hume LGA on 29 October 2019. The search did not return any results for the LGA.

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

Soil

The site lies within the mapping units **Va17** from the Digital Atlas of Australian Soils (CSIRO 2018, mapped in Figure 7-5. This unit is defined as "hard alkaline yellow mottled soils (Dy3.43) and (Dr2.33), both containing ironstone gravel and sometimes forming soil complexes associated with various earths (Dr2.32, Dr2.42, Um4.1, Dr2.23) undescribed soils in local situations, data are limited; occurs on sheet(s)".

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

CHROMOSOLS

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

Topsoil encountered across the site was typically moderately granular light brown silty loams and white silts with a pH (1:5 soil/water) 5.4 – 6.0 in the A horizon. Subsoil encountered across the site is described as having weakly to moderately massive structure. Colour varies from yellowish-brown to brownish-red in the B horizon and brownish-red to yellowish-red in C horizon (where encountered). Light to medium clays in B horizon and sandy silty clays in C horizon.

7.3.3 Results

The results of the soil analysis are described in Table 7-5 and shown in Figure 7-5.

Table 7-5 Soil analysis results (McMahon 2019)

Description	pH	Salinity rating (EC)	Cation exchange capacity	Exchangeable Sodium Percentage (ESP)	Dispersion	Plant available phosphorus	Phosphorus buffering index	Calcium: magnesium ratio	Soil infiltration /water holding capacity
Topsoil	Moderately acidic (5.4 to 5.9)	Very low	Very low to low 3.1 – 11.6 cmol (+)/kg	Non-sodic (1.7% - 4.7%)	Low	41 to 170 mg/kg (very high)	33 to 110 (very low to low)	1.9 to 5.9	Moderate to high (50-90mm/hr)
Subsoil	Moderately acidic (4.6 to 6.4)	Very low	-	-	Low	-	-	-	Very slow (<5 mm/hr), liable to waterlogging where there is limited topsoil horizon

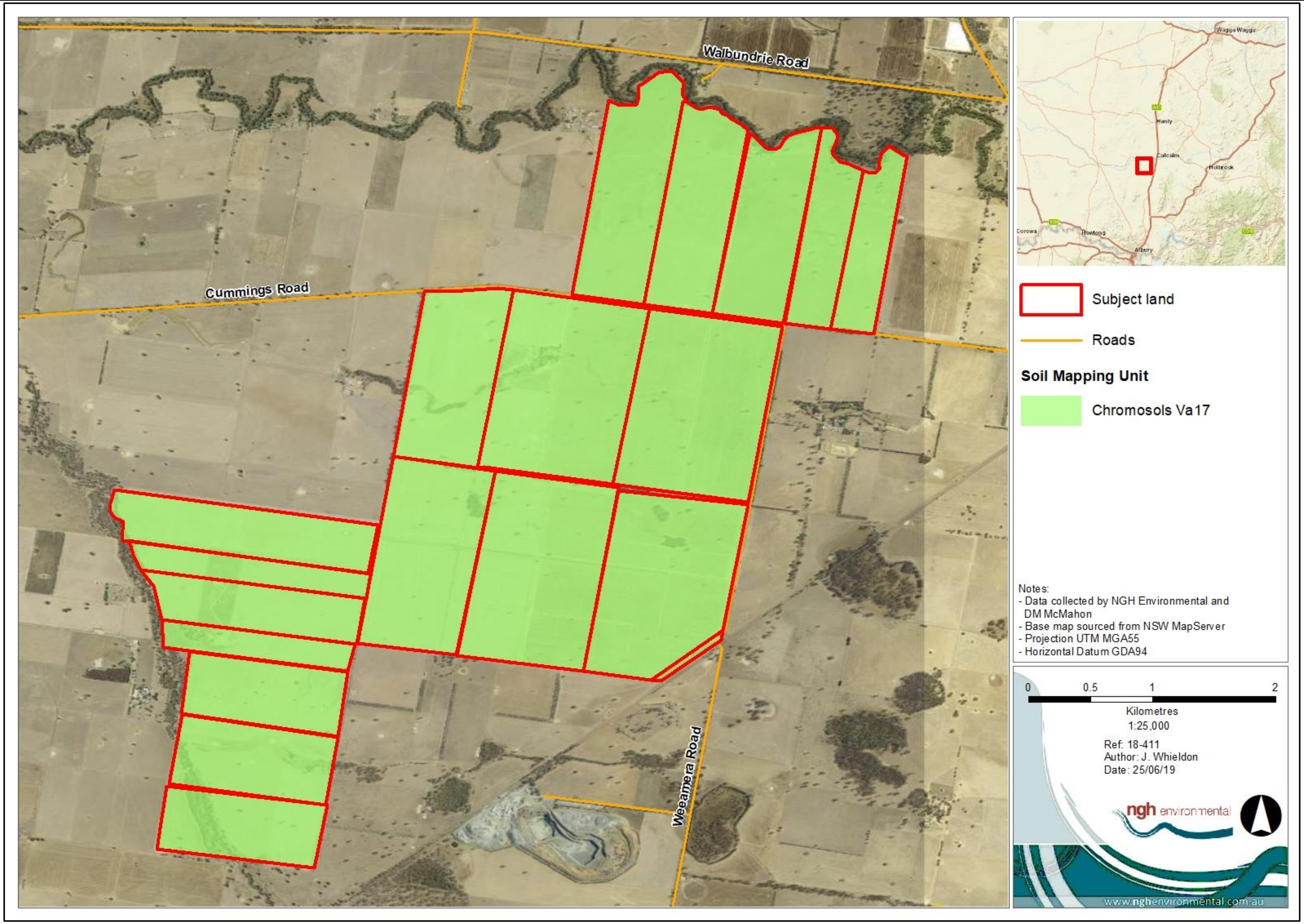

Figure 7-5 Soil mapping units of the development site.

Limitations

The identification of the landscape limitations of the site enable best practice management actions to be implemented for the construction, operation and decommissioning of the project. The potential landscape limitations are summarised below in Table 7-6.

Table 7-6 Landscape limitations (McMahon 2018)

Soil type	Location	Erosion Hazard	Salinity risk	Acid soil	Waterlogging risk	Acid sulfate soils	Infrastructure
Chromosol	Predominant across the site	Low	Low	Yes	Moderate	No	Low

Results summary

The risk of erosion on-site due to construction activities is considered to be low due to low relief and generally low salinity and sodicity of topsoils and subsoils. Excavation of soils should be limited where possible, and excavated subsoil stockpiled and contained to avoid potential dispersion. Groundcover should also be maintained to reduce erosion and sedimentation risk.

Groundcover around structures should be maintained where possible. Maintenance of groundcover will also aid in the prevention of topsoil loss from wind erosion. *Managing Urban Stormwater: Soils and Construction Volume 1* and *Volume 2A* and *2C* (Landcom 2004) should be consulted further in the development of an Erosion and Sediment Control Plan (ESCP).

Acid sulfate soils were not present on-site and are unlikely to occur due to lack of appropriate landscape characters, such as the dominance of mangroves, reeds, rushes and other marine/estuarine or swamp-tolerant vegetation, low lying areas, back swamps or scalded areas of coastal estuaries or floodplains etc.

Landscape characters such as the dominance of mangroves, reeds, rushes and other marine/estuarine or swamp-tolerant vegetation, low lying areas, back swamps or scalded areas of coastal estuaries and floodplains, and sulphurous-smelling areas following rain after prolonged dry periods (Stone *et al.* 1998) after soil disturbance were not observed. There was no evidence of a jarositic horizon or jarosite precipitates or coatings on any root channels or cracks in the soil. The results of the soil survey indicate that acid sulphate soils are not present on site.

Current operational procedures include dryland cropping and grazing. Associated water features across the investigated area include 20 dams and various open drainage channels and depressions. There are eight registered groundwater bores on site and a further four registered bores within 500 m of the site boundary. Most of the paddocks on the higher ground, excluding those on the northern side of Cummins Road, had maintained stubble at the time of the investigation. Given the majority of soils on site are classified as 'non-sodic' and are of low salinity, the risk of salt build-up in discharge areas is low. However, changing direction of surface waters and any run-on should be avoided as local changes in the water regime are likely to mobilise any salts stores, however low, in the soil. Deep rooted vegetation should be maintained where present and established where absent; ground clearing should be minimised.

7.3.4 Potential impacts

Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, and cause soil erosion and subsequent sedimentation. Earthworks are required during the construction phase for activities including the construction of access roads, compound, laydown and parking areas, pile erection, trenching and boring and fencing:

- Based on a worst-case scenario using the NexTracker system, 161,052 piles at approximately 20 cm x 20 cm will be pile driven into the ground = 0.64 ha of disturbance (0.06 % of the 1126 ha development footprint).
- 44 km of track at 5 m wide = 22 ha of disturbance (1.95 % of the 1126 ha development footprint).
- Substation pad of 4 ha of disturbance (0.36 % of the 1126 ha development footprint).
- 67 to 75 inverter transformer stations of 0.1 ha of disturbance (0.01 % of the 1126 ha development footprint).
- 50 containerised battery units of 1.9 ha disturbance (0.17 % of the 1126 ha development footprint).

Excavation of trenches for cabling would also be required up to 1000 mm deep and 1000 mm wide.

These activities would remove the existing ground cover and disturb soils, potentially decreasing their stability and increasing their susceptibility to erosion. Most of these activities require only minor earthworks or earthworks limited to a small defined area. As mentioned above, excavation of subsoils would be limited where possible, and excavated subsoils would be stockpiled and contained to avoid potential dispersion and sediment transfer.

Ground disturbance resulting from the proposal would also be limited, given no major earthworks are required due to low relief of the landscape. Groundcover would be retained as far as practicable prior to and during construction. A Ground Cover Management Plan would be prepared to ensure stability of post construction for the operation of the proposal.

Soil compaction would occur as hardstands and internal access roads are created, which would reduce soil permeability, thereby increasing run off and the potential for concentrated flows. During excavations, mixing of different soil horizons can limit plant growth due to an inadequate topsoil layer. Overall, these impacts would occur in small, discrete parts of the development site and are not considered substantial.

Given the majority of soils on site are classified as ‘non-sodic’ and are of low salinity, the risk of salt build-up in discharge areas is low. However, changing direction of surface waters and any run-on should be avoided as local changes in the water regime are likely to mobilise any salts stores, however low, in the soil. Deep rooted vegetation should be maintained where present and established where absent, and ground clearing should be minimised.

Pile driving/screwing of steel posts supporting the arrays as well as installation of fencing uses light equipment within a small and discrete footprint and is unlikely to result in substantial disturbance of soils. The areas of disturbance would be sparsely distributed, and groundcover would be retained as far as possible prior to, during and post-construction.

Overall, the risk of erosion is considered low. With limited topographic relief, runoff is considered to be readily manageable and unlikely to cause substantial erosion or lead to substantial sediment loads entering any natural waterways. Concrete spill risk is unlikely due to no overland flow paths or waterways present within the development footprint for solar panels and infrastructure.

The use of fuels and other chemicals onsite poses a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. When mobilised, such as in a rain event or flooding, the substances may spread via local drainage lines, affecting much larger areas including aquatic habitat. Overall, these risks are low and considered readily manageable.

The Greater Hume LGA is not classed as an area identified by NSW EPA (2019) as containing naturally occurring asbestos (NOA). Therefore, it is unlikely that the minor earthworks required during construction would impact on any NOA.

Operation

SOIL IMPACTS

The solar farm design creates a combination of impermeable panel area and open-air space between the arrays. Typically, this open-air space is at least 4 m. Rainfall between the panels would not alter from the current land use situation.

The primary risk of erosion during operation is from concentrated runoff from the panels. Such runoff could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts. The soils have a moderate to severe erosion risk and retaining vegetation underneath the panels would assist in reducing erosion from rainfall run-off. During high rainfall events, panels would be placed in a vertical position to decrease the concentrated surface runoff and increase the exposure of ground surface roughness.

Operational maintenance activities and vehicles would be largely confined to the formalised access tracks, minimising impacts to soils. Occasional vehicle access in between panel arrays would require traversing over undisturbed soils. This is expected to be infrequent and not likely to increase the erosion risk.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site.

Vegetation and ground habitats are also likely be affected by reduced insolation and temperature and increased humidity underneath the solar modules. Wind speeds may also be reduced.

Pasture grasses at the proposed solar array site comprise two physiological groups; cool season C3 grasses and warm season C4 grasses. C4 grasses require more sunlight to drive photosynthesis than C3 grasses. Therefore, in the grazed paddocks, the mix of existing native and exotic pasture across the site may change initially due to shading following PV array installation.

This is likely to be localised to areas subjected to permanent shading. These areas include a small section beneath the panel arrays where despite the movement of the array, light would not penetrate. A reduction in cover may lead to bare ground and susceptibility of the soil to erosion. The selection of a more suitable shade tolerant pasture species for planting would address this issue, if bare areas develop.

Soil underneath the PV modules would likely receive less rainfall than surrounding soil, although evapotranspiration losses would also be lower due to shading and reduced air movement. Lateral movement of surface and subsurface water from adjacent rain-exposed areas would likely occur. As such, the net amount of moisture available to vegetation under the PV modules should not be substantially altered.

Groundcover would be established and maintained in line with the Groundcover Management Plan.

By reducing cultivation activities less soil disturbance would be observed, as the site would no longer be tilled or harvested for pasture. On completion of the proposal, further soil disturbance or vegetation removal (exotic pastures or re-established native grasses) would not be observed until decommissioning, thus improving overall quality of the soil structure and reducing erosion potential.

7.3.5 Safeguards and mitigation measures

Activities with potential for adverse soil impacts would be managed through the development and implementation of site specific sediment control plans and spill controls, as detailed below (Table 7-7).

Table 7-7 Safeguards and mitigation measures for soil impacts

No.	Safeguards and mitigation measures	C	O	D
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction.	**Prior to and during construction**		**D**

No.	Safeguards and mitigation measures	C	O	D
SO2	A Groundcover Management Plan would be developed in consultation with a soil scientist and an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil restoration and preparation requirements. • Species selection. • Soil preparation. • Establishment techniques. • Maintenance requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements: o Live grass cover would be maintained at or above 70% at all times to protect soils, landscape function and water quality. o Any grazing stock would be removed from the site when cover falls below this level. o Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. • Identification of baseline conditions for rehabilitation following decommissioning.	**Prior to construction**		
SO3	The array would be designed to allow sufficient space between panels to establish and maintain groundcover beneath the panels and facilitate weed control.	**Design**		
SO4	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents. It would detail appropriate risk control measures that would need to be implemented to safely mitigate potential risk to soil, health and safety of firefighters and first responders in the case of a hazardous spill.	**C**	**O**	**D**
SO5	A Spill and Contamination Response Plan (SCRP) would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation). • A protocol would be developed in relation to discovering buried contaminants within the development site (e.g. pesticide containers, if any). It would include stop work, remediation and disposal requirements.	**C**	**O**	**D**
SO6	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored to original condition or re-vegetated with native plants.	**C**	**O**	**D**
SO7	Sodic soil should be treated with gypsum where required.	**C**		

No.	Safeguards and mitigation measures	C	O	D
SO8	Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation control: • Preserve and stabilise disturbed areas, drainageways and steep slopes. • Minimise the extent and duration of disturbance. • Install perimeter controls. • Employ the use of sediment control measures to prevent off- and onsite damage. Inspect and maintain sediment and erosion control measures regularly. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. • Provide access and general construction controls.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.4 HAZARDS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Hazards and Risks –

Including:

- *A preliminary risk screening in accordance with* State Environmental Planning Policy No. 33 – Hazardous and Offensive Development *and* Applying SEPP 33 *(DoP, 2011), and if the preliminary risk screening indicates the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with* Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis *(DoP, 2011) and* Multi-Level Risk Assessment *(DoP, 2011); and*
- *An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure against the* International Commission on Non-Ionising Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Field.

FIRE NSW REQUIREMENTS

In the event of a fire or hazardous material incident, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matter are recommended to be addressed:

1. *That a comprehensive ERP is developed for the site.*
2. *That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, battery energy storage systems, bushfires in the immediate vicinity) or potential hazmat incidents.*
3. *That the ERP detail the appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical hazards). Such measures 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 for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment).*
4. *Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP.*
5. *That two copies of the ERP (detailed in recommendation 1 above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.*
6. *Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC). The ELMC is a committee established by Section 28 of the* State Emergency and Rescue Management Act 1989. *LEMCs are required to be established so that emergency services organisations and other government and non-government agencies can proactively develop comprehensive inter-agency local emergency procedures for significant hazardous sites within their local government area. The contact details of members of the LEMC can be obtained from the relevant local council.*
7. *As a Condition of Consent that a Fire Safety Study (FSS) be prepared for the BESS part of the site and submitted to FRNSW for review and determination. The FSS should be developed in consultation with and to the satisfaction of FRNSW.*

DOI AGRICULTURE

Contingency and Environmental Management Plan developed –

Contingency plans should be developed to enable the operation to deal with emergency situations. Commitment to the preparation of an Emergency Management Plan that outlines procedures and responsibilities for responding to bushfire threats and possible mass mortality events which might result from extreme climatic conditions, routine or emergency animal disease outbreaks.

An environmental hazard is a thing or situation which can threaten the environment or human health. Hazards may be natural or created or result from the interaction between human activity and the natural environment. Hazards relevant to the proposal and proposal site include risks associated with hazardous goods, electromagnetic fields, fire and flooding.

7.4.1 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 Guidelines lists industries that may fall within SEPP 33, which does not include solar farms and energy storage facilities. Appendix 2 of the guidelines provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. The Applying SEPP 33 Guideline is however a guide only and final determination is made based on considerations if the development would fall under the definition of potentially hazardous in the actual SEPP 33.

RISK SCREENING

SEPP 33 screening procedure considers the quantity of dangerous goods stored or transported, the frequency of transportation movements, and in some cases the distance of the materials from the site boundary. The guidelines require goods to be classified according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

A development which exceeds the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. For quantities that fall below the stated thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage for the proposal are detailed in Table 7-8. The transportation and storage of dangerous goods would not exceed SEPP 33 thresholds. However, battery storage exceeds 30 MW and therefore triggers the requirement for a PHA (Appendix L).

Table 7-8 SEPP 33 Transport Thresholds

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
Class 2.2 Non-flammable, Non-toxic Gases					
Inert fire suppression gas	NA	NA	400 litres	Compressed in steel cylinders at each battery unit	N/A
Class 3 - Flammable Liquids (PG II)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	1 tonne	Stored in a bunded area, 20 m from boundary	No
Class 6.1 Toxic Substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1 tonne	Secure operations storage building	No
Class 9 Miscellaneous Dangerous Substances and Articles					
Li-ion batteries	N/A	>1000 cumulative >60/week	200 MWh of Li-ion batteries	Either: • Housed adjacent to 67	N/A SEPP 33 Yes, 30 MW threshold.

Hazardous Material	Storage Threshold	Transport Threshold	On-site Quantities	On-site Storage Arrangements	Exceeds Threshold?
				inverter skids OR • Installed next to the 33/330 kV substation.	

Class 2.2 Non-flammable, non-toxic gases

Inert gas would be stored in compressed form at each storage unit for fire suppression. Gases within class 2.2 are excluded from the SEPP 33 risk screening process and are not considered to be potentially hazardous with respect to off-site risk. These materials have a Workcover notification threshold of 10,000 litres.

The use of inert gases for fire suppression in enclosed spaces carries asphyxiation risk. Gases commonly used are blends of argon, nitrogen and carbon dioxide, and are used to reduce oxygen content to extinguish fires. The risk of accidental asphyxiation can be minimised by proper installation and operation, regular maintenance, provision of warning signs and information, emergency response training, fixed or personal oxygen monitoring equipment, auditable and visible alarm systems, incorporation of odour to gas, effective ventilation and air exchange, and the use of an effective purging system.

Furthermore, the BESS design considered for the project contains a structure that is a weatherproof steel enclosure rated to IP66 (NEMA 4) and provides robust protection against extreme environmental, chemical, and physical exposures. It cannot be entered by personnel, further limiting the possible interaction between maintenance personnel and internal components. Additional information on the BESS safety architecture is provided in Appendix L.

Class 9 Miscellaneous dangerous substances and articles

Class 9 represents all miscellaneous dangerous goods, which pose little threat to people or property but may pose an environmental hazard. Lithium-ion batteries (LIB) are under Class 9 Hazardous Goods, which are also not included in the SEPP 33 screening process. However, Appendix 4 of the Guidelines clarifies that the consent authority should consider whether a potential for harm exists. Currently, the consent authority requires a PHA (Appendix L) for battery storage greater than 30 MW. The major hazard offered by LIB is fire as a result of the flammability of the substances used in the battery. Class 9 materials have a Workcover notification threshold of 10,000 litres or kilograms.

LIB are classified as hazardous waste under the Commonwealth *Hazardous Waste Act (Regulation of Exports and Imports) 1989*, and are classified as Dangerous Goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The ADG Code requires dangerous goods to be carried in a secure, safe and environmentally controlled manner. The code specifies ‘special provisions’ and ‘packing instructions’ applying to the transportation of LIB. The code listing also applies to waste LIB. The National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998 (the NEPM), which sets the regulatory framework for transporting ‘controlled wastes’ between Australian states and territories, does not currently cover LIB. Waste LIB are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randal 2016).

The inclusion of the 100 MW / 200 MWh BESS for the proposal triggered a Level 1 PHA (Appendix L). The PHA assessed the inclusion of modular and containerised LIB systems. The PHA determined that the risk events from the BESS would have onsite impacts only and are assessed as medium to low risk. Further, mitigation and control measures would reduce the likelihood of these events to manageable risk levels and enable effects to be contained on-site. There are no postulated incidents that pose significant off-site risks.

OTHER RISK FACTORS

The proposal would not involve the storage or transport of incompatible materials, generation of hazardous wastes, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, or storage or processing operations involving high (or extremely low) temperatures.

POTENTIALLY OFFENSIVE INDUSTRY

The proposal would result in relatively minor vehicle and machinery exhaust emissions during the construction phase. The emissions occur outside, in a rural locality, and would be readily dispersed. The emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would be largely confined to standard working hours during the construction phase and have been demonstrated to fully comply with construction, operation and traffic criteria (section 6.3); noise emissions would not be hazardous to neighbouring residents. Exceedance of the NML would be expected to occur for nine residential receivers including R30, R31, R29, R24, R19, R33, R34, R14 and R9 during at least one of the scenarios 1, 2 and 3, as detailed in 6.3. Water pollution risks have been assessed as low (section 6.7), 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 life and assets and can adversely impact ecological values. 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, battery storage and other electrical components).

Existing environment

The development site is generally flat. The subject land comprises several large paddocks, which are currently used for agricultural activities. The paddocks have been mostly cleared of native vegetation and have been historically cultivated for cropping and grazing. Billabong Creek runs east-west along the northern boundary and Back Creek runs south-north along the western boundary. Three ephemeral drainage channels run east-west through the property. Billabong Creek holds water and/or is generally flowing all year round. Back Creek and the small unnamed drainage lines are generally dry, experiencing water flow only at times of high rainfall. Within the subject land there are 20 farm dams within the development site.

The surrounding landscape is generally flat and similarly agricultural. The development site is bound by Cummings Road and Weeamera Road. Adjacent paddocks to the Back Creek and Billabong Creek riparian vegetation are generally classified as bushfire prone land (RFS 2019).

The existing bushfire hazards within the development site include:

- Narrow strips of planted native vegetation in the north of the proposal, north of Cummings Road.
- Narrow strips of remnant woodland between property boundaries and internal Crown Lands paper road.

- Narrow strips of remnant woodland along Cummings Road and patches along Weeamera Road.
- Remnant patches of woodland and scattered paddock trees throughout the site.
- Riparian vegetation along Billabong Creek, Back Creek and the unnamed ephemeral drainage channels.

Groundcover has largely been removed or maintained at low levels due to cultivation practices and grazing.

The local bush fire danger period occurs between October and March, where conditions are most conducive to bushfire ignition; hot and dry. The harvest period of November to mid-December is considered a prime risk period due to the use of machinery (ignition source) in crops (fuel) and the generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas.

In terms of resources to fight fire, all farm dams would be retained within the development site. Additional dams are scattered on properties surrounding the proposal. Back Creek ephemeral channel borders the subject land and flows north-west for about 3 km to the confluence with Billabong Creek. There are 11 Rural Fire Services (RFS) within 30 km of the development site. The closest RFS station is about 12 km away in Walla Walla. The closest RFS Fire Control Centre is located in Albury. A minimum of two 20,000 L water storage tanks would be maintained on-site as a fire-fighting resource or as required by DPIE in consultation with RFS.

Internal access tracks would be 4 m to 8 m wide to ensure safe operational access and egress for emergency service personnel.

In terms of receivers and assets at risk from bush fire near the proposal, 17 dwellings are located within 1 km of the development site, three of these are associated landowners. 17 additional dwellings are located within 3 km of the development site. Additionally, farm sheds, watering points, silos and equipment are common in the local area. As stated above, November to mid-December represents a period of high activity when many people may be active in harvest and other farm activities onsite and in the local area.

PLANNING FOR BUSHFIRE PROTECTION GUIDELINES

According to the *Planning for Bushfire Protection (PBP) guidelines* (RFS 2018), an acceptable level of protection from bushfires is achieved for developments through a combination of strategies which:

- *control the types of development permissible in bush fire prone areas.*
- *minimise the impact of radiant heat and direct flame contact by separating the development from the bush fire hazards.*
- *minimise the vulnerability of buildings to ignition and fire spread from flames, radiation and embers.*
- *enable appropriate access and egress for the public and fire-fighters.*
- *provide adequate water supplies for bush fire suppression operations.*
- *focus on property preparedness, including emergency planning and property maintenance requirements.*
- *facilitate the maintenance of Asset Protection Zones (APZs), fire trails, access for firefighting and on-site equipment for fire suppression.*

The PBP guidelines provide six key Bush Fire Protection Measures for developments:

a) the provision of clear separation of buildings and bush fire hazards in the form of fuel reduced APZ (comprising inner and outer protection areas and defendable space).
b) construction standards and design.

c) _appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation._
d) _adequate water supply and pressure._
e) _suitable landscaping to limit fire spreading to a building._
f) _emergency management arrangements for fire protection and/or evacuation._

The _Planning for Bush Fire Protection_ (RFS 2018) 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._

Requirements of the APZ 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 m 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^{o}C.
- Maximum grades for sealed roads do not exceed 15^{o}C and not more than 10^{o}C for unsealed roads.

Standards from the guidelines to reduce hazard include:

1. **Raking or manual removal of fine fuels**: Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.
2. **Mowing or grazing of grass:** Grass needs to be kept short and, where possible, green.
3. **Removal or pruning of trees, shrubs and understorey**: The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling. Native trees and shrubs should be

retained as clumps or islands and should maintain a covering of no more than 20% of the area.

4. **Slashing and trittering**: Slashing and trittering are economical methods of fuel reduction for large APZs that have good access. However, these methods may leave large amounts of slashed fuels (grass clippings etc) which, when dry, may become a fire hazard. For slashing or trittering to be effective, the cut material must be removed or allowed to decompose well before summer starts. If clippings are removed, dispose of them in a green waste bin if available or compost on site (dumping clippings in the bush is illegal and it increases the bush fire hazard on your or your neighbour's property). Although slashing and trittering are effective in inhibiting the growth of weeds, it is preferable that weeds are completely removed. Care must be taken not to leave sharp stakes and stumps that may be a safety hazard.
5. **Ploughing and grading**: Ploughing and grading can produce effective firebreaks. However, in areas where this method is applied, frequent maintenance may be required to minimise the potential for erosion. Loose soil from ploughed or graded ground may erode in steep areas, particularly where there is high rainfall and strong winds.
6. **Burning (hazard reduction burning)**: Hazard reduction burning is a method of removing ground litter and fine fuels by fire. Hazard reduction burning of vegetation is often used by land management agencies for broad area bush fire control, or to provide a fuel reduced buffer around urban areas. Any hazard reduction burning, including pile burns, must be planned carefully and carried out with extreme caution under correct weather conditions. Otherwise there is a real danger that the fire will become out of control. More bush fires result from escaped burning off work than from any other single cause.
7. **Burning (pile burning)**: In some cases, where fuel removal is impractical due to the terrain, or where material cannot be disposed of by the normal garbage collection or composted on site, you may use pile burning to dispose of material that has been removed in creating or maintaining an APZ.

The guidelines (RFS 2018) do not specifically address solar farms. In relation to wind farms, the guidelines provide for a 10 m APZ from structures, associated buildings, infrastructure and adequate firefighting access. 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 guidelines (RFS 2018) require a bush fire 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.

7.4.3 Potential fire impacts

Construction and decommissioning

Specific activities that would be associated with the construction of the proposal that may cause or increase the risk of bushfire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol-powered tools.
- Hot works, including welding and soldering activities.

- Operating a petrol, LPG or diesel-powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the low vegetation cover as a fuel source over the development site and other factors discussed above, it is considered unlikely that construction of the solar farm would pose a significant uncontainable 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.

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 7.4.6.

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 5 m wide allowing adequate access for emergency vehicles including fire trucks.

Bush fire risks during operation of the solar farm and connection infrastructure would be manageable.

LITHIUM-ION BATTERIES

The proposal would include approximately 100 MW/ 200 MWh rated capacity units of battery storage. All energy storage systems carry risks associated with the uncontrolled release of energy. While LIB offer significant advantages over competing commercialised storage technologies in terms of energy density, efficiency and charging times, these advantages also elevate the risk of fire. The Li-ion based BSU would be designed with proper disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate the fire risk to the required level of safety. Additional system architecture and safety standards are provided in Attachment I, outlining the significant risk mitigation measures for the BESS.

Should a gas suppression system be installed, then the flooding agent will be either CO_2 or Novec 1230 or possibly water spray systems. This aspect will be covered under Detailed Design by Neoen and / or the DCC.

Operating strategies spanning proper planning, risk assessment, storage methods, maintenance protocols, and response protocols are the other important factors in mitigating Li-ion fire risks (Butler 2013).

<u>Fire risks</u>

Li-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Li-ion systems can span -10 to 50 degrees Celsius but the cells inside the containers are kept within a smaller range, 10 to

30 degrees Celsius, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come in contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350-400°C (Recharge, 2013). Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated.

There is potential for a fire event in the battery system which could initiate a bush fire in the surrounding grazed grasslands. Prevention measures to reduce the likelihood of a fire starting and effective mitigation measures to contain the fire reduces any risk.

<u>Fire causes</u>

Battery overheating may be caused by a range of factors including electrical shorting, rapid discharge, overcharging, manufacturers defect, poor design and mechanical damage (Butler 2013). LIB do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault (Department of Commerce 2017). The main failure modes for these battery systems are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum and Long 2016).

A large majority of incidents involving LIB have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge 2013).

<u>Risk and incident management</u>

Factors listed in Department of Commerce (2017) to avoid and mitigate battery fire impacts include:

- Adherence to Building codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations.
- Adherence to Manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature.
- Adequate ventilation.
- Containment of electrolyte spills.
- Adequately fire-rated walls are used to avoid or delay the spread of fire.
- Adequate access/egress for installation and maintenance.
- Adequate mechanical protection.

Battery location and spatial design are also important safety factors.

Fire containment and suppression systems need to be employed to deal with a potential battery fire event, applying the Suppression through Cooling, Isolation, and Containment (SCIC) approach (Butler 2013). However, while most current systems have automated and manually triggered fire suppression systems, the technology is new and there is limited knowledge about the usefulness of the suppression systems in the event of fire (Blum and Long 2016).

Li-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler 2013). The proposal would manage the fire risks associated with the BSU by:

- Locating the BESS in a central location within sufficient proximity to the substation and easements.
- Maintain an APZ around the BESS and each BSU.
- Locating the BSU as far as practicable from any sensitive receptors (residences) or large stands of vegetation.
- Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems.
- Installing reliable integrated fire detection and fire suppression systems (inert gas).
- Ensuring the battery containers are not vulnerable to external heat effects in the event of a bushfire.
- Designing appropriate separation and isolation between individual battery containers and between batteries and other infrastructure, including gravel surfacing around the facility.
- Compliance with all relevant guidelines and standards.
- Preparation of a specific Battery Fire Response Plan, under the general Fire Response Plan, in consultation with fire authorities, fire suppression experts, and in reference to relevant standards and guidelines.
- Facilitation (including funding) of first responder training in the management of LIB fires at the site for local brigades.

Though the specific battery manufacturer and model has not yet been determined, it is anticipated that each battery module within the implemented solution would have its temperature and voltage monitored.

The fire suppression system within the BSU would comprise the storage and release of inert gas within each battery container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas. The fire suppression system's agent will be either CO_2 or Novec 1230 or possibly water spray systems. This aspect will be covered under Detailed Design by Neoen and / or the DCC.

There would be spare aircon units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all aircon units fail, the auto shutdown of the batteries would prevent overheating.

Standards and guidelines

The installation of LIB has been identified as in need of relevant standards and Standards Australia has developed a new standard (AS/NZS 5139) for smaller scale battery installations. The Clean Energy Council provides requirements for accredited installers, the Australian Energy Storage Council has produced a Guide for Energy Storage Systems, and the WA Department of Commerce has released a guide for electrical contractors in relation to battery storage systems (Department of Commerce 2017).

BUSHFIRE AND COMPLIANCE WITH PBP GUIDELINES

Asset Protection Zones

Appendix 2 of the PBP guidelines (RFS 2018) provides minimum APZ requirements for habitable buildings in residential developments designated as bush fire prone. While the proposal is not residential, these APZ prescriptions would be applied to the solar farm infrastructure to provide defendable space and to manage heat intensities at the infrastructure interface.

The PBP guidelines (RFS 2018) 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 *Planning for Bush Fire Protection* (RFS 2018) specifies the following minimum APZ widths for residential subdivisions on flat ground in FDI 80 areas:

Grassy woodlands	11 m.
Forested wetland	6 m.

An APZ of minimum width of 10 m would be provided around the solar farm buildings, substation and BSU, and around the outside perimeter of the solar array. The 10 m APZ setback requirement would also be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm. All of the APZ would be managed as an Inner Protection Area. The APZ surrounding the proposed BSU and substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

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 ISSC 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 would incorporate a 4 m wide gravel access track. The perimeter track would comply with the requirements for fire trails in section 4.1.3 of the PBP guidelines, including:

- A minimum carriageway width of 4 m with an additional 1 m wide strip on each side of the trail clear of bushes and long grass.
- Minimum vertical clearance of 4 m.
- Capacity for passing using reversing bays and/or passing bays every 200 m suitable for fire tankers.
- Connection to the property access road and/or to the through road system at frequent intervals of 200 m or less.

The turn radius and swept path clearance on access roads would be suitable for Category 1 Tankers (Medium Rigid Vehicle).

Fire-fighting resources and preparedness

A steel or concrete water storage tank would be installed adjoining the main internal access road for firefighting and other non-potable water uses, with a 65 mm Storz outlet, a metal valve and a minimum of 40,000 litres reserved for fire-fighting purposes or as required by the DPIE in consultation with the RFS. Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity. Suitable fire extinguishers and PPE would be maintained at site buildings.

A Bush Fire Management Plan would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the solar farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through site orientation and information events and the facilitation of training in the management of lithium-ion battery fires. An Emergency Response Plan, including an Evacuation Plan, Emergency Fire Response Plan (with a specific battery fire response section) and SCRP would also be developed to enable rapid, safe and effective incident response.

7.4.4 Electric and magnetic fields

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs). While a low risk to the public, in terms of the levels produced by the proposal, it is an issue that is often of concern to the public, as evidenced by solar farm feedback collected by NGH over the last several years.

About EMFs

EMFs consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO, 2012).

Electric fields are produced by voltage. Magnetic fields are produced by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances while operational (WHO 2007). Electric and magnetic field strengths reduce rapidly with distance from the source and, while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50 Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

Research into photovoltaic solar arrays in California by Chang and Jennings (1994) indicated that magnetic fields (the EMF type of greatest public concern) were significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO n.d.). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF electric fields at the low levels generally encountered by the public (WHO 2007), such as those that would be produced by electricity generation at the proposed solar farm and along the transmission line.

Whether exposure to ELF magnetic fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA 2015) advises that 'the scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

Australia does not currently have a standard regulating exposure to ELF electric or magnetic fields. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that would provide protection against known adverse health effects.

To prevent health-relevant interactions with ELF fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached. The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions would also be met (in the body). These are not the actual limits, they are simply guidance figures for when it is necessary to investigate the basic restriction (ICNIRP 2010). Reference levels for occupational and general public exposure are shown in Table 7-9.

Table 7-9 ICNIRP reference levels for electric and magnetic fields. Values are for 50 Hz

Exposure characteristics	Electric fields	Magnetic fields
Occupational		
	ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
	field actually required: 24.2 kV/m	field actually required: 3.03 mT
General public		
	ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 µT
	field actually required: 9.9 kV/m	field actually required: 606 µT

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

1. Solar Panels and inverters.
2. Underground medium voltage cables.
3. Solar substation.
4. Battery storage.

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

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal.

The substation is classified as an intermediate substation (rated maximum capacity of 330 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. 2017). Works undertaken to facilitate the connection of the transmission line would require mitigation measures to ensure reduced exposure.

7.4.5 Potential EMF impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the project. The maximum magnetic field of the proposed transmission line is well under the 200 µT and 1000 µT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing high voltage 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 are therefore unlikely as a result of the proposal.

7.4.6 Safeguards and mitigation measures

ICNIRP sets out a number of protective measures to reduce personal harm from EMFs if the basic restrictions are expected to be exceeded. These include engineering design, administrative controls and personal protective clothing. The works undertaken for the proposed solar farm are not expected to exceed the basic restriction levels. The following safeguard and mitigation measures would be implemented to reduce any further risks associated with EMF exposure (Table 7-10).

Table 7-10 Safeguards and mitigation measures for health and safety

No.	Safeguards and mitigation measures	C	O	D
HA1	A comprehensive ERP would be developed for the site and address: • The foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, battery energy storage systems, bushfires in the immediate vicinity) or potential hazmat incidents. • The appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	hazards). 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 for shutting down and isolating the photovoltaic system and BESS (either in its entirety or partially, as determined by risk assessment). • Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. • That two copies of the ERP be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.			
HA2	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**
HA3	The design, storage, maintenance and transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	**C**	**O**	**D**
HA4	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA5	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA6	Design of electrical infrastructure to minimise EMFs through the solar array (underground).	**C**		
HA7	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of Planning for Bush Fire Protection 2006: ○ Identifying asset protection zones. ○ Providing adequate egress/access to the site. ○ Emergency evacuation measures. Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.	**C**	**O**	**D**
HA8	A comprehensive Emergency Fire Response Plan would be developed and implemented during construction, operation and decommissioning, and include but not be limited to: • Address foreseeable on-site and off-site fire events. • Detail 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.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.			

C: Construction; O: Operation; D: Decommissioning

7.5 RESOURCE USE AND WASTE GENERATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

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.

GREATER HUME SHIRE COUNCIL

The Council wishes to make the following comments for inclusion within the forthcoming EIS:

Detailed information concerning the proposed recycling of generated packaging waste.

7.5.1 Existing environment

Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar farm include those listed in Table 3-1.

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 54 kL / year of potable water and around 1 ML of non-potable water.

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. The proposal's resource management options would be considered against a hierarchy of the following order:

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

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

CONSTRUCTION

Solid waste is one of the major pollutants caused by construction. 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.

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. Materials would be sorted and packaged for removal from site for recycling or reuse. Much of the solar PV module would be recyclable (circa 90% of materials).
- Batteries would be removed and returned to the original supplier for 2nd-life applications or recycling
- Metals from posts, cabling, fencing (some fencing may be retained if it is requested by the landowners)
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Solar panels are manufactured using few components; predominantly aluminium, glass and silicon, and over 90% of a panel's weight can be recycled. These materials can be separated and captured, for reuse in the manufacture of other products.

Neoen is committed to its Project Custodian responsibilities across the life of the asset and will ideally do so with a local company, such as Reclaim PV Recycling. Companies such as Reclaim PV offer partnership solutions for solar waste management / resource recovery. The Proponent's procurement initiatives will include reverse-logistics and recycling of PV modules, inverters and batteries.

Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

7.5.2 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 6.7.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. The proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. The majority of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

Operation

LIFECYCLE ANALYSIS

Lifecycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total life cycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner 2000).

A lifecycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 25 to 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. 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 7-11.

Table 7-11 Safeguards and mitigation measures for resource use and waste generation

No.	Safeguards and mitigation measures	C	O	D
WM1	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sewage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.6 CUMULATIVE IMPACTS

7.6.1 Existing environment

Cumulative impacts relate to the combined effect of similar or different impacts on a particular value or receiver and may occur concurrently or sequentially. For these purposes, cumulative impacts are associated with other known or foreseeable developments occurring in proximity to the proposal. The incremental effects of the proposal on existing background conditions in the study area have been taken into account in the preceding assessment sections.

The proposed Culcairn Solar Farm will contribute to overall infrastructure development in the region.

A review of the State Significant Development register for the Greater Hume LGA and surrounding LGAs of Albury City, Federation, Lockhart, Wagga Wagga and Snowy Valleys (bordering LGAs) was conducted on 24 July 2019. Four major solar farms developments have been applied for within the Greater Hume LGA including Jindera, two in Culcairn, Glenellen and Walla Walla (Figure 7-6). One of the Culcairn Solar Farm applications has been withdrawn. Solar farms registered in surrounding LGAs include Mulwala Solar Farm, Gregadoo Solar Farm and Bomen Solar Farm. A number of other State Significant Developments have been applied for within the surrounding LGAs.

Major projects listed on the Major Projects Register within the Greater Hume LGA include:

- Glenellen Solar Farm – SEARs Issued.
- Jindera Solar Farm – SEARs Issued.
- Walla Walla Solar Farm – SEARs Issued.
- Culcairn Solar Farm (#1) – SEARs Issued.
- Rockley Falls Quarry (Modification 7 – 24-hour Concrete Production) – Determination.
- Rockley Falls Quarry (Modification 6 – Extended operations) – Determination.
- Hume Highway Duplication (Woomargama Bypass (modification 1) – Determination.
- Rockley Falls Quarry (Modification 5 – Wet Batch Plant and Operating Hours) – Determination.
- Rockley Falls Quarry (Modification 3 – Dry-Mix Batch Plant) – Determination.
- Rockley Falls Quarry (Modification 4 – Vegetation Offset Areas) – Determination.
- Hume Highway Duplication (Holbrook Bypass) – Determination.
- Hume Highway Duplication (Woomargama Bypass) – Determination.
- Hume Highway Duplication (Tarcutta Bypass) – Determination.
- Rockley Falls Quarry Project – Determination.
- Hume Highway Duplication (Woomargama to Mullengandra Modification 1) – Determination.
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 3) – Determination.
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 2) Determination.
- Hume Highway Duplication (Sturt Highway to Tarcutta Modification 1) Determination.
- Hume Highway Duplication (Kyeamba Hill Modification 1) – Determination.
- Hume Highway Duplication (Yarra Yarra to Holbrook Modification 1) – Determination.
- Hume Highway Duplication (Yarra Yarra to Holbrook) – Determination.
- Hume Highway Duplication (Woomargama to Mullengandra) – Determination.
- Hume Highway Duplication (Concept Plan) – Determination.
- Hume Highway Duplication (Sturt Highway to Tarcutta) – Determination.
- Hume Highway Duplication (Kyeamba Hill) – Determination.

- Hume Highway Duplication (Little Billabong) – Determination.
- Hume Highway Duplication (Tarcutta Bypass Modification 1 Ladysmith Road Quarry) – Withdrawn.
- Culcairn Solar Farm (#2) – Withdrawn.

Cumulative impacts may have a minor impact to SSD proposals occurring within the LGAs. Mechanisms to consult with local industry are however, included in section 5 and Appendix C.4 and would assist to manage cumulative impacts should additional developments become relevant to the proposal.

During construction and operation, key cumulative impacts may include additional stress on the grid, community complaints such as visual amenity impacts, stress on local business for supply and demand (in particular staff accommodation), noise impacts, air quality, waste management, traffic etc.

7.6.2 Potential impacts

Potential cumulative impacts with the proposed Walla Walla Solar Farm have been assessed for visual impact, noise impact and traffic impact. These have been addressed in the relevant sections, section 6.2, section 6.3 and section 6.6 respectively.

Potential cumulative impacts in the Greater Hume Shire are primarily associated with the following and addressed below:

- Biodiversity impacts.
- Visual and landscape character impacts.
- Noise impacts
- Traffic impacts.
- Pressure on local facilities, goods and services.
- Local agricultural impacts.

Biodiversity impacts

The clearing of native vegetation, which is a key threatening process at both the State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 % of native vegetation in NSW has been removed since European settlement (NSW Scientific Committee Key Threatening Process Determination) 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 via the BCC and offsetting of biodiversity impacts considered. However, the overall proposal has been designed to avoid and minimise impacts to biodiversity.

Visual and landscape character impacts

The visibility of the facility (the operation view) may generate a cumulative impact with the existing substation and transmission lines. The proposal requires security fencing and steel dominated infrastructure. The mitigation measures recommended in this report will act to reduce the cumulative impacts. Screen planting would be undertaken in key locations on-site, outside the perimeter fence, to minimise views of infrastructure.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure within the low relief landscape.

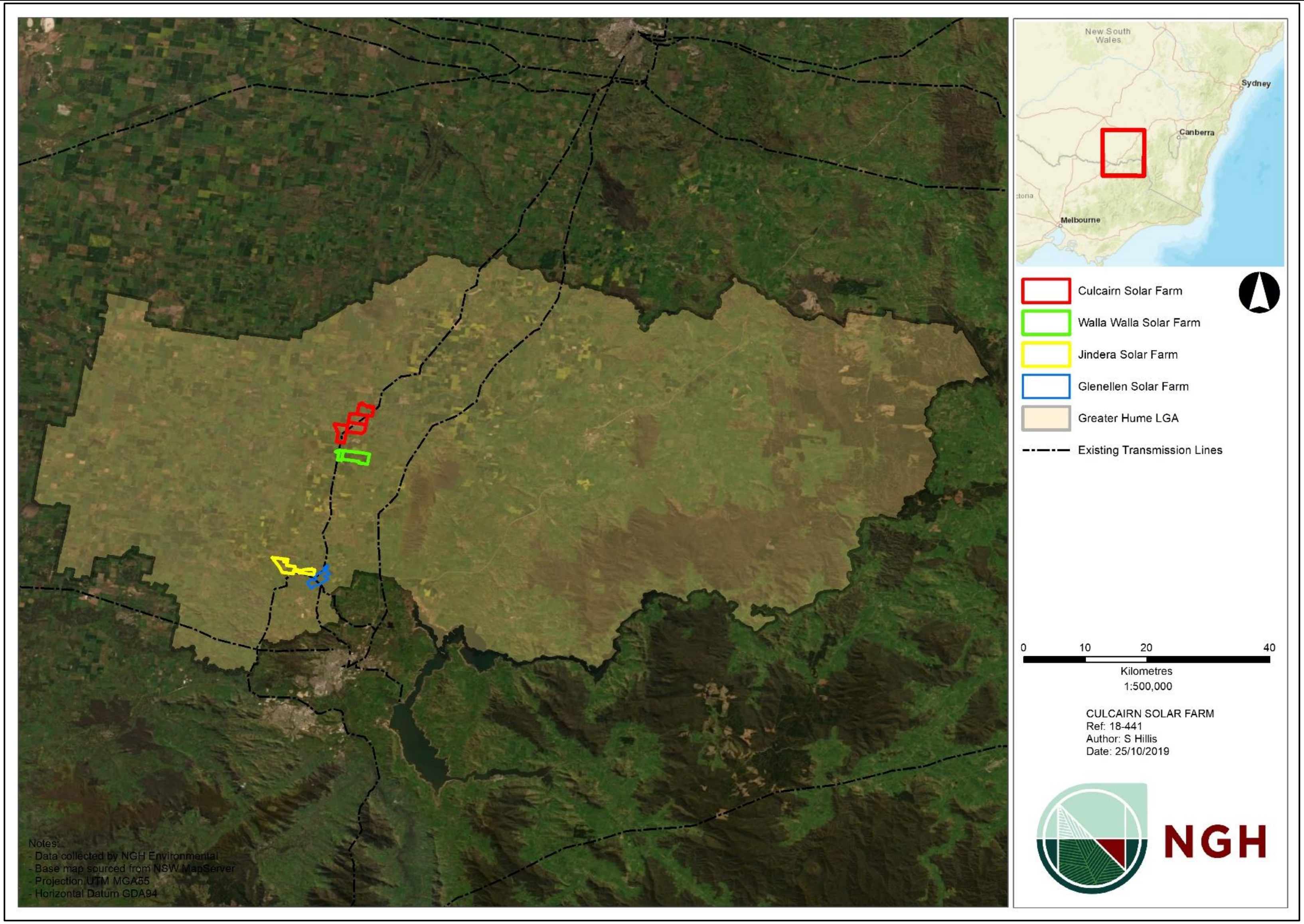

Figure 7-6 Four proposed solar farm major projects in the Greater Hume Shire.

Noise impacts

Noise impacts through the use of plant, machinery and vehicles would be heightened if the construction of other developments is undertaken concurrently.

However, the majority of residential and other noise sensitive receivers are a considerable distance from the proposal area. The operational noise impacts from the proposal are considerably lower than the NMLs, and construction noise from the proposal is considerably lower than noise management levels (refer section 6.3). There is unlikely to be any exceedance of the NMLs at common sensitive receivers during the construction and operation of concurrent developments, such as the proposed Walla Walla Solar Farm.

Traffic impacts

Cumulative traffic impacts may occur on common construction access and freight transport routes, primarily on Benambra Road, which will also be the main transport route for the proposed Walla Walla Solar Farm. The southern section of Weeamera Road would be used in conjunction with local traffic and Boral Quarry traffic.

Benambra Road and Weeamera Road south of the Boral quarry are sealed roads designed for heavy vehicle traffic and are likely to absorb any cumulative impacts. Weeamera Road north of the Boral quarry is a local road and any impact is expected to be noticeable between the Boral Quarry and the construction access. However, any impact from increased traffic would be predominately limited to the 16 to 18 month construction period. Cumulative traffic impacts are considered unlikely or would be short term.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, only a small maintenance team using light vehicles would be required.

Pressure on local facilities, goods and services

There is potential that the possible concurrent construction of the proposal with other SSD or local development would increase pressures on local community services including accommodation. However, there is also a potential for positive cumulative economic effects from the construction of multiple developments in the area. Socio-economic benefit in relation to developments in the region will be a continuous ongoing benefit for the community with increased jobs and economic input into local business.

The proposal would not result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. Due to the number of local communities in the area, any cumulative impacts on local services are likely to be spread between communities. There is sufficient residual capacity within the existing communities. It is unlikely that there would be negative cumulative impacts to local facilities, goods and services.

Local agriculture impacts

Approximately 1317 ha of cropping and grazing land would be converted into solar farm development. The proposal would not fragment any resource lands throughout the operational period. Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing productive capacity for agricultural land use.

Continued use of this land for livestock production could be maintained. Therefore, the development of a solar farm would potentially result in the following agricultural impacts:

- Limited resource loss for the lifetime of the solar farm.
- A potential change to biosecurity risks.
- Potential increased bushfire risks.

These impacts have been assessed in detail in section 6.5 and found to be highly manageable.

The four proposed solar farms within the Greater Hume Shire have the potential to increase the cumulative impacts affecting land use change and local agriculture. The development footprint of the Culcairn Solar Farm in addition to the development footprints for the Walla Walla (605 ha), Jindera (337 ha) and Glenellen (385 ha) solar equates to approximately 2,646 ha.

The Greater Hume Shire covers an area of approximately 5,746 km^2 (~574,600 ha). Of this area, approximately 4,359 km^2 (~435,900 ha) is used for agriculture (Greater Hume Council 2018). The temporary loss of 2,646 ha of agricultural land within the Greater Hume Shire represents a small fraction (~0.61%) of the land being used for agricultural production and would result in a negligible decrease in the overall productivity of the region. A case study of a solar farm in Nyngan by Dr Turlough Guerin of the Agricultural Institute of Australia (Australia Farm Institute 2017) indicated that the project did not significantly reduce the agricultural output of the locality.

Solar farm infrastructure is typically low in height and results in minimal physical impact to the land surface. As an example, only 0.61 ha of native vegetation would be removed. The site would largely remain vegetated with approximately 40 ha of compacted gravel surfaces for compounds, substation, BESS, internal tracks and inverter hardstands. These surfaces would include internal access tracks, compounds, inverter and BESS hardstands and the substation. As a result of the low scale of development of the solar farms, the agricultural capability of the land would not be affected by the proposals. As previously mentioned, grazing could continue to be managed across the sites to maintain the height of groundcover during the operational period.

The land can be returned to agricultural use following decommissioning of the proposals. There are many benefits of resting the land for a period of time (NSW Government 2012) and include:

- Increased groundcover and diversity of groundcover with biosecurity management.
- Increase in soil moisture and nutrients.
- Increases in soil organic matter means less evaporation, less impact of raindrops, less impact of runoff and less erosion.
- Controlled stocking rates will reduce soil compaction.
- Perennial grasses can be encouraged to increase soil stability of the grassland around the panels.
- A return of soil organisms for decomposition of organic matter, nutrient cycling and improving soil structure.

Potential loss of about 0.24% of agricultural land within the region should be measured against wider government strategic goals and environmental benefits, which include:

- Strategic goals of the Commonwealth and NSW Governments for renewable energy development going forward.
- The environmental benefits of solar energy production, in particular the reduction of greenhouse gas emissions.
- The economic benefits of using an area with reliable solar resources and access to existing electricity infrastructure.
- The benefits of alternative and increased energy supply for grid stability and reliability.

Currently, between the farms there are approximately 20 full time equivalent (FTE) staff employed in agriculture at the proposal with around 16 contractors employed during harvesting and during other busy periods. During construction there would be approximately 350 FTE staff on average and 5 - 10 FTE staff for the operational period of the proposal. There would be up to 6 service contractors annually for the proposal. During construction of the proposed Walla Walla, Jindera and Glenellen solar farms there would be approximately 140 FTE staff on average and around 24 FTE staff during the operational period and similar 18 contractors.

The potential cumulative impact of the reduction in agricultural employment would be balanced by the additional employment during construction and on-going employment of staff during operation. Additional local services could be maintained during operation. For example, to maintain the solar farm area mowing/slashing services would be required. Local agricultural services could be maintained if livestock are to be retained throughout the facility.

As such, no cumulative impacts to agricultural enterprise or local agricultural land use are expected.

7.6.3 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

Construction (C), Operation, (O), Decommissioning (D)

No.	Safeguards and mitigation measures	C	O	D
VA1	Screening would be required on-site, generally in accordance with the Landscaping Plan developed in consultation with neighbouring landholders. • Barrier plantings would be and where practical, planted on specific sections of the outside of the perimeter fence to break up views of infrastructure including the fencing. • The proposed plant species to be used in the screen are native, fast growing, with spreading habitat and mixed mature heights of 2-4 m, 3-5 m and 5-10 m. Proposed plants derived from the naturally occurring vegetation community in this area. • Plants were selected in consultation with affected near neighbours and a botanist or landscape architect, and/or local Landcare groups. • The timing is recommended to be within 2 months of completion of construction so that actual views of infrastructure can be more certain. The timing of planting should also be chosen to ensure the best chance of survival. • The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.	C	O	D
VA2	Prior to the commencement of construction, a detailed Landscaping Plan will be prepared including: • Screening location. • Species type.	Design stage		

No.	Safeguards and mitigation measures	C	O	D
	• Planting density and spacing. • Method for planting. • Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method). • A program to manage, monitor and report on the effectiveness of implemented measures.			
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**		
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 and operational night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations. Lighting will comply with *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*, including: • Eliminating upward light spill, directing light downwards and directing light away from sensitive receivers. • Use of shielded light fixtures. • Using asymmetric beams. • Compile and record a complaint register.	**C**	**O**	**D**
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 07:00 to 18:00. • Saturday 08:00 to 13:00. No work on Sundays or public holidays.	**C**		
NS2	A Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented as part of the CEMP. The CNVMP would generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The CNVMP would include the following: • Acoustics-Description and Measurement of Environmental Noise-General Procedures. • Noise measurements would be consistent with the procedures documented in AS1055.1-1997 Acoustics-Description and Measurement of Environmental Noise-General Procedures. Vibration measurements would be undertaken in accordance with the procedures documented in the OEH's Assessing Vibration-a technical guideline (2006) and BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings.	**Prior to construction**		**D**

No.	Safeguards and mitigation measures	C	O	D
NS3	Operate plant in a conservative manner, which includes: • Selection of the quietest suitable machinery. • Avoidance of noisy plant working simultaneously where practical. • Turning off plant and equipment that is not being used. Utilise broadband reverse alarm in lieu of high frequency type.	C	O	D
NS4	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	C	O	D
NS4	Consult with R30, R31, R29, R24, R19, R33, R34, R14 and R09 during pre-construction to develop suitable mitigation measures.	C		
NS5	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	C	O	D
NS6	Complete a one-off noise validation monitoring assessment to quantify emissions and confirm emissions meet relevant criteria.	C	O	D
NS7	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	C		D
NS8	For receivers located within 300 m of development infrastructure during maintenance activities including grass slashing, panel cleaning or major works/repairs: • Receive a written notification letter which may consist of the details of the proposed works, anticipated noise impacts, and the time periods over which these will occur, at least two weeks prior to the commencement of works. Verification of noise and vibration levels following reasonable complaints should be undertaken within a period of 14 days from the commencement of activities.		O	
SE1	A Neoen Community Relations Plan and Local Participation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.).Protocols to respond to any complaints received.	C	O	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C	O	
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	C		D
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	C	O	D

No.	Safeguards and mitigation measures	C	O	D
LU2	Consultation would be undertaken with TransGrid regarding connection to the overhead energy transmission infrastructure.	C		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the solar farm is decommissioned.			D
LU4	A Pest and Weed Management Plan would be prepared to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Greater Hume Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	C	O	
LU5	The Proponent would consult with GSNSW in relation to biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral resources.	C		D
LU6	Construction and operations personnel would drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and disturbance to livestock.	C	O	D
LU7	Underground cabling and other works to remain in situ following decommissioning of the solar farm would be installed deeper than 500 mm to allow cultivated cropping to resume following decommissioning or removed as necessary to allow restoration of land capability to pre-existing agriculture.	C		
LU8	If possible and practical, managed sheep grazing would be used as a preferred option to control weeds and grass growth, and to maintain agricultural production at the site.		O	
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. • 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 plan would include, but not be limited to: • Prior to construction, a pre-conditioning survey of the relevant sections of the existing road network, to be undertaken in consultation with Council. • Assessment of road condition prior to construction on all local roads that would be utilised.	C		D

No.	Safeguards and mitigation measures	C	O	D
	• 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. • Community consultation regarding traffic impacts for nearby residents. • 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 to minimise dust generation through increased traffic use.Following construction, a post condition survey of the relevant sections of the existing road network, to be undertaken to ensure it is of similar condition as prior to construction.			
TT3	Obtain a Section 138 Consent from the relevant council/agency to perform works within relevant road reserves.	C		
TT4	The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards. Weeamera Road north of the Boral quarry would be widened to 6.0 metres and have a light spray seal applied. This would allow two-way movement of heavy vehicles and reduce the impacts of dust on nearby dwellings.	Design Stage		
TT6	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
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	C	O	D
WA3	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	C	O	D
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C		D

No.	Safeguards and mitigation measures	C	O	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.	Desig n		
BD1	The following plans are to be prepared and approved by the relevant authorities: • Biodiversity Management Plan. • Construction and Operational Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. The plans should include but not be limited to the relevant commitments below.	Pre-construction	Pre-operations	
BD2	Timing works to avoid critical life cycle events such as breeding or nursing: • Hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts on all hollow-dependent fauna. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur.	C		
BD3	Implement clearing protocols including pre-clearing surveys, daily surveys and staged clearing, with a trained ecologist or licensed wildlife handler present during clearing events, including: • Pre-clearing checklist. Tree clearing procedure.	C		
BD4	Relocation of habitat features (fallen timber, hollow logs) from within the development site. Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement.	Pre - constructio		
BD5	Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed: • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance.	C		
BD6	Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise. Construction Environmental Management Plan would include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C	O	D
BD7	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
BD8	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operational activities.	C		D

No.	Safeguards and mitigation measures	C	O	D
	• Construction would cease if dust observed being blown from site until control measures were implemented. All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site.			
BD9	Temporary fencing to protect significant environmental features such as riparian zones.	C		D
BD10	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Pest and Weed Management Plan.	C	O	
BD11	Staff training and site briefing to communicate environmental features to be protected and measures to be implemented: • Site induction. • Toolbox talks. • Awareness training during site inductions regarding enforcing site speed limits.Site speed limits to be enforced to minimise fauna strike.	C	O	
BD12	Preparation of a Vegetation Management Plan to regulate activity in vegetation: • Protection of native vegetation to be retained. • Best practice removal and disposal of vegetation. • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. • Weed management. • Unexpected threatened species finds. Rehabilitation of disturbed areas.	C		
BD13	Sediment barriers and spill management procedures to control the quality of water runoff released from the site into the receiving environment: • An erosion and sediment control plan would be prepared and implemented in conjunction with the final design. Spill management procedures would be implemented.	C		
BD14	Appropriate landscape plantings of local indigenous species derived from local native plant communities.	Design Stage		
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 Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	C		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	C		
AH3	If complete avoidance of any of the 26 isolated find sites, 16 artefact scatters and single cultural stone site recorded within the proposal area is not possible the surface stone artefacts and cultural stone site within the development footprint must be salvaged. The surface collection salvage of these stone artefacts and cultural stone object must occur prior to the proposed construction works commencing for the Culcairn Solar Farm. Until	C		

No.	Safeguards and mitigation measures	C	O	D
	surface collection salvage has occurred a minimum 5 m buffer must be observed around all stone artefact sites and the cultural stone site.			
AH4	The development avoids the three modified trees and five cultural tree sites. A minimum 10 m buffer should be in place around each modified tree and cultural tree site to prevent any inadvertent impacts to the canopy and root system.	C		
AH5	All artefacts recovered from the subsurface testing programme undertaken within the Culcairn Solar Farm proposal are currently in temporary care at the NGH Canberra office and must be reburied in line with Requirement 26 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales and in an appropriate location within the proposal area that will not be subject to any ground disturbance.			
AH6	All objects salvaged, including those recovered from the subsurface testing program, must have their reburial location submitted to the AHIMS database. An Aboriginal Site Impact Recording Form must be completed and submitted to AHIMS following harm for each site collected or destroyed from salvage and/or construction works.			
AH7	If the proposed development footprint is changed and the areas of PAD along Back Creek and Billabong Creek will be impacted, a limited subsurface testing program must be conducted at the PADs not subject to the subsurface testing program undertaken during the current assessment. Excavated material may need to be analysed off site and this is most likely to be undertaken in NGH offices, where the material will be analysed and then subsequently returned to site for reburial.			
AH8	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the Code of practice for Archaeological Investigation of Aboriginal Objects in New South Wales. A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database.	C		
AH9	A minimum 5m buffer should be observed around all stone artefact sites that cannot be avoided, including those outside the development footprint.	C		
AH10	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		
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	C	O	D
AQ2	Protocols to guide vehicle and construction equipment use to minimise emissions would be included in construction and operational environmental management plans. This would include, but not be limited to, Australian standards and POEO Act requirements.	C	O	D
AQ3	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
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	C		
AQ5	Fires and material burning are prohibited on the development site.	C	O	D

No.	Safeguards and mitigation measures	C	O	D
HH1	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**
SO1	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure there are appropriate erosion and sediment control measures in place to prevent erosion and sedimentation occurring within the stormwater channel during concentrated flows. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • During excavation activities, monitor for increases in salinity, reduce water inputs and remediate the site with salt tolerant vegetation. • Stockpile topsoil appropriately to minimise weed infestation, maintain soil organic matter, and maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. Areas of disturbed soil would be rehabilitated promptly and progressively during construction.	**Prior to and during construction**		**D**
SO2	A Groundcover Management Plan would be developed in consultation with a soil scientist and an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil restoration and preparation requirements. • Species selection. • Soil preparation. • Establishment techniques. • Maintenance requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements: ○ Live grass cover would be maintained at or above 70% at all times to protect soils, landscape function and water quality. ○ Any grazing stock would be removed from the site when cover falls below this level.	**Prior to construction**		

No.	Safeguards and mitigation measures	C	O	D
	○ Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. Identification of baseline conditions for rehabilitation following decommissioning.			
SO3	The array would be designed to allow sufficient space between panels to establish and maintain groundcover beneath the panels and facilitate weed control.	**Design**		
SO4	A comprehensive Emergency Response Plan (ERP) would be developed for the site and specifically address foreseeable on-site and off-site emergency incidents. It would detail appropriate risk control measures that would need to be implemented to safely mitigate potential risk to soil, health and safety of firefighters and first responders in the case of a hazardous spill.	**C**	**O**	**D**
SO5	A Spill and Contamination Response Plan (SCRP) would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation). A protocol would be developed in relation to discovering buried contaminants within the development site (e.g. pesticide containers, if any). It would include stop work, remediation and disposal requirements.	**C**	**O**	**D**
SO6	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored to original condition or re-vegetated with native plants.	**C**	**O**	**D**
SO7	Sodic soil should be treated with gypsum where required.	**C**		
SO8	Best Management Practices (BMPs) should be employed where applicable to reduce the risk of erosion and sedimentation control: • Preserve and stabilise disturbed areas, drainageways and steep slopes. • Minimise the extent and duration of disturbance. • Install perimeter controls. • Employ the use of sediment control measures to prevent off- and onsite damage. Inspect and maintain sediment and erosion control measures regularly. • Control stormwater flows onto, through and from the site in stable drainage structures. Protect inlets, storm drain outlets and culverts. Provide access and general construction controls.	**C**	**O**	**D**
HA1	A comprehensive ERP would be developed for the site and address: • The foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, battery energy storage systems, bushfires in the immediate vicinity) or potential hazmat incidents. • The appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical hazards). Such measures will include the level of	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	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 for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment). • Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. That two copies of the ERP be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.			
HA2	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**
HA3	The design, storage, maintenance and transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	**C**	**O**	**D**
HA4	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
HA5	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
HA6	Design of electrical infrastructure to minimise EMFs through the solar array (underground).	**C**		
HA7	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of Planning for Bush Fire Protection 2006: ○ Identifying asset protection zones. ○ Providing adequate egress/access to the site. ○ Emergency evacuation measures. • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.	**C**	**O**	**D**
HA8	A comprehensive Emergency Fire Response Plan would be developed and implemented during construction, operation and decommissioning, and include but not be limited to: • Address foreseeable on-site and off-site fire events. • Details 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. Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
WM1	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sewage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**

9 CONCLUSION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

In particular, the EIS must include:

- *The reasons why the development should be approved having regard to:*
  - *Relevant matters for consideration under the* Environmental Planning and Assessment Act 1979*, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development;*
  - *The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and*
  - *Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.*

9.1.1 Need and benefits

The proposed Culcairn Solar Farm would involve the construction and operation of a proposed 350 MW AC / 402.5 MW DC PV solar farm at Culcairn, south eastern NSW. The 1317 ha development site is located on freehold rural land, approximately 4 km south-west of Culcairn in the Greater Hume LGA. The development footprint of the proposal is approximately 1126 ha.

The proposal would contribute to the NSW Renewable Energy Action Plan (NSW Government 2013), which supports the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013a). The proposal would also further the three goals of the Action Plan:

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

The proposal would also contribute to the Australian Government's objective to achieve an additional 33 GW of energy from renewable sources by 2020 under the LRET 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 500 employees at the peak of construction (8 - 12 months) and five to 10 operational staff for the life of the project. Maintenance contracts for panel cleaning, fence repair, road grading, etc. would also be required and would likely be met by local contractors.
- Direct business volume benefits for local services, materials, and contracting.

It is estimated that the solar farm would require around $12 000 per MW DC of panels per year of operational spending to maintain, or about $4.8 million per year. This would mostly be spent on local wages, local contractors, and material. Over the life of the project, this could provide around $144 million of additional economic activity in the local community.

9.1.2 Environmental assessment and mitigation of impacts

NGH, with input from specialists as required, has prepared this EIS on behalf of the Proponent, Neoen Australia Pty Ltd. This EIS has assessed the broader proposal and development site where infrastructure may be located. Overall, the proposed solar farm would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered compatible with existing land uses and highly reversible upon decommissioning; returning the site to its previous agricultural capacity is a commitment of the project.

The key environmental risks have been investigated through detailed specialist investigations. These included:

- Visual impact - the VIA concluded that the operational solar farm would have a very low visual impact on the majority of people living in or travelling through the landscape surrounding the proposed solar farm. Specific native vegetation plantings would be located in consultation with affected landowners to soften views of infrastructure. Screening would also be used to break up views at intersections of public roads.
- Noise impacts – the noise assessment concluded that generally noise impacts during construction and operation would be within the accepted noise criteria. Exceedances would occur during standard working hours and would be temporary and intermittent during construction. During operation, exceedances would occur during standard working hours and would be temporary and intermittent as vehicles move around the site. Mitigation measures would further manage noise impacts to affected receivers.
- Socio-economic and community – The Community Relations Plan details the extensive consultation that the Proponent has conducted since 2018 with near neighbours, the wider community and local businesses. The document outlines the avenues that have been provided to engage with community and the methods the Proponent has used to respond to feedback and concerns. The document also details the responses and strategies to address the concerns of community members.
- Land use - While the agricultural output from the existing farmland would be reduced by the operation of the proposed solar farm this would form a very small reduction in the agricultural output of the Culcairn area. The proposal is reversible and would not result in the permanent loss of agricultural land.
- Traffic, transport and road safety – the traffic assessment concluded that the existing road network would be able to accommodate additional traffic during construction and operation. Impacts would be mitigated through widening and improvement of Weeamera Road between Boral Quarry and the construction access, and consultation with neighbouring residents and industries to notify of the periods of large deliveries.
- Water use and water quality – Water would be sourced from a Greater Hume Shire Council standpipe and/or the nearby Boral Quarry during construction and operation. During construction, water would be used primarily for dust suppression. During operation, quantities of water required would be minimal and used primarily for staff amenities, and panel washing if required. Minimal impacts to water quality are expected with the correct use of erosion controls during construction and the maintenance of groundcover during operation. The flood assessment concluded that impacts of solar farm infrastructure on flood impacts would be minor and includes reduced peak flows and increases in flood height of 5 cm to 13 cm for the probable maximum flood.
- Biodiversity impacts – the BDAR concluded that no significant impacts to threatened species and ecological communities would result from development of the proposal. No referrals under the EPBC or BC Act are considered to be required. An offset requirement has been calculated for the project and would ensure an in-perpetuity commitment to account for the small area of native vegetation that the proposal cannot avoid.

- Aboriginal heritage impacts – the Aboriginal Heritage survey and assessment found that no operational impact to Aboriginal cultural heritage would occur from the proposal. Minor impacts will be seen from construction. A mitigation strategy has been developed for each site recorded and forms a commitment of the project, which includes salvage and avoidance.

Management measures have been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. Key management strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks. The management measures account for uncertainty and are precautionary where required. The impacts and risks identified are considered highly manageable with the effective implementation of the measures stipulated in this EIS.

9.1.3 Ability to be approved

- The development site is highly appropriate to solar energy generation.
- The proposal is consistent with local, State and Federal planning provisions.
- The development site has been selected to avoid or minimise environmental impacts where possible through an iterative constraints investigation/design process.
- The development footprint has been designed to avoid or minimise impacts to vegetation, habitat and aboriginal artefacts.
- Visual impacts have been reduced through proposed vegetative screening.
- Land use conflicts and hazard risks are considered manageable and acceptable.

The residual impacts are considered justifiable and acceptable in the context of the proposal’s benefits.

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APPENDIX A SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

APPENDIX B PROPOSAL MAPS AND DRAWINGS

APPENDIX C CONSULTATION

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