Metz Solar Farm

Environmental Impact Statement

Prepared for
Infinergy Pacific Ltd

March 2017

DOCUMENT TRACKING

Item	Detail
Project Name	Metz Solar Farm Environmental Impact Statement
Project Number	16ARM – 5300
Project Manager	Robert Cawley 02 8081 2689 92 Taylor Street Armidale, NSW 2350
Prepared by	Linden Burch and Robert Cawley
Reviewed by	Dr Paul Frazier
Approved by	Dr Paul Frazier
Status	FINAL
Version Number	1a
Last saved on	17 March 2017
Cover photos	Selected images of Bayley Park, 28 July 2016 (Robert Cawley)

This report should be cited as 'Eco Logical Australia February 2016. *Metz solar farm Environmental Impact Statement*. Prepared for Infinergy Pacific Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from the following companies: Infinergy Pacific Ltd; Nextracker Inc; RCR Ltd and Coronium Ltd.

Template 24/07/2015

Submission of an Environmental Impact Statement (EIS)

State Significant Development: Section 78A (8A) Environmental Planning and Assessment Act 1979.

EIS Prepared by:

Name:	Robert Cawley	
Qualifications:	BSc Hons (Ecology)	
Address:	92 Taylor Street, Armidale NSW 2350	
In Respect of:	Eco Logical Australia Pty Ltd	
Development Application:	SSD 7931	
Applicant Name:	Infinergy Pacific Ltd	
Applicant address:	44 Quayle St, Sandy Bay, Tasmania 7005	
Lot No. DP No. and Address of Land to be Developed:	"Bayley Park", Grafton Road, Metz	
	Lot 18 DP 755830	Lot 105 DP 755830
	Lot 61 DP 755830	Lot 107 DP 755830
	Lot 77 DP 755830	Lot 108 DP 755830
	Lot 80 DP 755830	Lot 112 DP 755830
	Lot 95 DP 755830	Lot 124 DP 755830

Environmental Impact Statement

This Environmental Impact Statement (EIS) assesses the potential environmental impacts associated with the proposed Metz Solar Farm accordance with the Secretary's Environmental Assessment Requirements, issued to the proponent on 28 September 2016.

I certify that I have overseen the preparation of the contents of this Statement and to the best of my knowledge:

- It has been prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*;
- It contains all available information that is relevant to the environmental assessment of the development to which the statement relates; and
- The information contained in this Statement is neither false nor misleading.

Signature:	
Name:	Robert Cawley
Date:	17 March 2017

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Abbreviations

Abbreviation	Description
µT	Microtesla
AC	Alternating Current
ACHA	Aboriginal Cultural Heritage Assessment
ADC	Armidale Dumaresq Council
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ANL	Acceptable Noise Levels
ANZECC	Australian and New Zealand Environment Conservation Council
ARC	Armidale Regional Council
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Projection and Nuclear Safety Agency
BAR	Biodiversity Assessment Report
BBCC	BioBanking Credit Calculator
BMP	Biodiversity Management Plan
BOM	Bureau of Meteorology
BOS	Biodiversity Offset Strategy
CCP	Community Consultation Plan
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CNVMP	Construction Noise and Vibration Management Plan
DC	Direct Current
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEM	Digital Elevation Model
DotEE	Department of the Environment and Energy
DMP	Decommissioning Management Plan
DPE	Department of Planning and Environment
EEC	Endangered Ecological Community

Abbreviation	Description
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
ELF	Extremely Low Frequency
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPC	Engineering Procurement Construction
EPL	Environment Protection Licence
ERP	Emergency Response Plan
ESD	Ecologically Sustainable Development
FBA	Framework for Biodiversity Assessment
FM Act	*Fisheries Management Act 1994*
GDE	Groundwater Dependent Ecosystems
GWh	Gigawatt hours
ICNG	DEEC Interim Construction Noise Guideline
ISEPP	*Infrastructure State Environmental Planning Policy 2007*
KFH	Key Fish Habitat
kV	Kilovolt
LCOE	Levelised Cost of Electricity
LEP	Local Environment Plan
LGA	Local Government Area
MW	Megawatt
NES	National Environmental Significance
NHMRC	National Health and Medical Research Council
NOW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
NSR	Noise Sensitive Receiver
NV Act	*Native Vegetation Act 2003*
OEMP	Operation Environmental Management Plan
OEH	Office of Environment and Heritage

Abbreviation	Description
PAC	Planning and Assessment Commission
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997*
PPA	Power Purchase Agreement
PSNL	Project Specific Noise Levels
PV	Photovoltaic
RA	Remnant Archaeology Pty Ltd
RAP	Registered Aboriginal Parties
RBL	Rating Background Level
RET	Renewable Energy Target
RMS	Roads and Maritime Services
SEARs	Secretary Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SRP	Spill Response Plan
SSD	State Significant Development
TEC	Threatened Ecological Community
The Hub	Renewable Energy Hub
TSC Act	*Threatened Species Conservation Act 1995*
TTM	TTM Consulting Pty Ltd
WM Act	*Water Management Act*
ZTV	Zone of Theoretical Visibility

Executive Summary

Introduction

This Environmental Impact Statement has been prepared on behalf of Infinergy Pacific to support a Development Application to build and operate a utility-scale photovoltaic solar farm at Metz, approximately 18 km east of Armidale, NSW.

Infinergy Pacific is an independent company with a strong focus on solar development in Australia. The development team has over 15 years' experience developing, owning, operating and manufacturing renewable technologies and possesses all the in-house expertise along with the experience needed to design, develop, build and operate renewable energy schemes.

The proposal

Fully constructed, the Proposed Development would have an electricity generation capacity of approximately 100 megawatts (MW), producing enough energy (233 GWh) to power the equivalent of 40,000 average NSW households each year, over a 30 year lifespan. In addition, the electricity generated by the Proposed Development would result in significant carbon savings due to the electricity displaced from the current NSW generation supply, which is heavily reliant on coal powered generation. Based on current NSW emission figures of 0.87 kg of CO_2-equivilent per kWh, up to 200,000 tonnes of CO_2 would be displaced by the Proposed Development annually.

The Proposed Development would include the following elements:

- Solar arrays: approximately 400,000 solar panels supported by a mounting system installed on approximately 50,000 piles driven or screwed into the ground;
- The panels would be installed on either:
    - A fixed tilt system (oriented north to south); or
    - A single axis system (orientated west to east);
- Up to 50 central inverters located throughout the development;
- Above and/or below ground onsite cabling and electrical connections;
- Onsite access tracks;
- Substation (connects the Proposed Development to the national electricity grid);
- Support buildings alongside the substation including communications equipment and tower;
- Perimeter fence (security fence approximately 2.5 m high);
- Vegetation buffers for visual screening; and
- Firebreaks.

In addition to the key components outlined above, there would be a temporary construction compound required to facilitate the construction and decommissioning phases of the Proposed Development.

The final scale of the Proposed Development would be optimised within the Site during post-consent studies based on a combination of the most suitable technology at the time of procurement, along with detailed geotechnical and grid connection studies. For this EIS the applicant has assumed a 100 MW design based on environmental constraints identified and the estimated capacity of the transmission line.

It is anticipated that the Proposed Development would take between 9 and 12 months to construct and would be operational for approximately 28 years. Following the operational period, all above ground infrastructure would be removed from the Site which would take approximately 6 months. As such, planning consent for the Proposed Development is sought for 30 years.

Statutory position

The Proposed Development has a capital investment value estimated to be approximately $130 million, and is classified as State Significant Development under Clause 20 of Schedule 1 of the *State Environmental Planning Policy (Infrastructure) 2007*.

The Proposed Development is sited on land zoned as RU1 Primary Production under the *Armidale Dumaresq Local Environmental Plan 2012*. Pursuant to clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007*, development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone).

The Minister for Planning is the consent authority for State Significant Development applications. This Environmental Impact Statement has been prepared in accordance with the requirements of Division 4.1 of the *Environmental Planning & Assessment Act 1979*, Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and the Secretary's Environmental Assessment Requirements, dated 28th September 2016.

Consultation

Infinergy has carried out extensive consultation with the local community, stakeholders from the wider area and relevant Government Agencies in order to understand and respond to community concerns during the design and assessment process leading to this Development Application.

Activities that have taken place are listed below:

- Identification and consultation (ongoing) with neighbouring residents;
- Consultation with the Aboriginal community through the preparation of a Cultural Heritage Assessment;
- Consultation with local organisations;
- Local Government consultation;
- State Government consultation;
- An onsite visit with statutory consultees;
- Public Information Sessions at Hillgrove and in Armidale;
- Advertisements in the local media;
- Establishment of a webpage (www.metzsolarfarm.com.au);
- Provision of an email address through which stakeholders can contact the project team; and
- Media coverage at the local and regional scale.

Consultation activities remain ongoing at the time of preparing this Environmental Impact Statement.

Environmental Assessment

In developing the Proposed Development, the following design hierarchy has been adopted in order to manage potential environmental impacts:

- Avoid – in the first instance, all efforts will be made to avoid potential environmental impacts;
- Minimise – where potential impacts cannot be avoided, design principles shall seek to minimise environmental impacts, as far as feasibly possible;
- Mitigate – mitigation strategies will be implemented to manage the extent and severity of remaining environmental impacts; and
- Offset – environmental offsets shall be used only as applicable, following all efforts to first avoid, minimise and mitigate environmental impacts.

The Environmental Impact Assessment (EIA) has been undertaken to assess potential environmental impacts for a range of specific issues identified through the consultation process and site investigations. All potential environmental constraints associated with the Site have been identified and are responded to within the Environmental Impact Statement.

Land use and soils

The Site and surrounding land is zoned RU1 Primary Production and is located within an undulating landscape, where elevation ranges between 990 - 1090 m Australian Height Datum. The Site has been historically cleared and grazed for sheep and cattle production and is typical of farmland in the region. A considerable portion of the Site has been cultivated for improved pasture and other food crops. Surrounding land uses include:

- Agriculture;
- Transportation – Waterfall Way is a major road connecting Armidale to the coast;
- Mineral exploration and mining; and
- Residential – the village of Hillgrove is located approximately 4.5 km south.

Hillgrove Mines Pty Ltd holds three Exploration Licences (EL6419, EL5937 and EL5997) that extend over the Site. Infinergy have consulted with Hillgrove Mines and the Department of Industry and it has been established that the Proposed Development can coexist with the Exploration Licences held over the Site.

The Proposed Development would have a life span of 30 years and would not involve permanent changes to the landscape. The scale of the Proposed Development would not compromise or significantly diminish the availability of land for primary production purposes within the Armidale Regional Local Government Area. Furthermore, the Proposed Development would not reduce or impact any Biophysical Strategic Agricultural Land, or compromise the capacity for immediate neighbours to conduct existing or proposed primary production in the immediate vicinity.

This EIS identifies a series of environmental controls and measures to ensure that land resources are protected from adverse impacts. Once the Proposed Development is decommissioned, the land would be returned to a suitable state to permit a return to agricultural use.

Biodiversity

As State Significant Development, the impacts of the Proposed Development on biodiversity must be assessed under the Framework for Biodiversity Assessment. Therefore a Biodiversity Assessment Report and a Biodiversity Offset Strategy have been prepared to assess the impacts to biodiversity, propose mitigating and ameliorating options, calculate offsets for unavoidable impacts, and identify a strategy which if implemented would offset any unavoidable impacts.

Habitat within the Site is highly modified due to long-term impacts of agriculture. Canopy species within the Site have been retained as scattered paddock trees with little fauna habitat potential. There are very few hollow-bearing trees due to the dominance of species such as *Eucalyptus caliginosa* and *Angophora floribunda*, which do not form multiple hollows regularly. *Eucalyptus moluccana* at the north of the Site do not support many hollows. There are several small granite outcrops which do not have cracks, caves or fissures. The mid-storey is absent and the groundcover is almost exclusively exotic pasture grasses. There is no leaf litter present.

Three Plant Community Types were identified within the Site:

- NR127: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion;
- NR131: Broad-leaved Stringybark – Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion; and
- NR282: Yellow Box – Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion.

All Plant Community Types are heavily impacted by the current agricultural practices used within the Site. The mid-storey has been removed from all Plant Community Types and the ground layer has been extensively modified through ploughing, nutrient enrichment and the sowing of pasture grasses such as *Lolium* sp. and *Bromus* sp.

The current biodiversity values of the Site are relatively low, with only sparse individuals of native species persisting within shaded areas under canopy trees. Current native groundcover species are likely to persist following construction of the Proposed Development.

The Proposed Development would involve impacts to native vegetation and fauna habitat through the loss of scattered paddock trees. The Proposed Development would impact up to 8.39 ha of native vegetation, depending on the final design of the solar farm. The Biodiversity Offset Strategy describes how the Proponent would offset this impact with ecosystem credits under the Framework for Biodiversity Assessment.

The Proponent has designed the Proposed Development to avoid or minimise direct impacts to:

- Threatened Ecological Communities;
- Plant Community Types that contain threatened species habitat;
- Threatened species that cannot be predicted by vegetation type;
- Declared critical habitat; and
- Regional and state significant biodiversity links.

A Biodiversity Management Plan and Construction Environmental Management Plan (CEMP) would be drafted following approval of the Proposed Development, which would put in place mechanisms to reduce impacts. The Biodiversity Management Plan would address impacts to flora and fauna such as delineation of clearing boundaries and minimising harm to fauna, whereas the CEMP would minimise indirect environmental impacts such as sediment control, dust, noise, lighting, and protection of waterways.

Prior to the issue of a construction certificate, the Proponent would acquire and retire the full quantum of ecosystem credits in line with commitments set out in the Biodiversity offset Strategy.

Aboriginal Cultural Heritage

Consultation with the local Aboriginal Community has followed the approach set out in *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*.

An Aboriginal Cultural Heritage Assessment was undertaken in accordance with the specifications set out in the following documents:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales*; and
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*.

A search of the Aboriginal Heritage Information Management System database and Armidale Dumaresq LEP 2012 with a 4 km radius centred on the Development Site identified no registered Aboriginal sites within the Proposed Development area.

Field surveys during December 2016 identified the following:

- Three low-density artefact concentrations;
- Thirty eight isolated (individual) artefacts;
- Two scarred trees; and
- A stone arrangement.

In consultation with the Aboriginal community, the proposal shall establish a 10 m buffer and subsequent no-go zone to avoid potential impacts to:

- Each of the two scarred trees; and
- The stone arrangement.

Where possible, design flexibility would allow the Proposed Development to avoid impacts to isolated artefacts identified during the field surveys. Where direct impacts cannot be avoided, recorded artefacts shall be collected prior to commencement of initial ground disturbance and in consultation with the Aboriginal community removed, either to a safe location on-site and reburied, or to a nominated keeping place. The collection of artefacts shall be carried out in accordance with Requirement 26 of the *Code Of Practice For The Archaeological Investigation Of Aboriginal Objects In New South Wales*.

Historic heritage

The Site is not located within a heritage listed area and no items of heritage significance were identified within the Site during database searches or during field surveys. Following detailed field surveys, it is considered highly unlikely any items of historic significance remain unidentified within the Site. Accordingly, the Proposed Development would not have any direct impacts on known historic heritage items.

A number of listed heritage items are located within 5 km of the Proposed Development, primarily reflecting past mining activities at Hillgrove and within Bakers Creek Gorge, to the south east of the Site. However, assessments of significance conclude that the Proposed Development would not result in indirect impacts to any listed heritage items.

Traffic and access

The Site is located north of Waterfall Way and is accessed via Bayley Park Road. The intersection of Waterfall Way and Bayley Park Road is a priority-controlled T-intersection. Construction and operational access for staff and material deliveries to the Site shall be via Bayley Park Road.

An independent road safety audit prepared to support the EIS does not identify any historical road safety issues related to the Bayley Park intersection.

It is estimated that overall traffic movements during the construction phase would be up to 75 light vehicles and 27 heavy vehicles daily, which would not have a significant impact on overall traffic volumes on Waterfall Way and is within the current and future capacity of highway. Additional vehicle movements associated with the operational phase would be negligible.

Due to the additional traffic associated with the Proposed Development, the following road safety mitigation measures are proposed to improve road safety:

- Advance truck warning signs to be installed on Waterfall Way;
- Double white lines should be extended past the intersection of Waterfall Way and Bayley Park Road;
- Guide posts with reflective markers should be installed at regular intervals (100 m spacing) and at specific roadside hazards such as on bends and culverts along Bayley Park Road; and
- Upgrading Bayley Park Road with improvements to the unsealed gravel pavement in accordance with the ARRB *Unsealed Roads Manual* (2009).

Visual impact

The landscape character of the Site and the wider study area is dominated by wide undulating to rolling hills which form part of the broader Armidale Plateau sub-region. The landscape character is rural, with a few homesteads scattered across the wider landscape. Vegetation cover is generally low except along ridgetops, within road reserves, in isolated patches in paddocks and gullies and within gardens surrounding homesteads. The sensitivity of the landscape is considered low, for it is of a type that is widespread and common in the local area and it does not have any notable landscape features or attributes that set it apart.

The Proposed Development has a relatively confined area of visibility due to it being positioned within a narrow valley that runs in a general north-east/south-west direction that is at a similar elevation to the surrounding landscape. The Site has a 1.1 km frontage to Waterfall Way. Topography and vegetation in this area naturally obscures potential views of the development Site, except for an area of visibility from east of Bailey Park Road to just east of the junction with Old Hillgrove Road. Distant views and glimpses of the Site are possible from Stockton Road and Hillgrove village.

The Proposed Development is not visible from either Bakers Creek Gorge or Oxley Wild Rivers National Park, which lie to the south of the Site.

The Proposed Development would be visible from two residential dwellings within 2 km of the development. These residences are located 240 m and 1,035 m from the southern boundary of the proposed development Site.

The Proposed Development has been developed in a manner to minimise potential visual impacts. The following mitigation measures are proposed:

- Establish an infrastructure free Visual Buffer Zone that would, as far as practical, maximise infrastructure setbacks from areas along Waterfall Way (50 m minimum setback from the Site boundary, increasing to 160 m from the Site boundary in areas visible from the nearest residence;
- Adopt minimum setback distances of 160 m (from the Site boundary) in areas that can be viewed from the nearest residence, providing a total set back from the residence of 400 m;
- Establish a vegetation buffer within the Visual Buffer Zone where Waterfall Way borders the southern boundary of the Proposed Development;
- Establish vegetation buffers within the Site boundary to help screen views from the second closest residence;
- Ensure the establishment of the vegetation buffers are commissioned as one of the first activities of Site construction;
- Continue to consult with neighbouring landholders to identify, where possible, the location of mutually agreeable vegetation screening both pre and post construction; and
- Promote management of road corridor vegetation to allow natural regeneration of native plant species.

Further visual mitigation measures include:

- Use of muted, low contrast colours for infrastructure;
- Select infrastructure to minimise potential for reflectivity and glare;
- Locate substation, support buildings, construction site compound and lay down areas away from visual receptors and apply visual screening if necessary;
- Minimise night lighting at the substation and associated support buildings; and
- Minimise vegetation clearing and earthworks and rehabilitate progressively.

Water resources

The Proposed Development is located within the Macleay River catchment. The development Site is located at the headwaters of Limerick Creek, an ephemeral 3rd order stream which joins Cooney Creek approximately 1.5 km downstream from the Site. Cooney Creek flows into Gara Gorge, part of the Oxley Wild Rivers National Park, before joining Salisbury Waters to eventually meet the Macleay River, which flows to the Pacific Ocean near South West Rocks.

Limerick Creek forms a series of shallow ponds, reflecting its low hydrological energy and upland setting. Local wetlands are present in the form of small riparian soaks and springs. These areas are likely fed by very shallow lateral groundwater movement and accordingly may be considered partially groundwater dependent ecosystems. Riparian vegetation and the riparian zone is highly degraded, having been cleared, grazed, sown and modified to support agricultural practices.

Groundwater systems in the vicinity of the Site would not be effected by the Proposed Development.

The Site is not flood prone and hydrological modelling indicates that the Proposed Development is unlikely to significantly influence flood risks under existing and future climate change scenarios.

The Proposed Development has been designed to minimise impacts to water resources, and the following environmental protections apply:

- Exclusion of 3rd order streams from the Development Footprint (except internal site crossing points for site access and cabling);
- Minimisation of creek crossings for site access and electrical cabling;

- Application of a 30 m buffer zone for 3rd order riparian zones;
- Exclusion of all local groundwater dependent ecosystems associated with Limerick Creek;
- Avoidance of footings and pilings within 1st and 2nd order drainage lines;
- Sourcing of non-potable, construction and operational water from rainwater tanks and existing farm dams where available, otherwise sourced offsite;
- All potable water would be sourced offsite; and
- The use of portable chemical toilets.

The Proposed Development could potentially result in impacts to surface water quality. Accordingly a suite of mitigation measures shall be incorporated into Environmental Management Plans for each of the construction, operational and decommissioning phases of the project. These mitigation strategies would consider:

- Sediment and erosion controls in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition*, known as 'the Blue Book';
- Pollution controls;
- Material storage and handling protocols;
- Accidental spill response strategies; and
- Adherence to best practice for creek crossings.

Noise

The Site is located within a rural landscape with residential areas of Hillgrove village approximately 5 km to the south east. The nearest noise sensitive receivers are located to the south of Waterfall Way, 240 m and 1,035 m from the southern boundary of the Site.

Background noise sources and levels are considered to be typical of the rural setting. The ambient noise environment includes noise from road traffic from Waterfall Way, agricultural activities, birds and insects.

Worst-case noise assessments, in accordance with the *Interim Construction Noise Guideline*, indicate that although construction noise is likely to exceed the Noise Affected Management Level of 41 dB(A) at the nearest residences for short periods of time, noise levels would be well below the highly affected noise limit of 75 dB(A).

Some construction noise is expected to be audible and there is likely to be some degree of adverse impact. However, a Construction Noise and Vibration Management Plan would include a suite of mitigation measures designed to ensure noise impacts at nearby residences are managed acceptably.

Operational noise impacts are demonstrated to have an insignificant impact on nearby residences, primarily through the application of generous minimum buffers between noise emitting infrastructure and nearby residences, these being:

- Invertors – greater than 400 m; and
- Substation – greater than 2,500 m.

Increases in traffic noise during the construction, operation and decommissioning phases of the Proposed Development is considered to be insignificant.

Bushfire and electrical fire

Small portions of the Site and its surrounds are mapped as Bushfire Prone Land. Ground cover at the Site is dominated by grazed pastures and crops and could be susceptible to grass fires. Other potential ignition sources include:

- Machinery movement in long grass;
- Hot work activities, including welders and grinders;
- The storage of waste and combustible materials onsite;
- Storage of flammable liquids;
- Electrical faults;
- Lightning strikes; and
- Carelessly discarded cigarette butts.

These risks shall be managed following a Bushfire Risk Assessment and development of a Bushfire Management Plan prior to commencing construction.

Electromagnetic interference

The existing environment exhibits variable topography and is sparsely populated. Existing potential sources of electromagnetic interference within the vicinity of the Site include three 132 kV transmission lines, one 66 kV, and one 330 kV transmission line.

The potential for impacts from electromagnetic fields during the construction and decommissioning phases are low. Exposure by construction staff would be limited to intermittent periods during works at and around the existing 132 kV and the 330 kV transmission lines that run across the Site.

Electromagnetic fields generated during operation would vary due to the type and size of electrical equipment on site and whether potential sources of electromagnetic fields are overhead or buried. However predicted electromagnetic levels are such that potential exposure on site would be below the NHMRC's Interim Guidelines on limits of exposure.

In limiting exposure to electromagnetic fields, following advice from the International Commission on Non-Ionizing Radiation Protection, priority would be given to engineering and access controls so that:

- The final design of the Proposed Development would be undertaken by qualified and competent persons;
- Design would meet relevant Australian standards, ensuring electromagnetic fields would be minimised as far as possible; and
- Access to electrical equipment would be limited to qualified personal only.

To reduce the potential for chronic or acute exposure to electromagnetic fields, no unsupervised public access to the Proposed Development would be permitted. Electromagnetic fields are considered likely to be indistinguishable from background levels at the boundary of the Proposed Development so pose no risk to the general public and would not impact on any electrical devices.

Air quality

The current air quality within the vicinity of the Proposed Development is typical of a rural area. Air quality is considered to be moderate to good. Potential air pollution sources include, agricultural practices, nearby mining and road transport.

Dust generation would accompany excavation and earthworks as well as the movement of trucks and other work vehicles along unsealed access roads during construction and decommissioning of the Proposed Development. Air emissions would also be produced from equipment and vehicle exhaust fumes.

The Proposed Development would have a positive impact on greenhouse gas emissions by displacing traditional carbon intensive electricity generation.

A suite of mitigation measures, primarily aiming to minimise dust and vehicle/plant emissions, would be incorporated into Environmental Management Plans for each phase of development.

Waste and resource use

Key resources required for the Proposed Development include gravel, sand, metal, glass, silicon and water. The supply of these materials is not currently limited or restricted, and the likely quantities required by the Proposed Development are unlikely to place significant pressure on necessary resources.

In order to encourage the efficient use of resources and reduce environmental impacts, resources and waste would be managed according to the following hierarchy:

1. Reduce waste production;
2. Recover resources (including reuse, reprocessing, recycling and energy recovery); and
3. Dispose of waste appropriately.

Waste would be classified in accordance with the NSW EPA *Waste Classification Guidelines – Part 1: classifying waste* and *addendum*, and if required disposed of lawfully at a licensed waste facility. A Waste Management Plan would be prepared in order to meet the hierarchy set out above. The objectives, protocols and responsibilities within it would be communicated to all staff and contractors through a Site induction process and ongoing training.

Specific waste management measures would be incorporated into a Waste Management Plan for each phase of development.

Social and economic factors

The environmental benefits of developing renewable energy sources and transitioning to a low carbon future are extensive, providing potential benefits to entire communities and helping to maintain quality of life. Indeed, increased adoption of renewable energy sources would assist Australia to transition away from traditional carbon intensive energy production which is linked to climate change. Reduced carbon emissions have the potential to reverse or slow the effects of climate change, benefitting current and future generations.

Electricity produced from the Site provides a clean power source for local and regional consumers in a cost effective manner. The Proposed Development would produce approximately 233 GWh of clean renewable energy. This would provide enough power for the equivalent of 40,000 NSW homes each year, and in doing so would reduce approximately 200,000 tonnes of CO_2 per annum through the displacement of conventional power supply.

The Proposed Development would have an overall positive impact on the local and wider economy during the constuction period. Construction would take between 9 to 12 months and up to 150 staff would be required. Local employment opportunities would be generated, while additional workers from

outside of the region would stimulate the local economy through demand for accommodation, hospitality and retail services. The operational phase would require 8 to 12 full time equivalent employees.

A Community Consultation Plan would be prepared and implemented outlining the measures that would be taken during the construction phase to increase positive benefits to the Armidale community and to reduce any adverse impacts.

Environmental management

Environmental Management Plans would be prepared to provide an overall framework for the management of environmental impacts that could potentially arise during each stage of the Proposed Development.

The Proposed Development would be designed, constructed, operated and decommissioned in accordance with the requirements of:

- Relevant legislation;
- Conditions of consent; and
- Commitments provided in this Environmental Impact Statement.

Project Justification

Residual risks following the mitigation strategies provided in this Environmental Impact Statement are shown to be generally low, or medium, and can be reasonably managed.

The reasons for justifying the Proposed Development are demonstrated by this assessment and accord with environmental, social and economic considerations, as well as the principles of Ecologically Sustainable Development.

Conclusion

Environmental impacts associated the construction, operation and decommissioning of the Proposed Development are compliant with the requirements for State Significant Development under the *Environmental Planning & Assessment Act 1979*.

The proposal presents relatively minor and manageable environmental impacts, which can be effectively mitigated using best practice strategies and methodologies. Potential benefits associated with the project include a reduction in greenhouse gas emissions, reduced reliance on non-renewable energy sources and positive outcomes for the local community. On this basis the Proposed Development is strongly justified.

1 Introduction

1.1 Purpose of this document

This Environmental Impact Statement (EIS) has been prepared on behalf of Infinergy Pacific (the 'Proponent') to support a Development Application (DA) to build and operate a utility-scale photovoltaic (PV) solar farm at Metz, approximately 18 km east of Armidale, NSW (Figure 1.1). The proposal would have an electricity generation capacity of approximately 100 megawatts (MW), producing enough energy to power the equivalent of 40,000 average NSW households each year.

Under the *State Environmental Planning Policy (State and Regional Development) 2011*, electricity generating works (including solar) that have a capital investment value of more than $30 million are classified as "State significant development" (SSD) and require approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) through the preparation of an EIS. The proposed Metz Solar Farm has an estimated capital value of just under $130 million.

As such, this EIS has been prepared under Part 4 of the EP&A Act, in accordance with the Secretary's Environmental Assessment Requirements (SEARs), dated 28th September 2016, and the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation).

1.2 Project Overview

The proposed Metz Solar Farm ('Proposed Development') would generate electricity through the conversion of solar radiation to electricity through the use of PV panels laid out across the proposal site in a series of modules, mounted on steel racks with piled supports. Other infrastructure on site would include electrical invertors, underground and/or above ground electrical cabling, telecommunications equipment, a substation, amenities and storage facilities, vehicular access and parking areas, along with security fencing and gates. A detailed description of the Proposed Development is provided in Section 3.

1.3 Project Setting

The Proposed Development is located approximately 18 km east of Armidale, within the Armidale Regional Council's Local Government Area (LGA) (Figure 1-1). The proposal site (the 'Site") is immediately north of Waterfall Way (locally known as Grafton Road) and is accessed via Bayley Park Road.

The Site comprises cleared agricultural land with a history of grazing and cropping. A 30 year land access lease has been negotiated for the life of the project. At the conclusion of the Proposed Development, the Site will be decommissioned and returned to a suitable condition to allow the resumption of agricultural activities.

Two TransGrid high voltage overhead powerlines (330 kV and 132 kV) cross the proposed Site and there are a further three lines located immediately to the south (one 66 kV line and two 132 kV lines). The Proposed Development would connect to the Armidale-Koolkhan 132 kV line which runs over the Site via a new onsite substation which would be located in a screened area towards the middle of the development (Figure 2-5).

The Proposed Development is located in a sparsely populated rural setting approximately 4.5 km north west of the village of Hillgrove. Two non-involved residences are located to the south of the Proposed

Development while Hillgrove Mines Pty Ltd (Hillgrove Mines) has a pending development application for an antimony mine (Clarks Gully Underground Mine) southeast of the Site.

1.4 The Proponent

Infinergy Pacific is an independent Company with a strong focus on solar development in Australia. The development team has over 15 years' experience developing, owning, operating and manufacturing renewable technologies. The company possesses all the in-house expertise along with the experience needed to design, develop, build and operate renewable energy schemes.

Infinergy Pacific believes solar energy has an important role to play in addressing the combined threats of climate change and decreasing energy security, both of which are identified as key issues facing the electricity sector in Australia. In response to these threats, Australia has committed to renewable energy targets to ensure that approximately 23.5% of the electricity supply is derived from renewable sources by 2020 (DEE, 2015). Infinergy Pacific is committed to making a significant contribution towards this target.

When assessing a renewable energy scheme, Infinergy Pacific in close consultation with statutory consultees and local communities, aims to put the right technology in the right place. This approach allows Infinergy Pacific to design developments that are sympathetic to the local environment while maximising operational outcomes

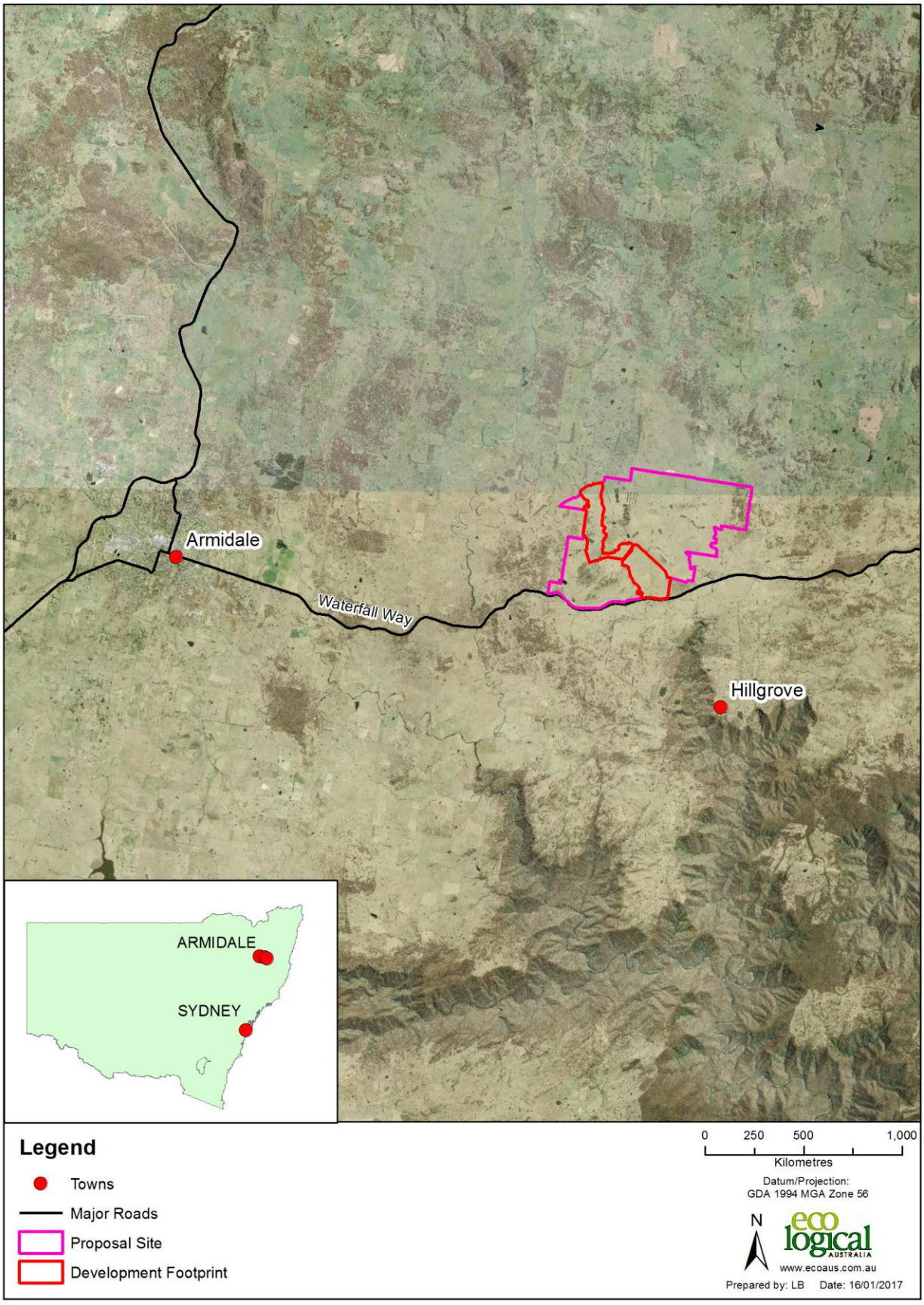

Figure 1-1: Location of the Proposed Development

2 Strategic Justification

2.1 Climate Change and Renewable Energy

There is substantial, scientifically verified, evidence that the Earth's climate is changing in response to both natural and anthropogenic substances and processes that act to alter the Earth's energy budget. Australia faces significant environmental and economic impacts from such climate change, across a number of sectors including water security, agriculture, coastal communities and infrastructure (DEE, n.d.).

There are a range of responses to climate change that are likely to be required to achieve effective mitigation. This includes a transition to less carbon intensive electricity generation technologies. Renewable energy technologies such as solar have very low CO_2 emissions and are hence compatible with strategies to address climate change.

2.2 Electricity Generation in NSW

In NSW there is approximately 20,000 MW of generation capacity installed across the State based on a range of energy sources including fossil fuels, such as black coal, natural gas, coal seam methane gas, and to a lesser extent renewable sources including hydro, wind, solar and biomass (DRE, n.d.). Approximately 30% of electricity in NSW is generated from renewable sources. Interconnectors with both Queensland and Victoria provide additional capacity as required.

In addition, there are proposals for approximately 17,500 MW of new generation capacity in the pipeline, of which approximately 8,500 MW is based on renewable technologies (DRE, n.d.).

2.3 Renewable Energy Commitments and Targets

Australia is a signatory to a number of international agreements, conventions and protocols regarding climate change and the reduction of greenhouse gas emissions, including the 2015 Paris Agreement to reduce CO_2 emissions to 26 - 28% below 2005 levels by 2030.

Other relevant strategic plans include:

- Australian Large Scale Renewable Energy Target (RET) – renewable energy production target of 33,000 Gigawatt hours (GWh) by 2020 from large scale generators;
- NSW 2012: A plan to make NSW Number One – Goal 22, to *"contribute to the national renewable energy target by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources"* (NSW Government, 2011); and
- NSW Renewable Energy Action Plan – goals and actions to efficiently grow renewable energy generation in NSW (NSW Government, 2013).

Overall, the Proposed Development is a positive response to Australia's ambitious targets and plans (as summarised above) to increase renewable electricity generation while reducing CO_2 emissions and playing a positive role in the diversification of the energy mix in NSW.

TransGrid owns and operates the high voltage network that connects generators, distributors and major end users in NSW and the ACT. TransGrid has received funding from the Australian Renewable Energy Agency (ARENA) and the NSW Government to prepare a feasibility study and report into the development of a Renewable Energy Hub (the Hub) in New England, utilising renewable energy

resources to optimise the transmission network (TransGrid, 2016). It is anticipated the Hub will displace up to 2.2 million mega-tonnes of CO_2. The New England region, where the Proposed Development is located, is considered a prime area for developing renewable generation, with existing high quality renewable energy resources leading customers to plan the development of wind and solar farms in the area (TransGrid, 2015).

2.4 Benefits of the Metz Solar Farm

The Proposed Development would increase Australia's renewable energy generating capacity and assist in meeting commitments and obligations under international conventions and agreements to reduce CO_2 emissions.

Fully constructed, the Proposed Development will generate approximately 233 GWh of clean electricity annually over a 30 year lifespan, enough to supply approximately 40,000 average NSW homes each year. In addition, the electricity generated by the Proposed Development would result in significant carbon savings due to the electricity displaced from the current NSW generation supply, which is heavily reliant on coal powered generation. Based on current NSW emission figures of 0.87 kg of CO_2-equivilent per kWh (DIICCSRTE, 2013), approximately 200,000 tonnes of CO_2 would be displaced by the Proposed Development annually.

The Proposed Development would also assist in the transition of the electricity sector away from a reliance on coal and gas fired power stations to renewable technologies that are aligned with the principles of Ecologically Sustainable Development (ESD), particularly that of inter-generational equity whereby the present generation makes land use decisions that ensure the environment is conserved for use by future generations.

It should be noted, that the Proposed Development would also result in significant local social and economic benefits including:

- Direct and indirect employment opportunities during the construction and operation of the solar farm. This would include:
  - Up to 150 construction jobs;
  - Between 8 and 12 full time jobs during the operational phase;
- Direct business volume benefits for local services, materials and contracting businesses;
- Diversification of rural income streams;
- Delivery of sufficient solar energy into the national electricity grid to power approximately half of the population of New England; and
- The development preserves the production values of the Site as the Proposed Development is wholly reversible at the end of the project life.

2.5 Alternatives considered

2.5.1 Do Nothing Scenario

Under the Do Nothing Scenario the Proposed Development would not take place and the benefits resulting from the opportunity to generate additional renewable energy, as well as the local socioeconomic benefits resulting from the Project Development would be forgone.

2.5.2 Alternative Locations

At a regional scale, a multi-criteria site selection process was undertaken to select the most suitable site for the Proposed Development. Initial investigations, including consultation with the network operator,

indicated that the capacity to export electricity from a development to the National Electricity Market (the NEM) is a key factor in selecting a site for a large scale generator in NSW. As such, excess capacity at the Armidale electrical substation was used as a starting point to identify a suitable site for the Proposed Development. The Proposal Site was then identified as the preferred location due to:

- Availability of an abundant solar source;
- Proximity to a transmission line with good connection capacity to the Armidale Substation;
- Low population density surrounding the site;
- Likely limited environmental constraints (little native vegetation cover and a high level of past disturbances);
- Likely limited visibility of the site due to topography and existing vegetation; and
- Landholder support.

2.5.3 Project design principles

The proposed Site was selected due to its suitability for a solar farm and the limited nature of the environmental constraints identified. In designing and assessing the potential impacts of the Proposed Development, the following design hierarchy was adopted:

- **Avoid** – in the first instance, all efforts will be made to avoid potential environmental impacts;
- **Minimise** – where potential impacts cannot be avoided, design principles shall seek to minimise environmental impacts, as far as feasibly possible;
- **Mitigate** – mitigation strategies will be implemented to manage the extent and severity of remaining environmental impacts; and
- **Offset** – environmental offsets shall be used only as applicable, following all efforts to first avoid, minimise and mitigate environmental impacts.

In addition, the following specific principles were adopted:

- Minimise vegetation clearing – areas of high conservation value and/or native vegetation shall be strategically avoided;
- Minimise land disturbance – solar arrays shall be attached using piles either driven or screwed into the ground (see Section 3.2). Ground disturbance shall be limited to the area of contact between the pile and the ground. Design footprints for tracks, cable trenches, support buildings, and the substation shall be limited further to the minimum area required;
- Protect riparian zones – defined 3rd order (Strahler) and higher riparian zones shall be excluded from the developable area;
- Use previously disturbed land – as much as possible the Proposed Development shall be located on previously cultivated and cropped land;
- Protect cultural heritage values – through the identification and evaluation of cultural heritage assets at the site;
- Protect agricultural values – existing agricultural values shall be preserved and a negotiated lease shall offset forgone landholder income while diversifying income streams for the duration of the project life;
- Minimise direct and indirect impacts – as far as possible, infrastructure shall be located away from nearby residences and adjoining properties; and
- Adopt a flexible approach to design – the final project design shall respond to identified environmental impacts and constraints.

2.5.4 Design evolution and constraints

From the outset, the project has adopted a methodology to, in the first instance, avoid all possible environmental impacts. This design ethic is central to the current proposal and has been adopted at all stages of design. The evolution of the design is summarised below:

- **Proposal Site** – the Bayley Park property was selected as the preferred Proposal Site based on an early, high level constraints analysis that compared it favourably with other potential locations in the region;
- **Proposal Study Area** – within the Proposal Site an initial Option Area was negotiated with the landholder, with the intention of minimising agricultural and environmental impacts. This resulted in the adoption of the Proposal Study Area considered for the Preliminary Environmental Assessment (PEA);
- **Refined Study Area** – High-level constraints identified during the PEA and preliminary ecological surveys were used to inform a Refined Study Area within the wider Proposal Study Area. High level constraints included areas of Ecologically Endangered Community (EEC), continuous native vegetation and design/engineering considerations;
- **Footprint Evolution** – the Proposal's footprint continued to evolve in response to environmental constraints until a definitive Development Footprint was identified;
- **Development Footprint (the 'Site')** – the Development Footprint forms the basis of this environmental impact assessment. In accordance with the 'Avoid' principle of the design hierarchy noted above, it was refined downwards in size as a response to ecological constraints identified on the periphery of the footprint.
- **Residual Constraints Layer** – The assessment process identified a number of constraints that have also been considered in the design of the Proposed Development. The Residual Constraints Layer illustrates constraints following mitigation and demarcates areas not subject to development within the Development Footprint. Additional site constraints adopted include:
    - Avoidance of development under or adjacent to overhead high voltage transmission lines;
    - 30 m buffer zone surrounding 3rd order (Strahler) streams; and
    - 10 m buffer zone surrounding scar trees and an Aboriginal cultural artefact of high significance;
    - Visual Buffer Zone – the proposal adopts a generous setback for infrastructure coupled with an extensive newly planted vegetation screen along the entire site frontage with the Water Fall Way; and
    - Noise buffer – the proposal adopts a generous set back (beyond minimum) distances from sensitive receptors to ensure there will be no operational noise impacts;
- **Developable Land** – the Developable Land was identified using the Residual Constraints Layer to demarcate the areas of land that could not be avoided through mitigation and identify the area that are subject to development;
- **Indicative Site Layout** – the Developable Land informs an Indicative Site Layout proposed in this EIS. The Developable Land and Indicative Site Layout formed the basis for public consultation sessions held at Hillgrove and Armidale during January 2017;
- **Detailed Design** – the modular nature of PV solar farms provides scope for further impact avoidance during the Detailed Design stage which will follow project approval and the tendering process. Where possible infrastructure will be located/positioned to avoid unnecessary physical impacts to:

- Scattered Aboriginal artefacts;
- Scattered native vegetation; and
- 1st and 2nd order streams;

- **Mitigation** – mitigation strategies identified within this EIS shall be applied to residual impacts that remain following the application of the above impact avoidance strategies.

The evolution of the project footprint is shown in Figure 2-1 and Figure 2-2, and summarised in Table 2-1 below (Figure 2-1 has been produced as per the SEARs). Residual Constraints within the Development Footprint and subsequent Developable Land are shown in Figure 2-3 and Figure 2-4, respectively. The Indicative Site Layout is shown in Figure 2-5.

Table 2-1: Project footprint evolution

Footprint	Area (Ha)	Comments	Map
Proposal Site	2945.66	Bayley Park was initially chosen as the preferred location for the proposed solar farm.	Figure 2-2
Proposal Study Area	950.25	The Proposal Study Area reflected initial site inspections and landholder negotiations. The PEA was developed based on the study area. At this stage, the project was for a solar farm generating up to 300 MW.	
Refined Study Area	660.82	The Refined Study Area responded to site constraints identified in PEA and initial ecological surveys, removing areas of threatened ecological communities and continuous native vegetation. The EIS commenced at this proposal.	
Footprint evolution	518.12	The footprint was refined further to reduce the impact area, reflecting findings made during detailed environmental assessments.	
Development Footprint (the 'Site')	507.47	The Development Footprint (the 'Site') represents the final extent of this development application and was reduced further in size as a response to identified ecological constraints on the periphery of the Footprint. All mitigation strategies, infrastructure, construction and operational activities will be undertaken within the Development Footprint (the 'Site'). A solar farm of approximately 100 MW can be accommodated within this footprint area.	
Constraints Layer	43.66	Identifies further constraints to concept design, as well as environmental impact mitigation commitments.	Figure 2-3
Developable Land	463.81	Identifies areas within the Development Footprint allowing for mitigation commitments identified in the Constraints Layer.	Figure 2-4

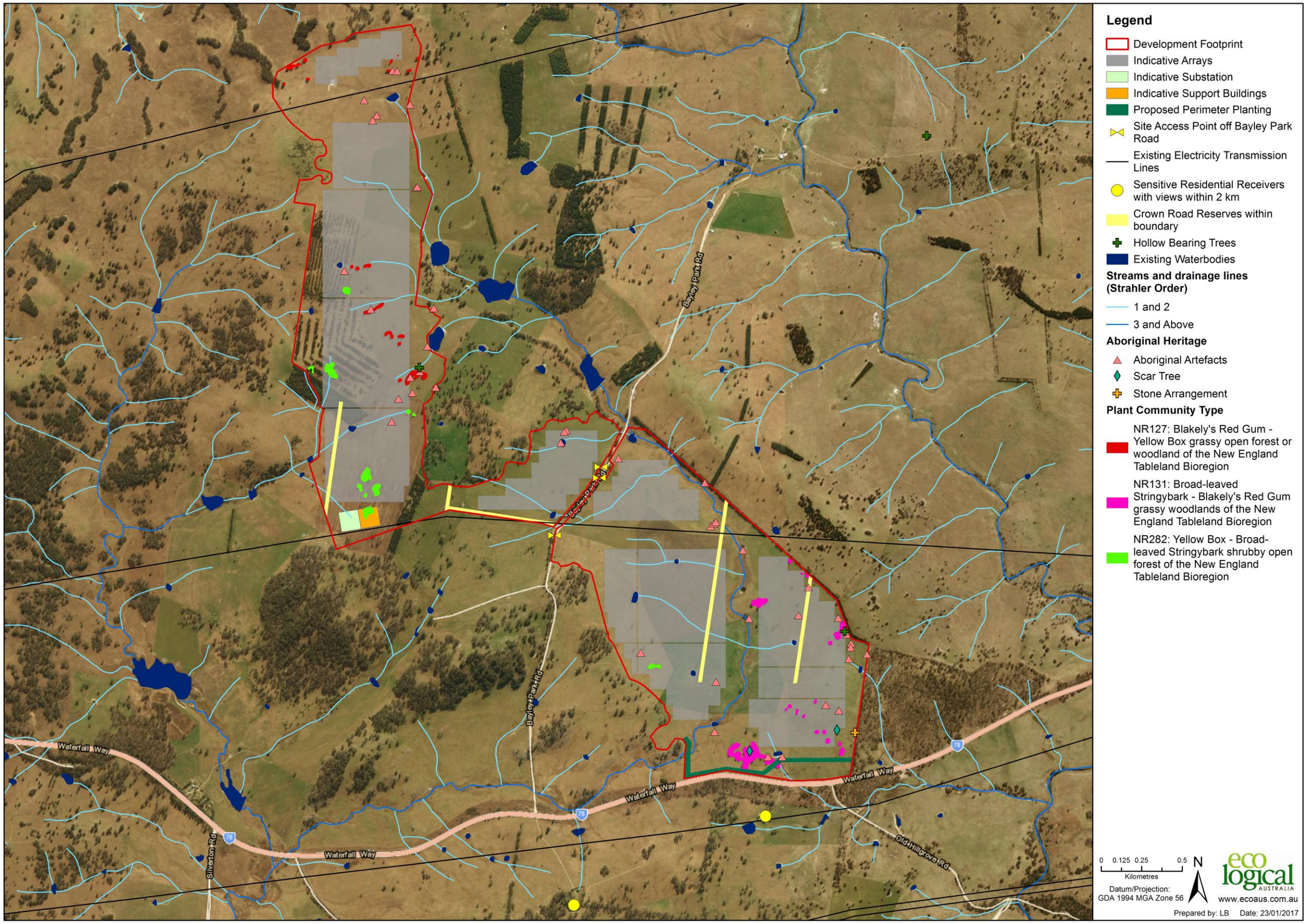

Figure 2-1: Known potential constraints within and around the Proposal Site

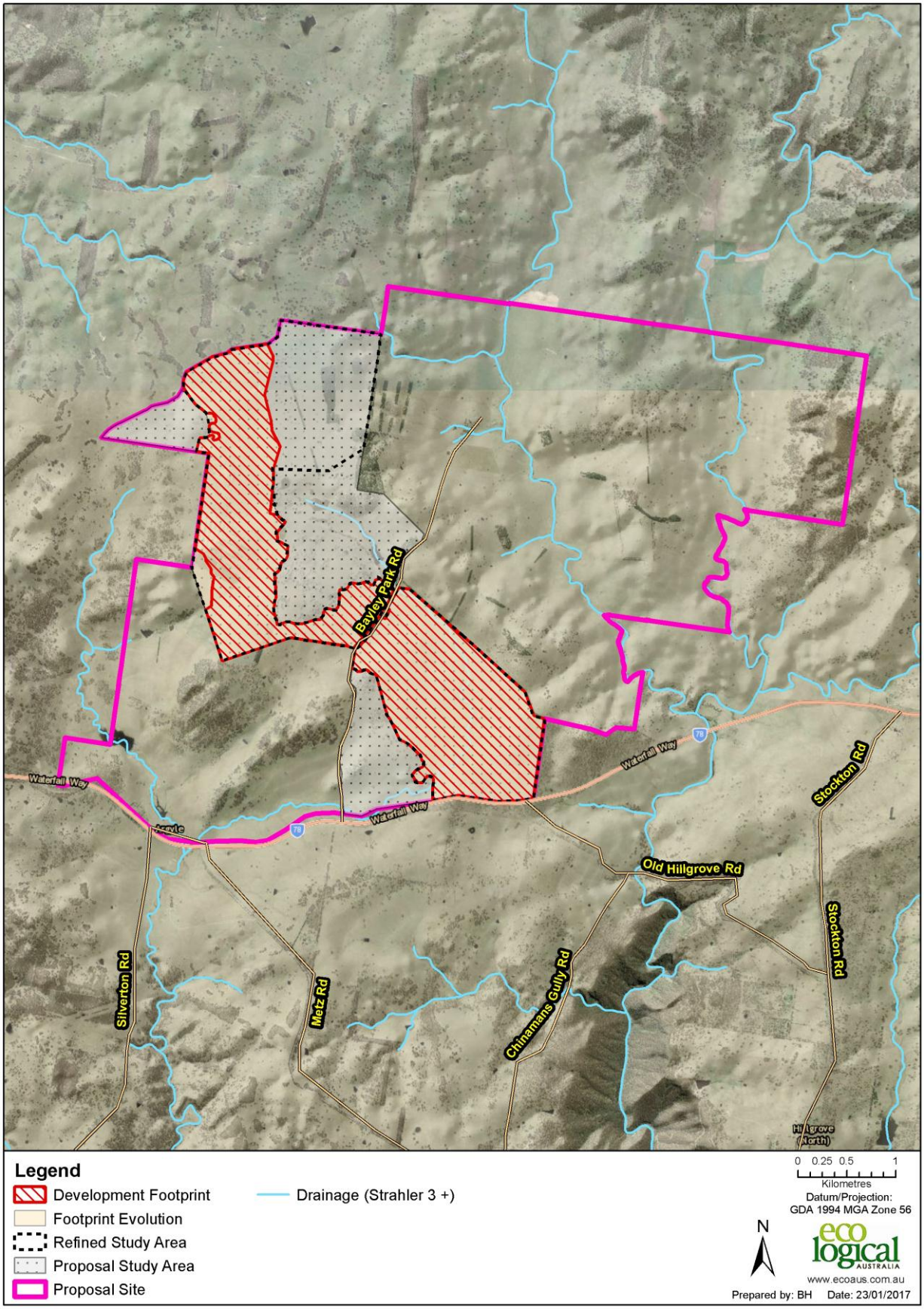

Figure 2-2: Project footprint evolution

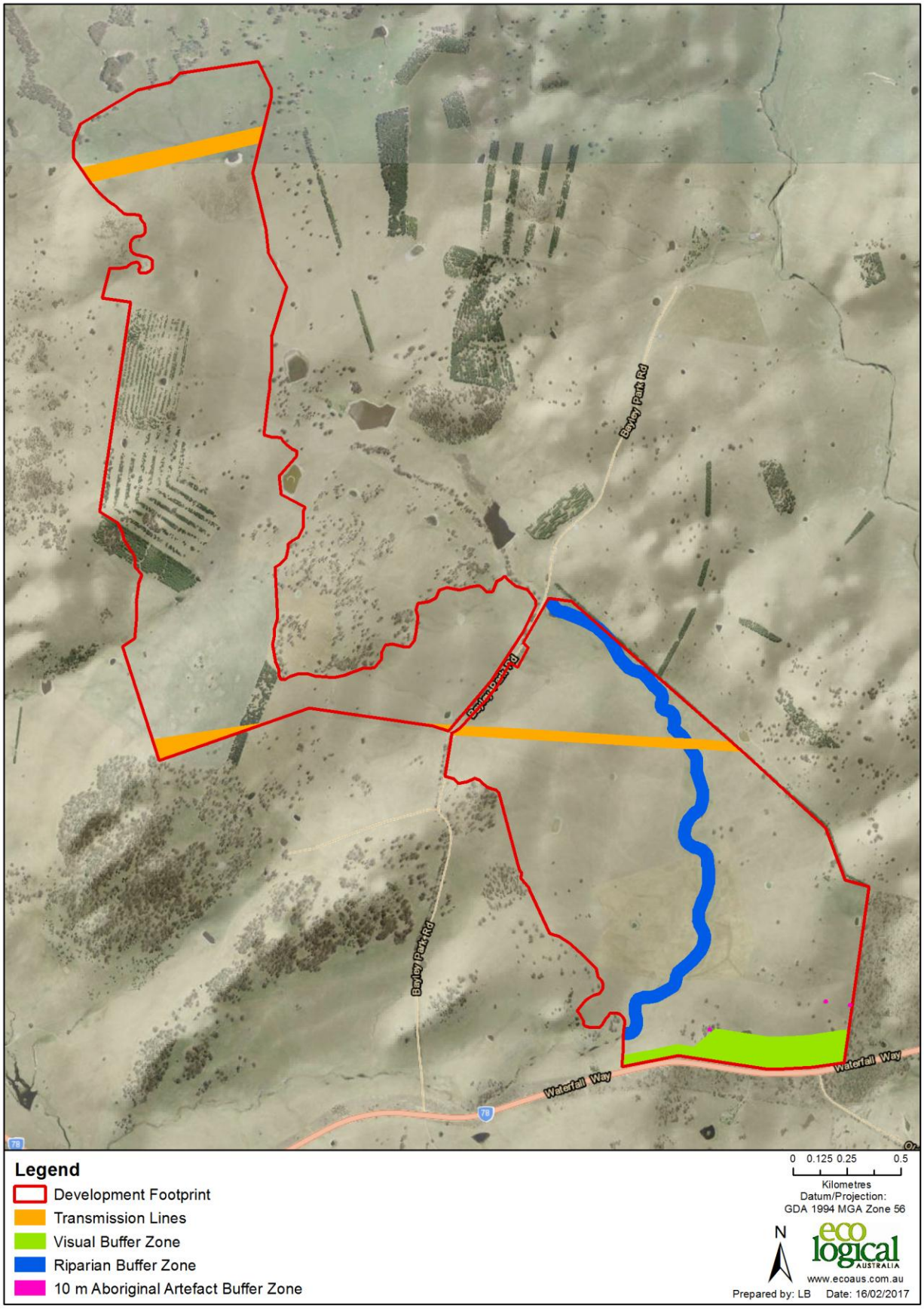

Figure 2-3: Residual Constraints Layer

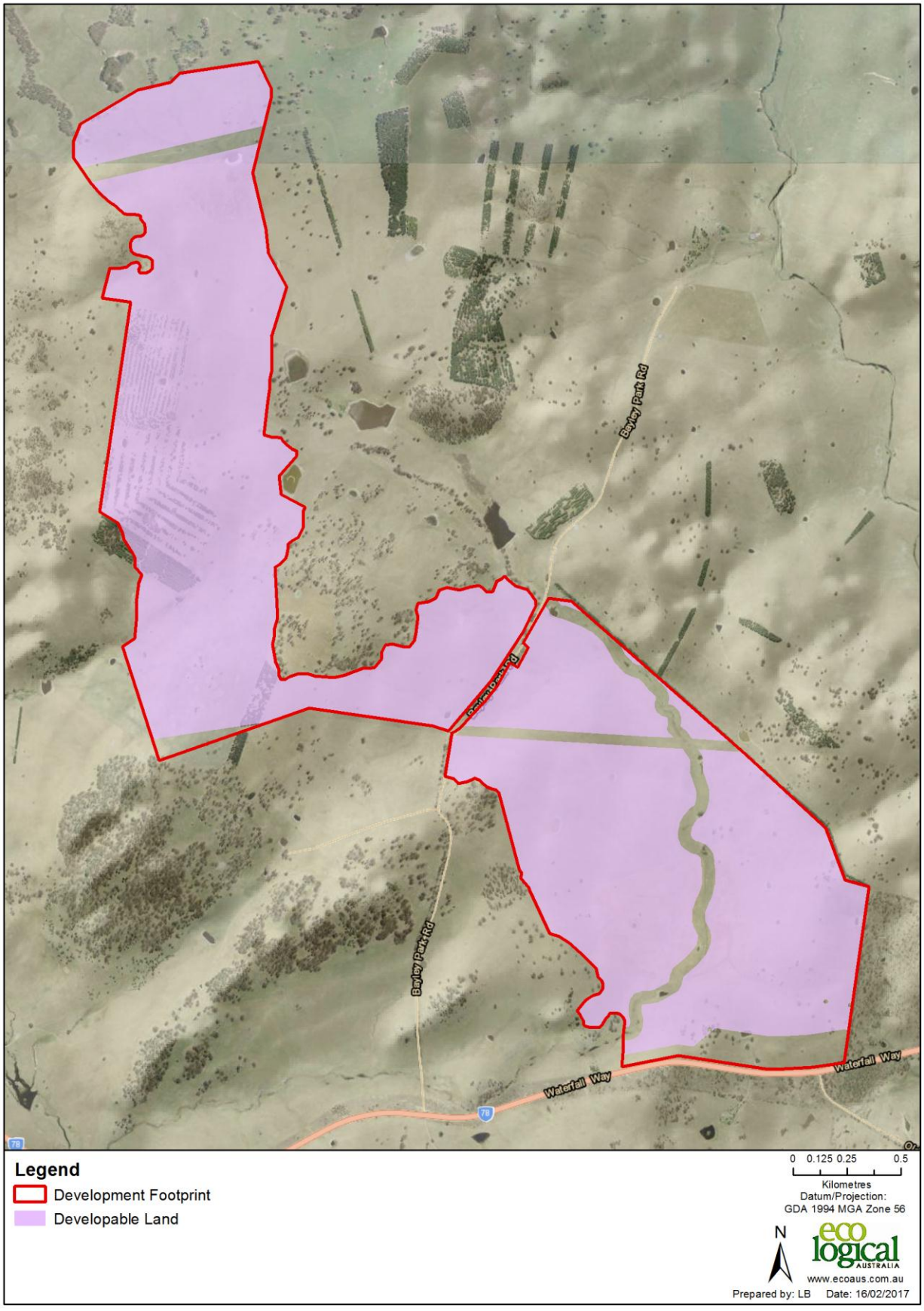

Figure 2-4: Developable Land within the Development Footprint

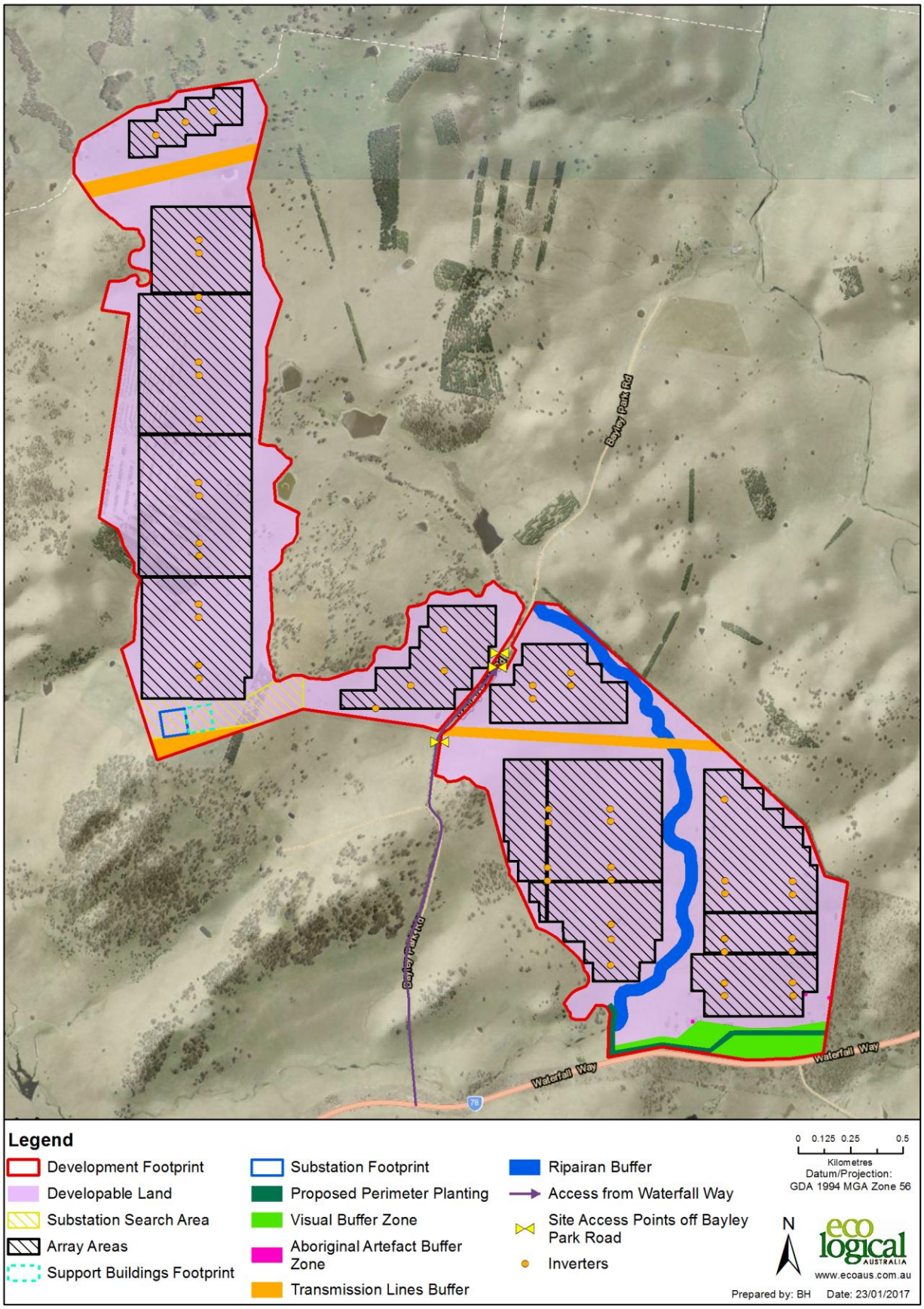

Figure 2-5: Indicative Site Layout (produced with assistance from RCR Ltd and Nextracker Inc)

2.5.5 Generation Capacity

Consultation with the network operator TransGrid confirmed that there is spare capacity that would allow approximately 100 MW to be connected to the existing electricity transmission network within the Development Footprint (as noted the Armidale-Koolkhan 132 kV). Once all site constraints were identified and the Development Footprint finalised, an indicative design was development for 100 MW (Figure 2-5). In order to make the most efficient use of the Site, and subject to the outcome of more detailed grid studies, constraint free land within the Development Footprint may be used to accommodate further capacity if this becomes viable. As such, the current EIS has been designed to assess the whole Site in order to reduce the need to conduct additional environmental assessments should this additional capacity be available (Section 3.1.2).

3 The Proposal

3.1 Proposal Description

3.1.1 Site Description

The Development Footprint comprises up to 507 ha, the majority of which has been historically cleared for grazing and much has been sown to improved pastures. A number of small *Pinus radiata* (Radiata Pine) plantations are located within the Site and there are patches of retained native woodland scattered throughout. The Site, situated within a broad valley contained by surrounding hills, slopes gently towards the south east, following Limerick Creek. A number of farm dams are scattered across the Site.

The Site is currently productive agricultural land, but is not mapped as Biophysical Strategic Agricultural Land (BSAL). The site is not mapped as Flood Prone Land. Portions within the Site are mapped as Bushfire Prone Land.

3.1.2 Key Components of the Proposed Development

The Proposed Development involves the installation of PV panels with a combined generation capacity of approximately 100 MW. An indicative layout for the Proposed Development is provided in Figure 2-5. The Proposed Development includes the following elements:

- Solar arrays: approximately 400,000 solar panels supported by a mounting system installed on approximately 50,000 piles driven or screwed into the ground;
- The panels would be installed on either:
    - A fixed tilt system (oriented north to south); or
    - A single axis system (orientated west to east);
- Up to 50 central inverters located throughout the development;
- Above and/or below ground onsite cabling and electrical connections;
- Onsite access tracks;
- Substation (connects the Proposed Development to the national electricity grid);
- Support buildings alongside the substation including communications equipment and tower;
- Perimeter fence (security fence approximately 2.5 m high);
- Vegetation buffers for screening; and
- Firebreaks.

The final location of the elements listed above will be determined during a detailed post consent design process.

In addition to the key components outlined above, there will be a temporary construction compound required to facilitate the construction and decommissioning phases of the Proposed Development. The construction compound would include:

- Temporary construction offices;
- Car and bus parking areas (the transport assessment has considered car transport only as a worst case scenario, Section 6.6);
- Staff amenity block including portable toilets, showers and a kitchen) designed for peak staff numbers during the construction period; and
- Laydown areas.

All land required for the temporary construction compound, if not used as part of the array area, will be restored to its current condition.

The 100 MW layout for the Proposed Development in this EIS is 'indicative' (see Figure 2-5). The reasons for this are threefold:

- The market for solar panels is dynamic with technology changing quickly and it is the intention of the applicant to take advantage of any advances to ensure that the benefits of the Proposed Development are maximised;
- While the topography of the site has been assessed as suitable for solar development, detailed geotechnical studies will be required to determine the most suitable location for each of the solar farm components; and
- TransGrid who own the transmission line into which the Proposed Development will connect can only provide an estimate in relation to the scale of development that could be accommodated on the line.

These aspects cannot be resolved until after consent when detailed procurement studies are conducted and grid connection studies are completed. As such, the proponent has identified a Development Footprint within which all components of the Proposed Development would be accommodated. This application has been designed to assess the entire potential Development Footprint which provides a degree of flexibility in which the final design can be optimised to utilise best in class technology, while ensuring that environmental effects are acceptable. By adopting this approach, the assessment represents a worst case scenario in line with Environmental Impact Assessment (EIA) principles and reduces the likelihood of needing to seek modification approvals for minor layout changes.

3.1.3 Scale of Development

The final scale of the Proposed Development will be optimised within the Development Footprint during post-consent studies based on a combination of the most suitable technology at the time of procurement along with detailed geotechnical and grid connection studies. For this EIS the applicant has assumed a 100 MW design based on environmental constraints identified and the estimated capacity of the transmission line. A solar farm of this scale would result in a final output of approximately 233 GWh based on the solar resource at the Site, with an estimated capacity factor of 27%.

It should be noted that the final scale of development will aim to maximise generation capacity at the Site based on the constraints identified though the EIA process (Figure 2-3) and the post consent studies described above (Section 3.1.2). As such, the final scale of development could be greater than 100 MW, however any design would be contained within the Development Footprint (the 'Site') assessed in this EIS (Figure 2-2), and would not exceed the environmental effects identified.

3.1.4 Indicative Timeline

An indicative timeline for the Proposed Development is provided in Table 3-1 below. It is estimated that the Proposed Development would take between 9 and 12 months to construct and would be operational for approximately 28 years. Following the operational period, all above ground infrastructure would be removed from site which would take approximately 6 months. As such, planning consent for the Proposed Development is sought for 30 years.

Table 3-1: Indicative timeframe for project phases

Phase	Indicative Start	Indicative Period
Construction	January 2018	9 to 12 months
Operation	September 2018	~28 years
Decommissioning	2046 / 2047	6 months

3.1.5 Description of Solar Farm Key Components

Solar array

The solar array refers to the solar farm as a whole and would comprise of approximately 400,000 individual solar panels with a combined generation capacity of approximately 100 MW.

The solar panels would be fitted to either or a combination of:

- Fix tilt frames which would be orientated so the panels face upwards at approximately 25 to 30^0 in a north, north west or north easterly direction; or
- A single-axis tracking system which would track the sun from east to west as it moves throughout the day.

The solar array will be supported by approximately 50,000 piles which would be mechanically driven or screwed into the ground. Figure 3-1 and Figure 3-2 below show examples of solar farms during construction. Figure 3-3 and Figure 3-4 illustrate an operational fixed array solar farm and an operational tracking solar farm respectively.

The solar array would be wired in 'blocks' that would be connected to inverters (likely to be 2.5 MW) located throughout the Proposed Development. Blocks would not necessarily appear as discrete entities but would appear as a series of continuous rows. In the case of a fixed tilt mounting system the rows would run west to east, while the single-axis tracking system would be installed in rows that are oriented north to south. The solar array would connect to the Substation through a series of 33 kV lines that would be above or below ground depending on local ground conditions.

Figure 3-1: Piles for the solar farm in place (image supplied by Infinergy UK)

Figure 3-2: Fixed array assembled before PV panels added (image supplied by Infinergy UK)

Figure 3-3: Fully assembled fixed array solar far (image supplied by Infinergy UK)

Figure 3-4: Fully assembled tracking array solar farm showing inverter housing (image courtesy Nextracker Australia, actual tracking system and inverters may differ)

Inverters

PV panels produce Direct Current (DC) electricity which would be converted to Alternating Current (AC) at a number of central inverters. The inverters will be approximately 2.5 MW each, although other sized inverters are being considered (for example 2 MW). Inverters are typically housed in containers, or located on platforms, either singularly the size of a 20 ft container, measuring approximately 6.1 m (l) x 2.9 m (h) x 2.5 m (w), or doubly the size of a 40 ft container measuring approximately 12.2 m (l) x 2.9 m (h) x 2.5 m (w). Each inverter would also have:

- A 33 kV Medium Voltage (MV) transformer;
- Circuit breakers; and
- Communication equipment.

Inverters will be transported to site readymade and require little in the way of foundations, either attached to steel or concrete pilings approximately 1.6 m deep depending on ground conditions. Figure 3-5 and Figure 3-6 below illustrate a double inverter and single inverter respectively.

Figure 3-5: Double inverter container (image courtesy of SMA)

Figure 3-6: Single inverter container (image courtesy of SMA)

Onsite substation

The onsite Substation would be the point of connection to the existing 132 kV line that crosses the site as detailed in the site layout (Figure 2-5). The final design specifications are subject to a grid connection agreement with TransGrid and would contain the following items:

- One or two 132 kV transformers;
- High Voltage (HV) circuit breakers and switch gear;
- Metering equipment;
- Control room;
- Storage shed;
- Lattice communications tower approximately 20 m high of lattice type construction;
- Low Voltage (LV) power connection;
- Overhead cables connecting the substation to the existing 132 kV line that runs through the site;
- Parking space for service vehicles;
- Perimeter fencing; and
- Perimeter screening if required.

The substation infrastructure as described above will be built within a 120 m x 120 m area within the Substation Area of Search, and as close as possible to the existing transmission line, as illustrated in Figure 2-5. Buildings heights will not exceed 8 m.

Support buildings

Adjacent to the substation but also within the Substation Area of Search would be support buildings for the Proposed Development. The Support Buildings and associated parking would take a maximum additional area of 120 m by 120 m and may include the following:

- Office building, consisting of office, toilets, showers, staff room and kitchen;
- Maintenance building;

- Up to 3 storage buildings/sheds;
- Parking;
- Water storage;
- A septic tank; and
- A workshop.

Onsite support buildings will comply with all relevant Australian building standards and regulations. They will be designed to accommodate the maximum number of staff that will be required during the operational life of the Proposed Development (8 – 12 staff). Water for the support buildings will be supplied to site by commercial contactors and stored in onsite water tanks. In addition, there will be a requirement for a 20,000 litre water tank solely for the purposes of fire protection.

Cables and cable trenching

All cables will be designed based on site conditions in accordance with relevant Australian and international standards. Subject to final design, cable trenches will contain:

- Below ground warning tapes;
- Below ground Polymeric cover strips;
- Electrical cables to export power;
- Electrical supply cables where necessary;
- Earthing cable;
- Communications and SCADA links; and
- Above ground warning signs.

Where possible, trenches will be located alongside/underneath internal access tracks to minimise ground disturbance (Figure 3-7). Cables will be either laid underneath or constructed over Bayley Park Road to connect the solar array.

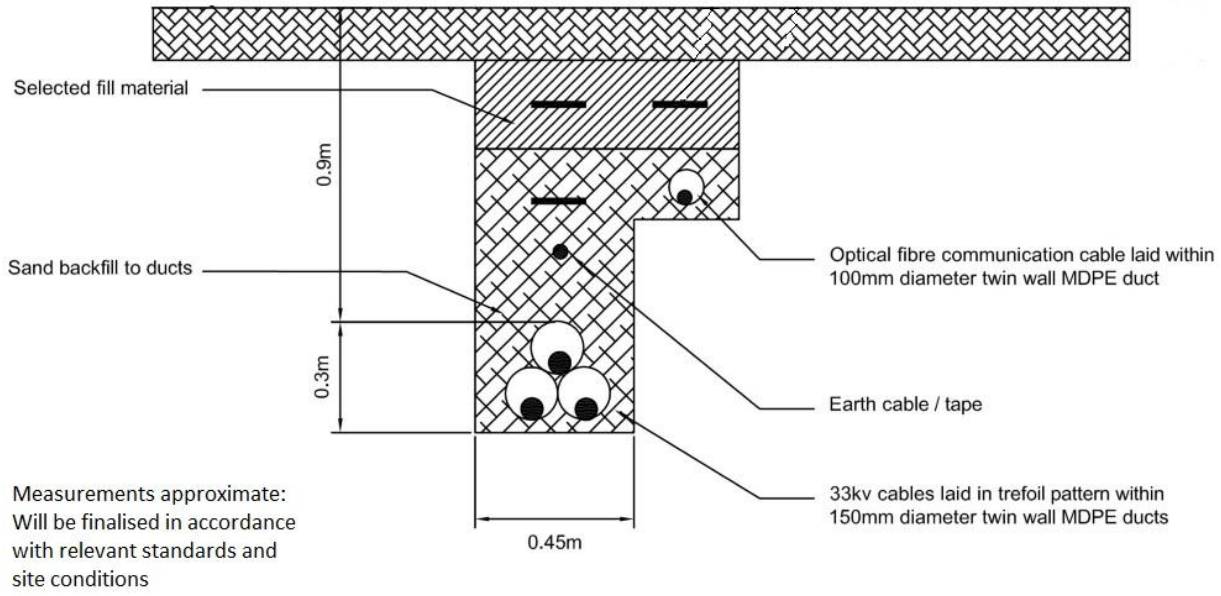

Figure 3-7: Indicative 33kV cable trench design

Site Access

The Site will be accessed directly off Bayley Park Road as illustrated in Figure 2-5. Bayley Park Road joins Waterfall Way, a Roads and Maritime Services (RMS) Classified State Road (widely known and referred to as Waterfall Way in this document) immediately south of the project boundary. Bayley Park Road is an unsealed local road that dissects the Site providing access to two existing residences located on the property. Bayley Park Road will require limited upgrading and maintenance to support delivery vehicles during the construction phase. Upgrading and maintenance activities will ensure the road is suitable for heavy equipment delivery, as required.

To ensure safety and security at the site, a perimeter fence up to 2.5 m will be installed around the perimeter of the solar array to ensure entry into the site is controlled. Once operational, all access points will be gated. Within the Site there will be a CCTV security system.

Internal Tracks

Internal tracks will be constructed of compacted gravel to an approximate depth of 150 mm depending on soil conditions. Internal access tracks would be up to 4 m wide with intermittent wider stretches for passing, parking, and at corners. Small culverts over identified stream crossings would also be constructed. Culverts on Limerick Creek will be designed in line with the following guidance:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2004); and
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).

Figure 3-8 depicts a typical internal track design.

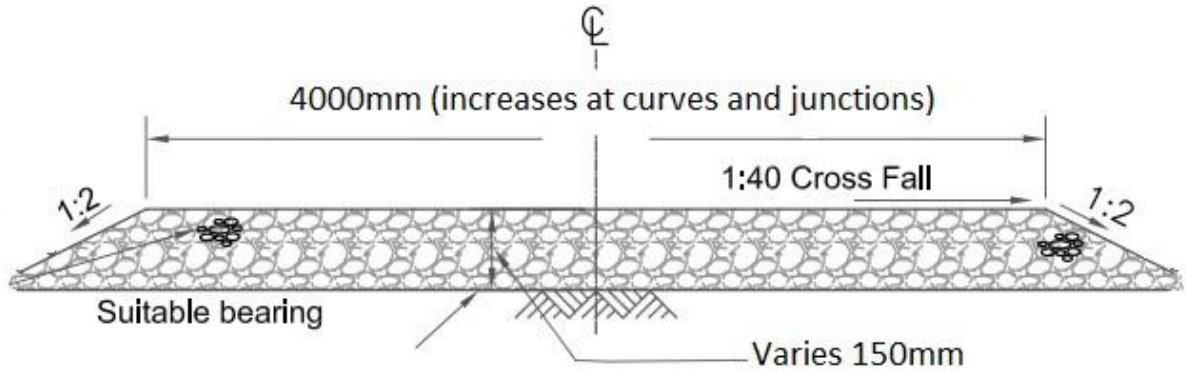

Figure 3-8: Typical track cross section

Vegetation Screen

As denoted in Figure 2-5, there will be a vegetation screen across the southern perimeter of the Site, located within the visual buffer constraint area, adjacent to Waterfall Way. The vegetation screen will include a mix of native species chosen for their suitability for the area (Appendix G) and has been

designed to help screen the Proposed Development from Waterfall Way and neighbouring residences (See Section 6.7).

Within the Construction Environmental Management Plan (CEMP) and the Operational Environmental Management Plan (OEMP), the Proponent will commit to protocols ensuring that the screening is effective throughout the project lifetime (for example that weeds are cleared to allow young trees to grow, and that establishing trees are watered to encourage healthy growth and ensure survival). If required, additional vegetation screening post construction may be planted in other areas of the Site.

Firebreak

A firebreak will be located around the solar array inside the proposed perimeter fence. The firebreak will be ploughed, mown or grazed, and maintained in accordance with the NSW Rural Fire Service (RFS) standards (RFS, 2006). The firebreak is to ensure, as far as possible, that a fire that originates within the Site does not escape into the wider landscape or conversely the firebreak should reduce the potential of a fire that originates offsite encroaching onto the Site. The firebreak will be approximately 5 m wide (refer to Section 6.10 where fire protection is discussed in more detail).

3.1.6 Construction Phase

It is anticipated that the Proposed Development would take between 9 and12 months to construct.

Primary Construction Activities

The primary construction activities would be as follows although the particular order may change:

- Mobilisation; establishment of temporary construction compound and laydown areas;
- Vegetation screen planting;
- Construction of internal tracks and culverts;
- Construction of perimeter fence and establishment of firebreak;
- Establishment of Substation and Support buildings;
- Preparation of array area;
- Installation of foundations piles and mounting system;
- Securing panels to the mounting system;
- Installation and connection of Inverter Containers;
- Trench digging, cable laying and/or cable stringing;
- Grid connection;
- Removal of temporary construction compound and facilities;
- Rehabilitation of disturbed areas of site; and
- Solar Farm Commissioning.

Overall solar farms sit lightly on the land. Ground disturbance is low and will be principally associated with the installation of piles to support the panels which will be limited to less than 1% of the Site depending on the final technology chosen and the configuration of the solar farm design (see Figure 3-1 and Figure 3-2). Other components that would impact directly on the site include access tracks, the substation, support buildings, the temporary construction compound and the perimeter fence (Figure 2-5).

Construction hours

Construction work will be undertaken within standard construction hours:

- Monday to Friday, 7am to 6pm; and

- Saturday, 8am to 1pm.

Any construction activities outside these hours would only be undertaken with the permission of relevant authorities and the notification of neighbours.

Construction resource requirements

Resource requirements and their likely sources are shown in Table 3-2 below. As far as possible local resources will be used for the construction of the Proposed Development.

Table 3-2: Resource requirements and sources for the Proposed Development

Resource	Detail	Likely Source
Plant and Machinery	Pile drivers, mobile crane, earth moving equipment, diesel generators, concreting equipment for Substation and Support buildings	Wider NSW for larger equipment; local where possible
Materials and equipment	Steel, gravel, sand, cables, trees for landscaping, solar panels, inverters, transformers	Gravel, sand, and landscaping equipment will be sourced locally; some materials and equipment, for example solar panels inverters and transformers are manufactured overseas
Labour	Variety of positions required depending on construction activity	National and local contracting staff
Accommodation	Accommodation for workers	Armidale and wider New England

3.1.7 Operational Activities

Operations

The operational period is expected to begin in the first half of 2018. Operational activities include:

- Monitoring of solar production – analysis of SCADA data;
- Export of solar energy to the National Electricity Grid;
- Maintenance of all plant and equipment – visual inspections and/or engineering work as required, analysis of SCADA data; replacement of equipment as required;
- Security – remotely and through routine site inspections;
- Vegetation monitoring and management – routine vegetation management and monitoring in panel areas (small live stock may be permitted to graze within panel areas, for example sheep) and the vegetation buffer areas;
- Erosion monitoring – routine monitoring for scarring beneath the panels and along access tracks and waterways (Section 6.8).

During the operational period there would be approximately 8 to 12 full time staff who may routinely visit the solar farm to carry out activities as listed above. Travel would be in standard 4x4 vehicles. Should there be a requirement for major maintenance work larger trucks and equipment may need to be deployed.

3.1.8 Decommissioning

During decommissioning all above ground infrastructure would be removed to a level of at least 0.5 m below the surface and the site restored to its pre-development state.

Main activities include:

- Disconnection from the existing 132 kV onsite transmission line;
- Dismantling of the substation and support buildings;
- Removal of the solar arrays, piles and cabling;
- Removal of onsite tracks and fences unless agreed otherwise with the landowner; and
- All disturbed ground would be reinstated.

It is anticipated that decommissioning would take up to 6 months. Impacts would generally be similar in effect but shorter in duration than those experienced during construction.

4 Statutory and Planning Framework

4.1 Permissibility

The Proposed Development is sited on land zoned as RU1 Primary Production under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Dumaresq LEP). Solar energy systems are prohibited in the RU1 Zone. However, pursuant to clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone). Therefore, the Proposed Development is permissible with consent.

As an activity that is permitted with consent, the Proposed Development shall be assessed under Division 4.1 of the EP&A Act.

4.2 Commonwealth Legislation

4.2.1 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act protects Matters of National Environmental Significance (MNES), such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others).

Any actions that will, or are likely to have a significant impact on the MNES require referral and approval from the Australian Government Environment Minister. Significant impacts are defined by the Commonwealth guidelines and policies (DotE, 2013) for MNES.

MNES have been assessed in Section 6 of this EIS. The Proposed Development will not have an impact on any of the MNES, including World Heritage properties, National heritage places, Ramsar wetlands, threatened species and ecological communities, migratory species, a Commonwealth marine area or the Great Barrier Reef Marine Park. Furthermore, the Proposed Development is not a nuclear action, nor is it a coal seam gas development or large coal mine that has the potential to impact water resources. A referral or approval under the EPBC Act is not required.

4.2.2 Native Title Act 1993

The *Native Title Act 1993* recognises the rights and interests of Indigenous people to land and aims to provide for the recognition and protection of common law native title rights. Areas of land where native title may exist include public road reserves and other Crown land.

The Proposed Development is located on freehold land and is not subject to Native Title claims.

4.2.3 Renewable Energy (Electricity) Act 2000

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

(a) to encourage the additional generation of electricity from renewable sources;
(b) to reduce emissions of greenhouse gases in the electricity sector; and
(c) to ensure that renewable energy sources are ecologically sustainable.

The objects of the RE Act are achieved through the issuing of certificates for the generation of electricity using eligible renewable energy sources. This requires certain purchasers (called liable entities) to surrender a specified number of certificates for the electricity that they acquire during a year. Under section 17 of the RE Act solar energy is a renewable energy source eligible under the Commonwealth

government's RET. The Proposed Development will need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

4.3 State Legislation

4.3.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals.

As an activity that is permitted with consent, the Proposed Development shall be assessed under Division 4.1 of the EP&A Act.

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

Clause 20 of Schedule 1 states that development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that have a capital investment value of more than $30 million shall be classified as "State Significant Development" (SSD) under Division 4.1 of the EP&A Act.

The Proposed Development has a capital investment value estimated to be approximately $130 million, therefore is classified as SSD. A formal quantity surveyor's report confirming the capital investment value of the Proposed Development is included as part of the development application.

The Minister for Planning is the consent authority for SSD applications. SSD applications are assessed by the Department of Planning and Environment (DPE), in some cases the minister may delegate decision making to Department staff. However, the Minister may also delegate the consent authority function to the Planning and Assessment Commission (PAC) if the application is not supported by Council or the Department has received more than 25 public objections.

4.3.3 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

The ISEPP was introduced to facilitate the effective delivery of infrastructure across NSW. In most cases, the ISEPP overrides the provisions of other Environmental Planning Instruments and provides permissibility and development assessment provisions which apply across the State for different infrastructure sectors.

Pursuant to clause 34(7), development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone). Therefore, the Proposed Development is permissible with consent.

4.3.4 State Environmental Planning Policy (Rural Lands) 2008

The aims of this Policy are as follows:

(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; and

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

Pursuant to clause 13 land identified as being State significant agricultural land is listed in Schedule 2. Schedule 2 does not currently identify any land. The Proposed Development does not compromise any of the above objectives or impact any State significant agricultural land.

4.3.5 State Environmental Planning Policy No. 44 (Koala Habitat) (SEPP 44)

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for *Phascolarctos cinereus* (Koala) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. Developers of land with Koala habitat must consider the impact of their proposal on Koalas, and in certain circumstances, prepare individual Koala plans of management for their land.

Armidale Regional Council is listed as one of the Councils in which SEPP 44 applies. Councils are encouraged to prepare LGA-wide Koala plans of management, and once agreed to by the NSW Department of Planning, they may be used by developers to address Koala issues and individual plans of management would no longer be required. Currently, potential and core koala habitat has not been surveyed in the Armidale Regional Council LGA, or included as a special provision in the Armidale Dumaresq LEP, or the *Armidale Dumaresq Development Control Plan 2012*.

Potential koala habitat is defined as areas of native vegetation (>1 ha) where the trees types listed in Schedule 2 of the SEPP constitute at least 15% of the total number of trees in the upper and lower strata. Core Koala habitat is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population.

The potential impact of the Proposed Development on Koalas and whether the potential Koala habitat identified in the PEA meets the definition of core Koala habitat is assessed in Section 6.3. No core Koala habitat was identified within the Development Footprint.

4.3.6 State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)

SEPP 55 aims to promote remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

Under clause 7, a consent authority must not consent to the carrying out of any development on land unless:

(a) it has considered whether the land is contaminated, and
(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and
(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

A review of the EPA Contaminated Land Record under s 58 of the *Contaminated Land Management Act 1997* (CLM Act) and the List of NSW contaminated sites notified to the NSW Environmental Protection Agency (EPA) under section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding the Site.

A review of premises currently regulated by an Environmental Protection Licence (EPL) under the POEO Act and premises that are no longer required to be licensed under the POEO Act did not reveal any premises within or surrounding the Site.

Pursuant to clause 7 of SEPP 55 there is no apparent reason to consider that land to be impacted by the Proposed Development would be contaminated.

4.3.7 Threatened Species Conservation Act 1995 (TSC Act)

The TSC Act lists and protects threatened species, populations and ecological communities that are under threat of extinction in NSW. NSW Office of Environment and Heritage (OEH) is responsible for administering the TSC Act.

Impacts to species, populations, or endangered communities listed under the TSC Act must be assessed using the '7-Part Test' under section 5A of the EP&A Act. If the assessment determines that a significant impact to a particular species, population or community is likely to result, a Species Impact Statement (SIS) may be required.

The TSC Act establishes a system for biodiversity certification, and establishes the Biodiversity Banking and Offsets Scheme. All major projects require that impacts to biodiversity are assessed in accordance with the Framework for Biodiversity Assessment (FBA) (Section 6.3; Appendix B and Appendix C).

4.3.8 Fisheries Management Act 1994 (FM Act)

The FM Act provides for the protection, conservation, and recovery of threatened species defined under the Act. It also makes provision for the management of threats to threatened species, populations, and ecological communities defined under the Act, as well as the protection of fish and fish habitat in general.

One creek (Limerick Creek) within the Development Footprint is mapped as Key Fish Habitat (KFH), and further KFH is identified downstream of the site (NSW DPI, n.d.). Key Fish Habitat is not defined under the FM Act, however the NSW DPI provides a definition for KFH as generally including habitats that are crucial to the survival of native fish stock, excluding man-made habitats such as off-stream dams and ponds, and those natural waterways which are dry for the majority of the time or have limited habitat value.

Pursuant to section 89J of the EP&A Act a 201 permit will not be required for the Proposed Development for any dredging or reclamation works due to the Proposed Development being classified as SSD. Nevertheless, best practice methods for vehicular and cable crossings (as detailed in Section 6.8.4) will be implemented to reduce impacts to Limerick Creek.

The Proposed Development will not harm marine vegetation of block fish passage, therefore, permits under sections 205 or 219 of the FM Act are not required by virtue of section 89J of the EP&A Act.

4.3.9 Water Management Act 2000 (WM Act)

The WM Act regulates controlled activities on waterfront land in NSW. Waterfront land is defined as the bed of any river, together with any land lying between the bed of the river and a line parallel to, and the prescribed distance (being 40 m) inland of, the highest bank of the river. Cables and vehicular crossings will cross Limerick Creek that is classified as a 3rd order stream.

A controlled activity, within the meaning of the WM Act, includes the deposition or removal of material (whether or not by extractive material) or vegetation from land, or the carrying out of any other activity that affects the quality or flow of water in a water source. Whilst vehicular crossings and the installation

of cables in Limerick Creek constitutes controlled activities undertaken on waterfront land, a permit under section 91 of the WM Act is not required by virtue of section 89J of the EP&A Act.

4.3.10 Native Vegetation Act 2003 (NV Act)

The NV Act regulates the clearing of native vegetation on all land in NSW, except for land listed in Schedule 1 of the Act and biodiversity certified land (within the meaning of Part 7AA of the TSC Act). Clearing is defined as cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation including native grasses and herbage.

Authorisation for clearing is not required for SSD pursuant to section 89J of the EP&A Act. Native vegetation communities associated with the Site are presented in Section 6.3 of this EIS.

4.3.11 National Parks and Wildlife Act 1974 (NPW Act)

The main aim of the NPW Act is to conserve the natural and cultural heritage of NSW.

An initial 'due diligence'" assessment has indicated that there is a low risk that Aboriginal objects and/or sites may occur within the Site. An Aboriginal Cultural Heritage Assessment is provided in Section 6.4 and Appendix D. Pursuant to section 89J of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for SDD.

4.3.12 Heritage Act 1977

Historic relics, buildings, structures and features are protected under the *Heritage Act 1977* (Heritage Act). The Heritage Act defines "environmental heritage" as those places, buildings, works, relics, moveable objects and precincts of Local or State significance. Identified heritage items are listed in the heritage schedule of the local Council's LEP or listed on the State Heritage Register, or by an active Interim Heritage Order.

Under section 139 of the Heritage Act a person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damage or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit. A relic is any deposit, artefact, object or material that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and is of State or local heritage significance. Section 139 does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Order.

The potential impacts on historic heritage are addressed in Section 6.5 of this EIS. No heritage items or places have been identified on the site. The Proposed Development would not have any direct or indirect impacts on any items of historic heritage significance and a section 139 permit is not required pursuant to section 89J of the EP&A Act.

4.3.13 Roads Act 1993

Section 138 of the *Roads Act 1993* sets out the requirement for approval to carry out certain works within the vicinity of a road. Under section 138 a person must not, without consent of the appropriate roads authority:

(a) Erect a structure or carry out a work in, on or over a public road;
(b) Dig up or disturb the surface of a public road;
(c) Remove or interfere with a structure, work or tree on a public road;
(d) Pump water into a public road from any land adjoining the road; and/or
(e) Connect a road (whether public or private) to a classified road.

The Proposed Development will be accessed by Bayley Park Road, an existing public road. Activities that change the structure of Bayley Park Road and its intersection with the Waterfall Way will require approval from the appropriate roads authority under section 138. The roads authority for Bayley Park Road is ARC and RMS is the roads authority for Waterfall Way.

4.3.14 Protection of the Environment Operations Act 1997 (POEO Act)

The objectives of the POEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecological sustainable development.

Pursuant to section 48 of the POEO Act, premises-based scheduled activities, as defined in schedule 1, require EPLs from the NSW EPA. Under cl 17 of schedule 1, electricity generation is scheduled activity requiring an EPL, however solar power is not included in this definition. Therefore, the Proposed Development is not a scheduled activity under the POEO Act, and an EPL is not required.

4.3.15 Noxious Weeds Act 1993 (NW Act)

The NW Act provides the regulatory framework for controlling weeds in NSW. The objects under section 3(a) of the NW Act are *to reduce the negative impacts of weeds on the economy, community and environment by establishing control mechanisms to:*

(i) Prevent the establishment of significant new weeds;
(ii) Prevent, eliminate or restrict the spread of particular significant weeds; and
(iii) Manage widespread significant weeds in NSW.

There are five classes of noxious weeds. A weed that is a Class 1, 2 or 5 noxious weed is a notifiable weed, for which the relevant officer of the Local Control Authority must be notified of their presence within here days of their detection. The plants must be controlled in order to prevent the introduction of those plants into NSW, the spread of those plants within NSW, or from NSW to another jurisdiction.

Weed management is discussed in Sections 6.2 and 6.3.

4.3.16 Rural Fires Act 1997

The *Rural Fires Act 1997* (Rural Fires Act) provides for the preparation, mitigation and suppression of bush and other fires in local government areas and to provide protection of infrastructure and environment, economic, cultural, agricultural and community assets from damage arising from fire.

The Site contains Bushfire Prone Land. However, the Proposed Development is not a subdivision for residential or rural residential purposes nor is it for a special fire protection purpose, hence issue of a bush fire safety authority under section 100B of the Rural Fires Act is not required. Furthermore, a section 100B authority is not required pursuant to section 89J of the EP&A Act. Fire risk is discussed in Section 6.10.

4.3.17 Mining Act 1992

The objective of the *Mining Act 1992* is to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage Ecologically Sustainable Development.

There are three existing Exploration Licences (EL6419, EL 5973 and EL5997) that extend over the Proposal Site. Infinergy, in consultation with the NSW Department of Industry (DRE) and Hillgrove Mines who holds the licences, have established that the proposed development can ‘co-exist’ with the exploration licences that are held over the Site (further detail is provided in Section 5.2.2).

4.4 Other relevant Policies and Plans

4.4.1 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) integrates social, economic and environmental considerations into the decision making process. The principles of ESD are defined within the NSW *Protection of the Environment Administration Act 1991* and have been incorporated into NSW legislation, including the EP&A Act and the EP&A Regulation. The Proposed Development is assessed against each of the principles of ESD in Section 8.3.

4.4.2 New England North West Strategic Regional Land Use Plan

The *New England North West Strategic Regional Land Use Plan* has been developed to help address potential land use conflicts, with a particular focus on managing coal and coal seam gas issues. Of relevance to the Proposed Development, the plan identifies land that is considered to be Strategic Agricultural Land, i.e. land that is highly productive and has both unique natural resource characteristics and socio-economic values.

Two categories of strategic agricultural land have been identified:

- Biophysical strategic agricultural land (BSAL); and
- Critical industry clusters.

There are no critical industry clusters within the New England North West and the Proposed Development does not impact upon BSAL. This EIS considers potential impact to land resources in Section 6.2.

4.5 Summary of Licences and Approvals

A summary of approvals required for the Proposed Development prior to construction are outlined in Table 4-1.

Table 4-1: Approvals required for the Proposed Development

Legislation	Approval
Roads Act 1993	Section 138

Although all relevant environmental impacts have been assessed in this EIS, due to the Proposed Development being SSD, there are a number of approvals and licences not required, which are outlined in Table 4-2.

Table 4-2: Approvals and licences not required for the Proposed Development

Legislation	Approval
Fisheries Management Act 1994	Section 201
	Section 205
	Section 219
Water Management Act 2000	Section 91
Heritage Act 1977	Section 139
National Parks and Wildlife Act 1974	Section 90
Protection of the Environment Operations Act 1997	Section 48

5 Stakeholder and Community Consultation

5.1 Consultation

Effective and broad community and stakeholder consultation provides communities and stakeholders with a clear understanding of a development proposal as well as opportunities to provide feedback to identify issues important to them and, as such, it is an essential part of the EIA process. Infinergy has carried out extensive consultation with the local community, stakeholders from the wider area and relevant Government Agencies in order to understand and respond to community concerns during the design and assessment process leading to this Development Application (DA).

5.1.1 Consultation Objectives

Table 5-1 below outlines how the consultation objectives for the Proposed Development were established. These objectives will be developed into a Community Consultation Plan (CCP) post consent for the construction and operational phases of the project.

Table 5-1: Development of Consultation Objectives

Question	Considerations	Objectives
Who are the community stakeholders for the proposal?	Community stakeholders may come from groups within a range of geographical scales, for example: • Local residents; • Nearby villages or towns; • The broader regional council area; • The wider State level; and • The National level.	• Consultation needs to ensure that all geographical scales are considered in the development of stakeholder and community understanding; • Ensure those community groups that are potentially most affected by the Proposed Development are engaged with as a priority; and • Utilise the SEARs responses as an additional tool to identify stakeholders.
What could be the main issues associated with each group, and how can these issues be clarified?	• Issues may be positive or negative depending on stakeholder perspective, and the potential impacts of the Proposed Development; and • Open and regular dialogue with interested and potentially impacted stakeholders allow an understanding of stakeholder perspectives to be built over time.	• Following the identification of stakeholders, address using appropriate communication tools at a level that correlates to stakeholder interest; • Ensure that consultation with stakeholders is developed in a timely manner (at appropriate geographical scales) so that feedback can be incorporated into assessment and design; and • Ensure that project information is transparent and easy to understand.
What tools could be used to provide and receive information for each stakeholder group and what would be an effective	• Different stakeholder groups will favour different communication methods; and	• Use a wide variety of communication tools in order to ensure that all interested stakeholder groups can participate in the consultation

Question	Considerations	Objectives
communication strategy for each group?	• All stakeholder groups will not necessarily be known at the beginning of the project lifecycle.	process; • Invest in wide range of mediums to facilitate ease of communication with the project team; and • Communication and consultation strategies must be adaptive to ensure they remain relevant as the Proposed Development develops.
How will consultation requirements change over time?	• Stakeholders requirements will be different at different stages of the proposal; and • Consultation strategies will need to be engaged over the course of all project timescales.	• Ensure that communication about project timelines is communicated effectively; • Ensure that the changing needs for communication of potentially affected stakeholders, particularly at the local level, or those that are deemed to have a high sensitivity to the Proposed Development are understood; and • Commit to maintaining effective communication through different project stages.

5.1.2 Consultation to date

Following the consideration of the consultation objectives and the identification of key stakeholders, the Proponent considered that a broad range of activities would be required to ensure that the scope of the Proposed Development could be adequately communicated to all relevant stakeholders.

Activities that have taken place are listed below and then expanded in the text that follows:

- Identification and consultation (ongoing) with neighbouring residents;
- Consultation with local organisations;
- Local Government consultation;
- State Government consultation;
- An onsite visit with statutory consultees through the SEAR's process;
- Public Information Sessions at Hillgrove and in Armidale;
- Advertisements in the local media;
- Establishment of a webpage (www.metzsolarfarm.com.au);
- Provision of an email address through which stakeholders can contact the project team; and
- Media coverage at the local and regional scale.

5.2 Community Consultation

5.2.1 Consultation - Neighbouring Residences

The assessment process has identified three potentially affected neighbouring properties that are adjacent to the Proposed Development. Two properties are situated to the south of the site on the far

side of Waterfall Way, and a further property lies to the north (Figure 5-1). The residents of each property were consulted individually before wider public consultation and there has been ongoing consultation through phone calls, email and visits at each address during the period August 2016 to February 2017.

The location of each residence with respect to the Proposed Development is shown in Figure 5-1. The key issues identified through consultation with the neighbouring residences are listed in Table 5-2, along with mitigation responses and expected outcomes.

Individual chapters on Noise (Section 6.9), and Landscape and Visual Impact Assessment (Section 6.7) detail mitigation responses further.

Table 5-2: Summary of issues arisen through consultation with residents of nearby properties

Residence	Main issues/concerns raised	Summary of issue and mitigation response
Cubba Cubbah	1. Concern raised about operational noise 2. Concern raised about Landscape and visual Impacts including reflection 3. Additional Fire and Flood Risk	1. Operational noise levels of all electrical infrastructure was modelled conservatively accounting for worst case and rare environmental conditions. As such, a buffer of 350m has been applied as the minimum distance an inverter can be placed from a residence, this accounts for rare, but worst case, atmospheric conditions. Additionally and in response to the concern raised in relation to noise, other potentially noise generating electrical infrastructure (the substation) has been intentionally located well away from neighbouring residences (approximately 2 km) and outside a range that could result in noise impacts; 2. The Visual Impact Assessment concluded that non-mitigated, the residence would have views over the south east corner of the Proposed Development but over a relatively narrow vertical depth of field. The assessment concluded that reflection would not be an issue. The following mitigation elements have been designed to reduce visual impact at the residence as far as possible: • Within visible directions from Cubba Cubbah, a 160m wide no development area denoted as the 'visual buffer' has been established within the Development Footprint. This means that there would be a minimum distance between the residence and the nearest potentially visible part of the array of 400 m; • Analysis of predicted viewsheds coupled with site visits led to the development of a vegetation screen, designed to work with existing screening to limit already partially obscured views of the proposed Development; • The Substation and other key ancillary buildings have been located in an area over 2 km away, which will not be visible to the residence due to the topography of the site; and • A commitment to offer additional screening within the property boundary to further reduce visual impacts. 3. Other issues included fire risk from lightning strikes, concern in relation to increased flood risk due to the impermeable nature of the PV panels, and concern about a possible heat island effect from the PV panels.

Residence	Main issues/concerns raised	Summary of issue and mitigation response
		• The Proposed Development will utilise a firebreak around the permitter of the solar array and will meet the fire protection requirements of the NSW RFS standards. • The Proposed Development will be earthed appropriately to protect the solar farm assets from lighting strike and any associated fire risk (see Section 3.1.5). • Hydrological studies (Section 6.8 and Appendix J) demonstrate that the Proposed Development will not increase flood risk or influence the magnitude of any flood event at the site. • Heat island effects associated with PV arrays is an emerging area of scientific research. Literature review indicates that there could be a slight increase in air temperature over the panels during the day; however the effect would dissipate quickly with distance from the panels and is not considered to be an issue beyond the immediate Development.
Kiama	No issues raised by residents. Consultation focused on approach to screening buffer if deemed necessary by land owner following construction.	The Visual Impact Assessment concluded that there would be mid-distance views of the south east corner of the Proposed Development. Infinergy has communicated the findings to the residents of the property and has agreed it will plant screening along the south east corner of the Proposed Development in a location(s) agreed following construction (if wished by the landowner at the time). Further, if required, Infinergy has committed to additional planting within the Kiama property boundary.
Brookside House	No issues raised by residents, nor through technical environmental studies on landscape and noise, due to location of residence outside of visual and noise impact areas	No mitigation introduced as a result of consultation. Impacts to Brookside House are not considered further in this assessment.

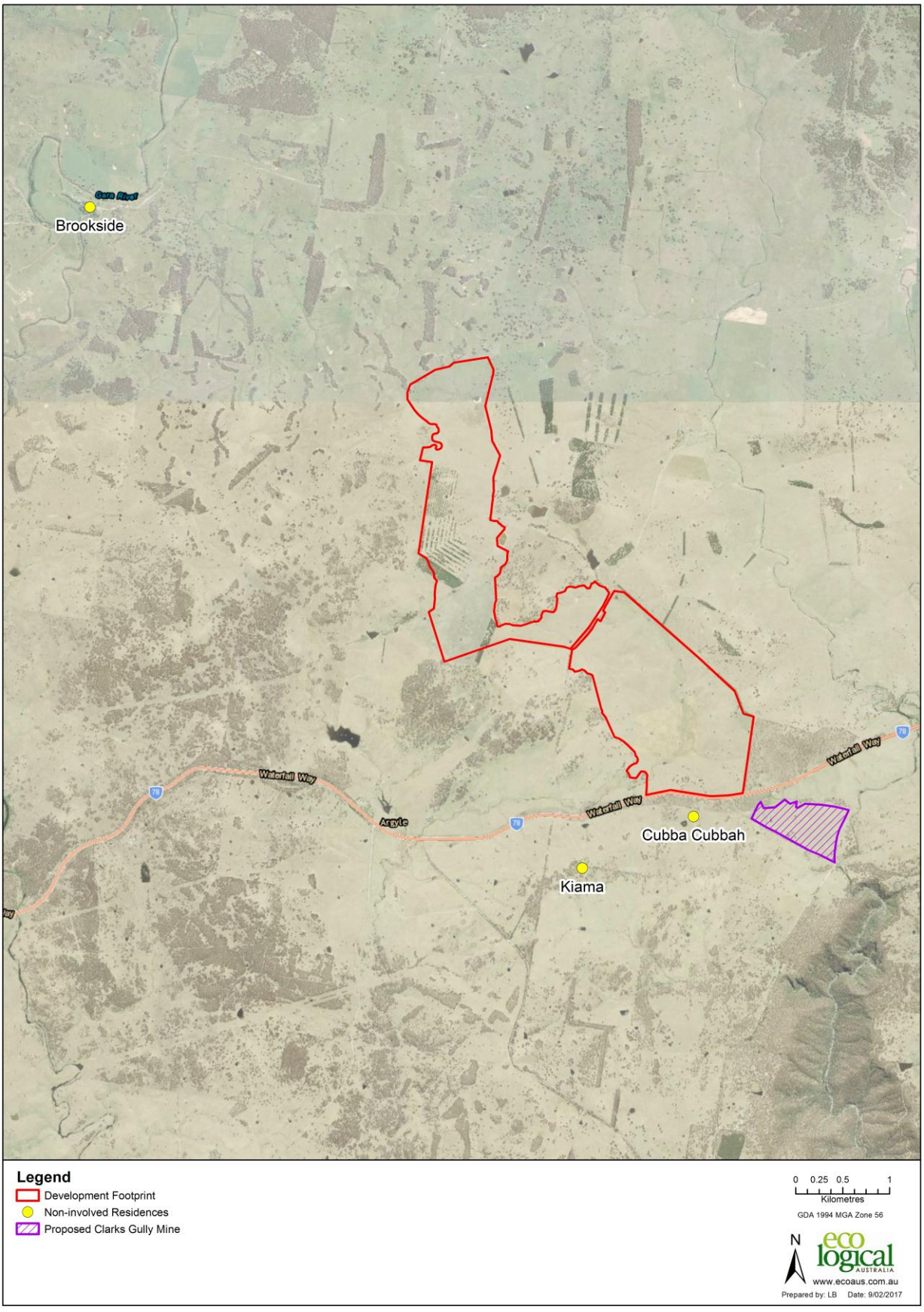

Figure 5-1: Location of nearby neighbouring properties consulted with during assessment process

5.2.2 Consultation - Local Organisations

Hillgrove Mines has proposed an antimony mine at Clarks Gully diagonally opposite the southernmost corner of the Proposed Development Site, as illustrated in Figure 5.1 above. The DA for the proposal is currently being considered by the Armidale Regional Council. Infinergy contacted Hillgrove Mines to inform them that it was considering developing a solar farm on neighbouring land in early August 2016 and have continued to keep them up-to-date as the design of the development progresses.

In addition, consultation revealed that Hillgrove Mines holds three Exploration Licences over the Proposed Development Site. In light of these Licences, the NSW Department of Industry, Resources & Energy (DRE) requested through the SEARs process '*an assessment of the mineral and extractive resources* [at the Site] *by a suitably qualified geologist…'* (Appendix A). In a letter appended to the SEARs the DRE explained that these:

'*…requirements are consistent with Part 3 (13) of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) which requires a test to be carried out by the relevant consent authority regarding the compatibility of a proposed development with potential mining, petroleum production or extractive industry activities*.'

In light of the SEARs request, Infinergy opened discussions directly with the DRE to clarify the level of geological assessment required. In response to these discussions, it was agreed that Infinergy should engage with Hillgrove Mines to understand if the proposed development would be *'compatible'* with current and/or future exploration plans at the Site. Consultation revealed that the Proposed Development would not preclude exploration activities at the site in line with the Exploration Licences held or any potential extraction of mineral resources, should these be found at the site and permission to extract be granted.

Based on the results of the consultation it is clear that it is possible for the Proposed Development to coexist with the interests of the Exploration Licences held by Hillgrove Mines at the site and as such would be '*consistent'* with *Part 3 (13) of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP)*.

In light of the above consultation, DRE wrote to the DPE to confirm that they were satisfied with the level of consultation. As such, the detailed assessment defined by the SEARs in relation to this issue was not required.

The Hillgrove Progress Association has also been consulted in relation to the Proposed Development. Open Information Sessions.

Two open Information Sessions for the Proposed Development were held at the Hillgrove Hall and in the Armidale Mall on the 11th and 12th of January, 2017 respectively. The locations of the Information Sessions were chosen due to the proximity of the Hillgrove Hall to the Site (approximately 4.5 m) and the community within which it will be located and Armidale was chosen as this is the nearest regional centre which is likely to benefit from the potential positive direct and indirect benefits that would be associated with the Proposal (Section 6). The events were advertised on the radio, in the local newspaper and via a flier drop. A copy of the newspaper advertisement and flier are provided in Figure 5-2 and Figure 5-3.

Over 35 people, all of whom were local residents, attended the Hillgrove session between 7 and 9pm. Similarly at least 50 people attended the Armidale session, which ran for 5 hours in the mall in the centre of town (2 - 7pm). Attendees were presented a series of information boards that summarised the Proposed Development providing detail of the design and assessment process. The project team

including the lead environmental consultant were on hand to answer questions and listen to comments or suggestions.

Over the course of the two days no attendees expressed openly negative views of the project with people generally being either supportive of the Proposed Development, or showing interest without expressing either support or negative views. One attendee at the Hillgrove session did raise a question about the visibility of the Proposed Development from Waterfall Way. This viewpoint has been assessed as part of the visual impact assessment provided in Appendix G. Without mitigation the Proposed Development would be highly visible from Waterfall Way. However, the solar panels would be orientated away from Waterfall Way and no more than 3 m in height; in addition, to mitigate this impact the Proponent has designed vegetation screening along this section of the Site to help limit views of the Proposed Development from the road.

A large number of attendees, particularly in Armidale, spoke of their enthusiasm in relation to the potential for local jobs. On this topic, there was also concern raised (two attendees) about whether these jobs would provide opportunities for local workers. Although the Engineering Procurement Construction (EPC) Company to build the Proposed Development has not been determined, the proponent will work with the selected EPC Company to ensure that local contractors/suppliers/workers are utilised wherever feasible. This will include a requirement that the EPC Company ensure local contractors/suppliers/workers are provided with timely information regarding potential opportunities.

Attendees at each session were informed of the projects website and provided with contact details for the project team should they have any further issues they would like to raise. The website will be updated regularly and will include a copy of this EIS post submission.

Advertisements about the Proposed Development

In order to ensure as the greatest attendance at the Information Sessions as possible, the sessions and the project details were advertised as detailed below:

- Advertised on the local ABC radio 3 times daily for 3 days leading up to the events
- Advertised in the Armidale Express, on the 10th and 11th of January 2017 (Figure 5-2); and
- A flier drop to 150 residents in Hillgrove and the wider local area (Figure 5-3).

SOLAR FARM INFORMATION SESSIONS

Infinergy Pacific is developing a large scale solar farm east of Armidale at Metz. The development will be approximately 100 MW and will potentially provide enough energy to power 40,000 average households in New South Wales annually.

To find out more about the 'Metz Solar Farm' the Infinergy Pacific project team would like to invite you to information sessions at:

- Hillgrove Village Hall
  Wednesday 11th January 7-9pm
- Armidale Mall
  Thursday 12th January 2-7pm

The information sessions will provide the community the opportunity to view and comment on the proposed plans. The project team will be on hand to listen to comments and answer questions.

For more information:
information@infinergypacific.com
www.metzsolarfarm.com.au

Pacific INFINERGY

Figure 5-2: Newspaper advertisement in the Armidale Express

Pacific INFINERGY

METZ SOLAR FARM OPEN INFORMATION SESSION

Dear Sir/Madam

Infinergy Pacific is in the process of developing a planning application for a utility scale photovoltaic (PV) solar farm 18 km east of Armidale within the Metz area.

The proposed solar development would be approximately 100 MW and potentially provide enough energy to power the equivalent of 40,000 average New South Wales households each year. The map below shows the boundary of landholding within which the solar farm would be located; approximately 4km to the north west of Hillgrove, on the northern side of Waterfall Way.

Photo showing northern area of site

Solar farm search area

To find out more about the "Metz Solar Farm" Infinergy Pacific would like to invite you to an open information session at:

- Hillgrove Hall
  Wednesday 11th January 7-9pm

The information session will provide the community an opportunity to view and comment on our proposed plans and to provide valuable feedback to our project team, who will be on hand to listen to comments and answer any questions.

If you're not able to attend the Hillgrove session you will also find us in Armidale on the following day:

- Armidale Mall
  Thursday 12th January 2-7pm

We would warmly welcome your participation at either of the information sessions.

Should you require any further information please don't hesitate to contact our team via e-mail or myself directly on 0418 632 727.

Jane Ross
Project Director

For more information:
information@infinergypacific.com
www.metzsolarfarm.com

Figure 5-3: Flier dropped to residents in Hillgrove and the wider local area

Metz Solar Farm webpage and email address

A webpage has been established (www.metzsolarfarm.com.au) in order to provide project information and promote communication and consultation relating to the Proposed Development. The website provides a clear description of the Proposed Development along with a 'news' page with up-to-date information about its progress. A copy of the DA and the supporting documents will be uploaded to the website once it has been submitted and accepted for consideration to DPE.

The webpage address has been extensively advertised in a variety of ways including flyers and newspaper and radio advertisements. The webpage includes a contact page which contains a dedicated email address that automatically generates an email which can be sent to the project team.

Local Government Consultation

Armidale Regional Council has been formally briefed on the Proposed Development. A meeting with the Appointed Administrator and the Development Manager for Town Planning was conducted on the 10th of August 2016. This meeting detailed the location and general details of the Proposed Development. Since the initial briefing, updates have been provided directly to ARC. Members of the ARC planning team also attended the information session held in the Armidale Mall on the 12th of January 2017.

State Government Consultation

A meeting was held with the Member for Northern Tablelands on the 12th August 2016. The Member was briefed on the location and general details of the Proposed Development. He indicated his general support for the Proposed Development at this meeting. Additional updates have been provided during a meeting on the 25th November 2016 and various emails dating back to August 2016.

5.3 Agency Consultation

Infinergy attended a pre-application meeting with the DPE for the Proposed Development to discuss the Proposed Development and understand the NSW approval process for SSD's on the 11th of March 2016. As the Proposed Development is a SSD the Proponent prepared a scoping study and SEARs were requested (for a 300 MW solar farm) in August 2016.

As part of the SEARs process a site visit was organised by DPE. This meeting was held on the 20th September 2016, with the following Agencies in attendance:

- Department of Planning and Environment;
- Office of Environment and Heritage;
- Armidale Region Council; and
- Department of Industry.

The site visit gave the Agencies the opportunity to see the Site and understand the scope of the development being proposed. It also provided a forum for the Agencies, the Proponent and the lead consultants to discuss specific issues in relation to the requirements for the EIA.

Infinergy has further consulted with, and subsequently applied to, the NSW Department of Industry - Lands to have several Crown roads within the Site purchased and closed down on behalf of the landholder.

5.3.1 Secretary's Environmental Assessment Requirements

As the Proposed Development is classified as SSD, a Preliminary Environmental Assessment (PEA) was prepared and SEARs were requested (for up to a 300 MV PV solar farm). The SEARs were provided by DPE on the 28th of September 2016. 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 Proposed Development.

A summary of key issues raised in the SEARs and the section of the EIS where they are addressed is provided in Table 5-3.

In addition to the SEARs, additional issues raised by statutory agencies through formal correspondence attached to the SEARs are summarised in Table 5-4, together with the relevant section which addresses that issue in the EIS.

Table 5-3: Secretary's Environmental Assessment Requirements

Issue	Requirement	Section in EIS
General Requirements	• A full description of the development, including: o Details of construction, operation, upgrading and decommissioning; and o A site plan showing all infrastructure and facilities (including site access location, site access routes, site compounds, laydown areas, substation, carpark and any other ancillary infrastructure that would be required for the development).	Section 3 Figure 2.5
	• A strategic justification of the development focusing on site selection and the suitability of the proposed site, including the permissibility of the proposal and the capacity of the existing electricity transmission network with consideration for other potential electricity generation projects.	Section 2
	• An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: o A description of the existing environment likely to be affected by the development; o An assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; o Consideration of the cumulative impacts of other developments (where relevant); o 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 o A description of the measures that would be implemented to monitor and report on the environmental performance of the development.	Section 6
	• A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and	Section 7
	• The reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development.	Section 8

Issue	Requirement	Section in EIS
Key Issues	**Constraints**	
	• A detailed map identifying the key environmental and other land use constraints that have informed the final design of the development, including but not limited to existing electricity transmission lines, the project site boundary, proposed infrastructure, site access, vegetation types, residences within 2 km of the project site, existing waterbodies, proposed perimeter planting, Crown public roads and all identified Aboriginal heritage items.	Section 2.5 Figure 2-1
	Land	
	• A baseline assessment of the soil and land capability prior to development; • An assessment of the impact of the development on agricultural land, flood prone land and mineral resources and exploration activities in proximity to the project site, having regard to the requirements of the Department of Industry requirements (attachment 2); and • Consideration of the compatibility of the development with the existing agricultural land uses on and adjacent to the site both during operation and after decommissioning, particularly in relation to the zoning provisions applying to the land.	Section 5.1.2 Section 6.2
	Biodiversity	
	• An assessment of the likely biodiversity impacts of the development, particularly in regard to all native vegetation present including Endangered Ecological Communities (EECs) and isolated trees, and any steps taken to avoid, mitigate or offset any identified impacts, having regard to the NSW Biodiversity Offsets Policy for Major Projects, and in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by the Department.	Section 6.3 Appendix B Appendix C
	Heritage	
	• An assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.	Section 6.4 and 6.5 Appendix D
	Transport	
	• An assessment of the site access route, the site access point off Waterfall Way, the likely traffic volumes and transport impacts of the development on the capacity, condition, safety and efficiency of any local	Section 6.6

Issue	Requirement	Section in EIS
	and State road networks including Waterfall Way and Bayley Park Road, having regard to the requirements of Roads and Maritime Services (attachment 2), and a description of: o The measures that would be implemented to mitigate any impacts during construction, upgrading or decommissioning; and o Any proposed road or intersection upgrades developed in consultation with the relevant road authorities (if required).	Appendix E Appendix F
	Visual	
	• 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 to demonstrate it has been developed in consultation with affected landowners.	Section 6.7 Appendix G
	Water	
	• An assessment of the likely impacts of the construction, operation and decommissioning of the development on: o The quality and quantity of groundwater and surface water resources (including any nearby watercourses), adjacent water users, riparian land, and aquatic and groundwater dependent ecosystems, and measures that would be implemented to mitigate any impacts; o Annual volumes of surface water and groundwater required, details of water supply arrangements, 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); and o Details on proposed creek crossing locations and designs (if required).	Section 6.8
	Noise	
	• An assessment of the construction, upgrading and decommissioning noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and sub-station noise impacts in accordance with the NSW Industrial Noise Policy (INP), and a description of the measures that would be implemented to mitigate any impacts if the assessment shows construction, upgrading or	Section 6.9 Appendix H

Issue	Requirement	Section in EIS
	decommissioning noise is likely to exceed applicable criteria.	
	Hazards	
	• Consideration of any relevant hazards including electrical fire and impacts from electromagnetic interference.	Section 6.10, Section 6.11, Section 6.12 and Section 6.13
Consultation	In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners. In particular, you must undertake detailed consultation with affected landowners surrounding the development, and Armidale Regional Council. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Section 5

Table 5-4: Key issues raised by statutory agencies

Agency	Issues raised	Section in EIS
NSW Department of Industry (Division of Resources & Energy)	Consultation with the Division	Section 5
	Identification of any Mining Leases (MLs) and Exploration Licenses (ELs) affecting the project site and the outcomes of consultation with the lease/licence holder.	Section 1.3 Section 5 Section 6.2
	Identification of any known mineral resources within or in the vicinity of the site.	Section 5.2.2
	Identification of any areas with high potential for the discovery of mineral resources within or in the vicinity of the site.	Section 5.2.2
	Demonstration of how the project (including potential biodiversity offsets associated with the proposal) will avoid or minimise impacts on mineral resources, mining titles and exploration licence activities for the life of the project.	Section 5.2.2
	A signed statement by the geologist stating their considered opinion regarding the prospectivity of the land.	Consultation with NSW Department of Industry (Division of Resources & Energy) negates the need for this action
NSW Department of Industry (Division of Lands)	Crown roads identified within the Development Footprint. Application to close these roads on behalf of the landowner has been submitted with the Department of Industry (Division of Lands, Grafton Office), Application Number W572612.	Not addressed further in this EIS.
Roads & Maritime Services	That the Traffic Impact Assessment include: • The total impact of existing and Proposed Development on the road network with consideration for a 10 year horizon; • The volume and distribution of construction and operational traffic generated by the proposed development; • Intersection sight distances at key intersection/s providing access to the site; • Existing and proposed site access standards; and • Details of proposed improvements to affected intersections.	Section 6.6 Appendix E Appendix F

Agency	Issues raised	Section in EIS
	• Details of servicing and parking arrangements. • Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling. • Impacts of road traffic noise and dust generated along the primary access route/s.	
	Consideration for a Driver's Code of Conduct, including: • A map of the primary access route/s highlighting critical locations; • Safety initiatives for transport through residential areas and/or school zones; • An induction process for vehicle operators & regular toolbox meetings; • A complaint resolution and disciplinary procedure; and • Any community consultation measures for the peak construction period.	Appendix F It is concluded through the Traffic Assessment that a Driver's Code of Conduct should be conditioned as part of the Consent.
	A Road Safety Audit to accompany the TIA to address any road safety concerns.	Section 6.6 Appendix E
Office of Environment & Heritage	**Biodiversity**	
	Biodiversity impacts related to the proposed project can be assessed and documented in accordance with the *Framework for Biodiversity Assessment*, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the *Threatened Species Conservation Act 1995.*	Section 6.3 Appendix B Appendix C
	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 project and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the *Guide to investigation, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW 2011) and consultation with OEH regional officers.	Section 6.4 Appendix D
	Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage*	Section 6.4

Agency	Issues raised	Section in EIS
	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 EIS.	Appendix D
	Impacts on Aboriginal cultural heritage values are to be assessed and document in the EIS. The EIS 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.	Section 6.4 Appendix D
	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 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	Section 6.5 No Impacts to State or locally significant heritage items were identified. Therefore further assessment of impacts were not undertaken.

Agency	Issues raised	Section in EIS
	results of these test excavations.	
	Water and soils	
	The EIS must map the following features relevant to water and soils including: • Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map); • Rivers, streams, wetlands, estuaries ; • Groundwater; • Groundwater dependent ecosystems; and • Proposed intake and discharge locations.	 Section 6.2 (Figure 6-2) Section 6.8 (Figure 6-24) Section 6.8 (Figure 6-25) Section 6.8 (Figure 6-25) Not proposed. Appendix I
	The EIS must describe background conditions for any water resource likely to be affected by the project, including: • Existing surface and groundwater; • Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations; • Water Quality Objectives (as endorsed by the NSW Government) including groundwater as appropriate that represent the community's uses and values for receiving waters; and • Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.	 Section 6.7.2 Not proposed. Section 6.7.2 Water quality data not available for groundwater resources. Section 6.7.1 Appendix I
	The EIS must assess the impacts of the project on water quality, including: • The nature and degree of impact on receiving waters for both surface and groundwater. Demonstrating how the project protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are not currently being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction; and • Identification of proposed monitoring of water quality.	 Section 6.7.3 Appendix I Water quality monitoring is not proposed.
	The EIS must assess the impact of the project on hydrology, including:	

Agency	Issues raised	Section in EIS
	• Water balance including quantity, quality and source; • Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas; • Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems; • Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplain that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches); • Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water; • Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options; and • Identification of proposed monitoring of hydrological attributes.	Section 6.8.3 Appendix I Not proposed.
	Flooding and coastal erosion	
	The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005: • Flood prone land; • Flood planning area, the area below the flood planning level; and • Hydraulic categorisation (floodways and flood storage areas).	Section 6.8.3 Appendix I Flood prone land mapping is not available for the site, nor is there a local history of flooding at this site.
	The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event.	Section 6.8 Appendix H Appendix I
	The EIS must model the effect of the proposed project (including fill) on the flood behaviour under the following scenarios: • Current flood behaviour for a range of design events as identified above. The 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Section 6.8 Appendix H Appendix I

Agency	Issues raised	Section in EIS
	Modelling in the EIS must consider and document: • The impact on existing flood behaviour for a full range of flood events including up to the maximum 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; and • Relevant provisions of the NSW Floodplain Development Manual 2005.	Section 6.8 Appendix H Appendix I
	The EIS must assess the impacts on the proposed project on flood behaviour, including: • Whether there will be detrimental increases in the potential flood affection of other properties, assets and infrastructure; • Consistency with Council floodplain risk management plans; • Compatibility with the flood hazard of the land; • Compatibility with the hydraulic functions to flow conveyance in floodway's 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 SES; and • Any impacts the development may have on the social and economic costs to the community as consequences of flooding.	Section 6.8 Appendix H Appendix I ARC has not prepared a floodplain risk management plan for the Metz locality. Section 6.8.3 The flooding impact has been assessed as negligible and will not impact existing emergency management arrangements for flooding. The development will not increase risk to life from flood. The flood risk of the development is low. Emergency management, evacuation and access, and contingency measures are not required. Any impacts from flooding (e.g. damage to infrastructure) will be restricted to on-site.

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5.4 Aboriginal Community Consultation

Consultation with the Aboriginal community was conducted by Remnant Archaeology Pty Ltd (RA) in accordance with guidance set out in the DECCW (2010a) document *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. A summary of the consultation is provided in the draft Aboriginal Cultural Heritage Assessment (ACHA) provided in Appendix D. Registered Aboriginal Parties (RAPs) have had the opportunity to provide feedback on the draft ACHA prior to its finalisation and submission to OEH.

The ACHA identifies ongoing consultation commitments and recommends the development of a Cultural Heritage Management Plan (CHMP) to guide this process.

5.5 Ongoing Stakeholder Consultation

In addition to the consultation activities summarised above, Infinergy is committed to continued community and stakeholder consultation. It will continue to provide information and engage in consultation with the community and interested stakeholders with respect to the Proposed Development's Environmental Assessment.

6 Environmental Assessment

6.1 Assessment methodology

The **Environmental Assessment** (Section 6) has been undertaken to assess potential environmental impacts for a range of specific issues identified within the SEARs and through site investigations. These are:

Issues	Section
Land use and soils	6.2
Biodiversity	6.3
Aboriginal cultural heritage	6.4
Historic heritage	6.5
Traffic and access	6.6
Visual impact	6.7
Water resources	6.8
Noise	6.9
Bushfire and electrical fire	6.10
Electromagnetic interference	6.11
Air quality	6.12
Waste and resource use	6.13
Socio economic factors	6.14

A description of ***existing conditions*** is provided for each issue, considering existing levels of development, as well as antecedent conditions as relevant. This provides an opportunity to consider both environmental state and function in the absence of the Proposed Development.

In accordance with the requirements of the SEARs, all ***potential impacts*** associated with the Proposed Development are considered across the entire lifespan of the development, considering construction, operational and decommissioning phases. Potential impacts are considered in addition to existing environmental conditions, representing potential cumulative impacts. Furthermore, where known future development is proposed (i.e. Clarks Gully Mine), consideration is given to potential cumulative impacts as relevant.

Mitigation measures are proposed to effectively manage all potential environmental impacts. These may include design considerations, monitoring strategies, construction safeguards, consultation, training and awareness programs, modified work practices, management plans or other relevant management strategies. A full list of mitigation and environmental management strategies and commitments is provided in **Environmental Management** (Section 7).

The **Project Justification** (Section 8) provides triple-bottom-line (environmental/social/economic) evaluation of the Proposed Development in order to fully describe potential benefits and impacts to the environment and the local, regional and NSW community.

Potential **residual environmental risks** following mitigation are investigated using likelihood/consequence analysis to describe the potential magnitude of residual impacts. Where the mitigated impact remains high or extreme, further justification is provided to contextualise project risks going forward.

Justification against high level social and economic expectations is then considered against the principles of **Ecologically Sustainable Development**, and more specifically, considering the particular **socio-economic** attributes associated with the Proposed Development.

Finally, **potential alternatives** are considered to ensure that approval of the Proposed Development is not detrimental when assessed against potential alternative land uses or development.

The **Conclusion** (Section 9) integrates the relevant **Statutory and Planning Framework** (Section 4) and commitments made through the **Stakeholder and Community Consultation** process (Section 5) with the findings of the **Environmental Assessment** to provide a concise statement regarding the suitability of the Proposed Development and outlines any key points for consideration as part of the development approval process.

6.2 Land Use and Soils

6.2.1 Introduction

In accordance with the requirements of the SEARs, this section establishes a baseline assessment of current land use, soils and land capability prior to the Proposed Development.

Potential impacts associated with the Proposed Development on agricultural land, flood prone land and mineral resources and exploration activities in proximity to the Site are considered to ensure the compatibility of the development with the existing agricultural land use on and adjacent to the Site both during operation and after decommissioning.

The Site and surrounding land, is zoned RU1 Primary Production under the provisions of the Armidale Dumaresq LEP. Solar energy systems are prohibited in the RU1 Zone. However, a SSD, development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed rural residential zone). Therefore, the Proposed Development is permissible with consent.

6.2.2 Existing environment

The Site is located within an undulating landscape, where elevation ranges between 990 - 1090 m Australian Height Datum (AHD). The Site has been historically cleared and grazed for sheep and cattle production and is typical of farmland in the region. A number of stock dams have been developed across the Site. A considerable portion of the Site has been cultivated for improved pasture and other food crops. Surrounding land uses include:

- Agriculture;
- Transportation – Waterfall Way is a major road connecting Armidale to the coast;
- Mineral exploration and mining; and
- Residential – the village of Hillgrove is located approximately 4.5 km south.

Land Use

The Site and surrounding land, is zoned RU1 Primary Production. Under the provisions of the Armidale Dumaresq LEP (2012) the objectives of this 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 allow for non-agricultural land uses that will not restrict the use of other land in the locality for agricultural purposes.*

Historically, agriculture has been a significant industry in the Armidale region and still plays an important role in both the social and economic wellbeing of the region today. The Proposed Development involves a temporary diversification in land use of up to 507 ha of a larger 2946 ha landholding for the duration of the project life (estimated to be 30 years). This changed land use may temporarily reduce agricultural production. However, a lease agreement has been established to compensate the landholder for foregone income due to reduced agricultural production. In addition, once constructed limited sheep grazing may continue within the Site to control vegetation beneath the solar array.

The Armidale Dumaresq LGA covers 423,084 ha, of which 257,407 ha is used for dryland and irrigated agricultural production (ABS, 2013). Impacts of the Proposed Development on agricultural production at a regional and state level are therefore not significant. At the conclusion of the life of the project, the Site would be decommissioned in order to permit the resumption of grazing activities or other agricultural uses. Therefore, the Proposed Development does not conflict with the objectives of the RU1 Zone as described by the Armidale Dumaresq LEP (2012).

Mineral Resources

The Hillgrove Mineral Field is a roughly elliptical corridor (9 km long by 6 km wide) of hydrothermal vein and shear hosted deposits. The corridor is bounded by two large regional faults of east-north-east strike to the north (Hillgrove Fault) and south (Chandler Fault). Mid Permian hydrothermal activity has resulted in gold, antimony, arsenic and tungsten mineralisation in a north-west trend, tension gash structures. The corridor predominates in an area of relative weakness in the Mid Carboniferous Girrakool sediments wedged between two late Carboniferous Hillgrove Suite granite bodies. The Project Area sits within the Hillgrove Adamellite, a medium to coarse grained granite containing bluish quartz, feldspar and variable biotite, with accessory amphibole, ilmenite and graphite. The Hillgrove deposit contains state significant gold, antimony and tungsten resources, and is the largest antimony resource outside of China.

Hillgrove Mines Pty Ltd holds three Exploration Licences (EL6419, EL5937 and EL5997) that extend over the Site. As discussed in Section 5.2.2, Infinergy have consulted with Hillgrove Mines and the Department of Industry, and it has been established that the Proposed Development can coexist with the Exploration Licences held over the site.

Soil Landscapes

The Site lies within the New England Orogen and is located on the Hillgrove Adamellite and Sandon Beds, to a lesser extent Girrakool Beds underlie parts of the Site.

The *Soil Landscapes of the Armidale* mapsheet (King, 2009) covers approximately 80% of the Site, and no mapping is available for the very northern portion. However, site observations and extrapolation from existing mapping, indicates that the northern portion of the Site is likely to be classified as the Middle Earth and Argyle landscapes.

The *Soil Landscapes of the Armidale* mapsheet (King, 2009) identified the following soil landscapes occurring over the project area (Figure 6-1):

- Middle Earth;
- Cubba Cubbah;
- Argyle;
- Devil's Elbow; and
- Limerick Creek.

The Middle Earth landscape is mapped as occurring on the undulating plains, rise and footslopes of the Sandon Beds, and the Cubba Cubbah soil landscape occurring on the flat to gently undulating plains and low rises of the Hillgrove Adamellite. The Limerick Creek soil landscape occurs to a lesser extent, intersecting the Middle Earth and Cubba Cubbah soil landscapes. The Limerick Creek soil landscape occurs as drainage depressions on the Hillgrove Adamellite and associated alluvium. Kurosols are associated with each of these soil landscapes.

The Devil's Elbow soil landscape is mapped as occurring on the rolling low hills and rises of the Hillgrove Adamellite, with rudosols and tenosols associated with this soil landscape. The Argyle soil landscape is mapped as occurring on the rolling low hills and occasional hills on greywacke/chert and related sediments, and kandosols are associated with this landscape.

These soil landscapes have an erodibility potential ranging from moderate to very high. The site is dominated by Kurosols, Kandosols, and to a lesser extent Rudosols and Tenosols.

Land and Soil Capability

Land capability classes aim to classify land according to its inherent ability and protection from erosion and other forms of land degradation. The classification of any land is based on biophysical features which determine the limitations and hazards of that land. The main hazards and limitations include: water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils, rockiness, and mass movement. The eight class system recognises four types of land uses with land capability decreasing from Class 1 to Class 8 (OEH, 2012):

- Class 1 – 3: land suitable for cultivation;
- Class 4 – 5: land suitable for grazing and restricted cultivation;
- Class 6: land suitable for grazing; and
- Class 7 – 8: land not suitable for agricultural production.

Land and soil capability mapping corresponds to each soil landscape, based on the most limiting factor. The majority of the site has moderate to severe limitations (Class 4 and Class 5) for more intensive use other than grazing, but remains suitable for a variety of land uses if careful management to prevent long-term degradation is implemented. The Site is interspersed with patches of lower capability land (Class 6), and land capability is restricted to low impact land uses. The land and soil capability for each soil landscape is provided in Table 6-1.

Table 6-1: Land and soil capability classes within the Site

Hazard Classification	Soil Landscape				
	Middle Earth	Cubba Cubbah	Argyle	Devil's Elbow	Limerick Creek
Soil Acidification	4	4	5	5	4
Water Erosion	5	4	6	5	5
Soil Structure Decline	4	3	4	3	4
Wind Erosion	2	2	1	3	1
Shallow soils/Rockiness	2	4	4	5	1
Salinity	1	1	1	3	4
Mass Movement	1	1	1	1	1
Water-logging	3	2	2	2	6
LSC Class	**5**	**4**	**6**	**5**	**6**
Capability	**Moderate - low**	**Moderate**	**Low**	**Moderate - low**	**Low**

Source: Land and Soil Capability Mapping for NSW (OEH, 2013)

Biophysical Strategic Agricultural Land

The Project Area contains land suitable for grazing, but does not contain any Biophysical Strategic Agricultural Land (BSAL). The closest mapped BSAL is approximately 4 km to the south.

Acid Sulfate Soils

The Australian Soil Resource Information System (ASRIS) online data base indicates that there is a low to extremely low probability of occurrence of acid sulfate soils (Fitzpatrick, Powell & Marvanek 2011). The Site is approximately 100 km from the coast at high altitude and as such the potential for acid sulfate soils to occur is negligible. Additionally, based on the soil landscapes, iron sulphide minerals or their oxidation products are not abundant in the soil profile, hence sulfuric acid is unlikely to be produced as a result of ground disturbance.

Contaminated Land

A review of the EPA Contaminated Land Record under Section 58 of the CLM Act and the List of NSW contaminated sites notified to the NSW EPA under Section 60 of CLM Act did not reveal any registered contaminated land sites within or surrounding the Site.

A review of premises currently regulated by an Environmental Protection Licence (EPL) under the POEO Act and premises that are no longer required to be licensed under the POEO Act did not reveal any identified premises within or surrounding the Site.

Pursuant to Clause 7 of the *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land to be utilised by the Proposed Development would be contaminated.

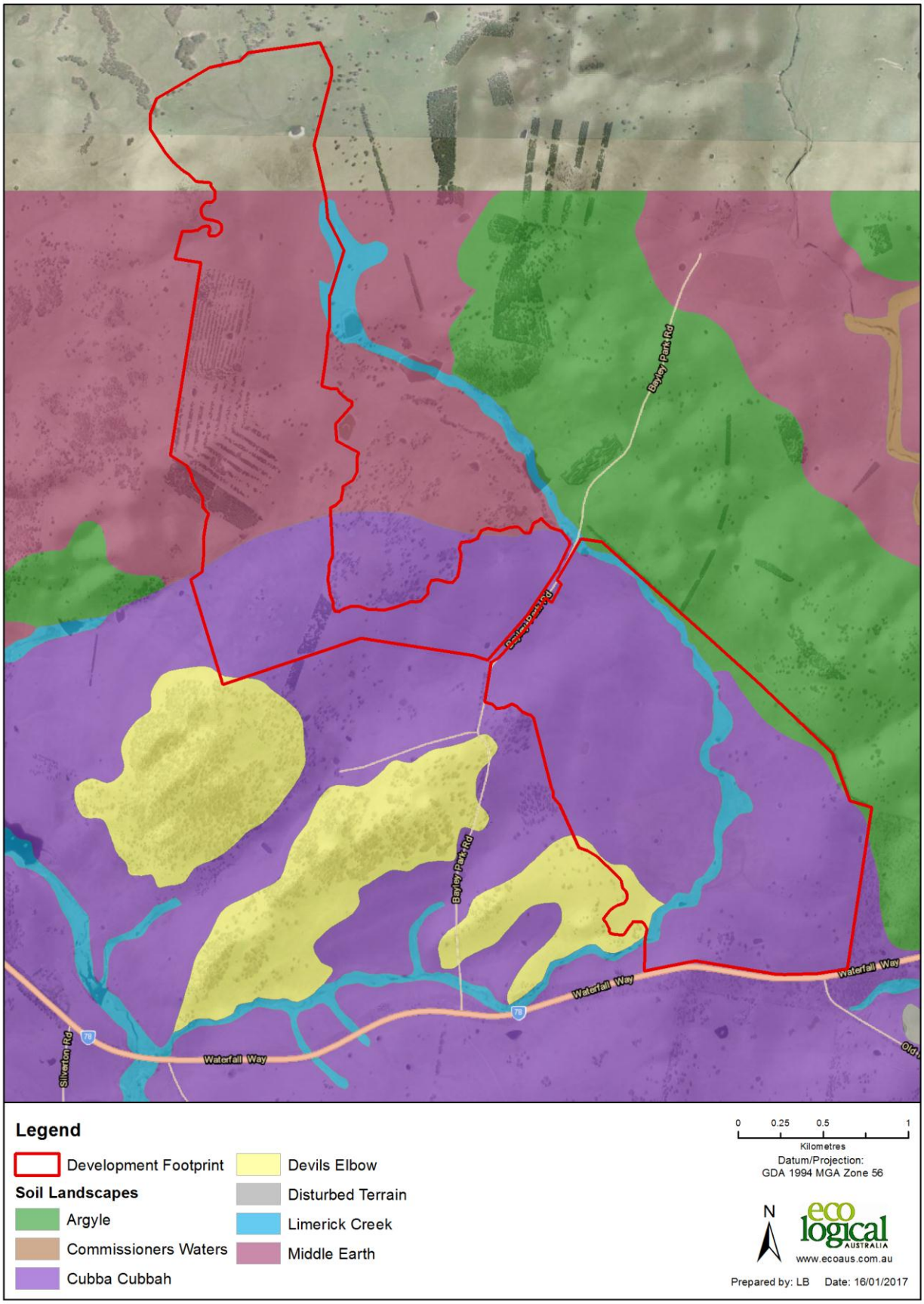

Figure 6-1: Soil landscapes in the Development Footprint and surrounds (King, 2009).

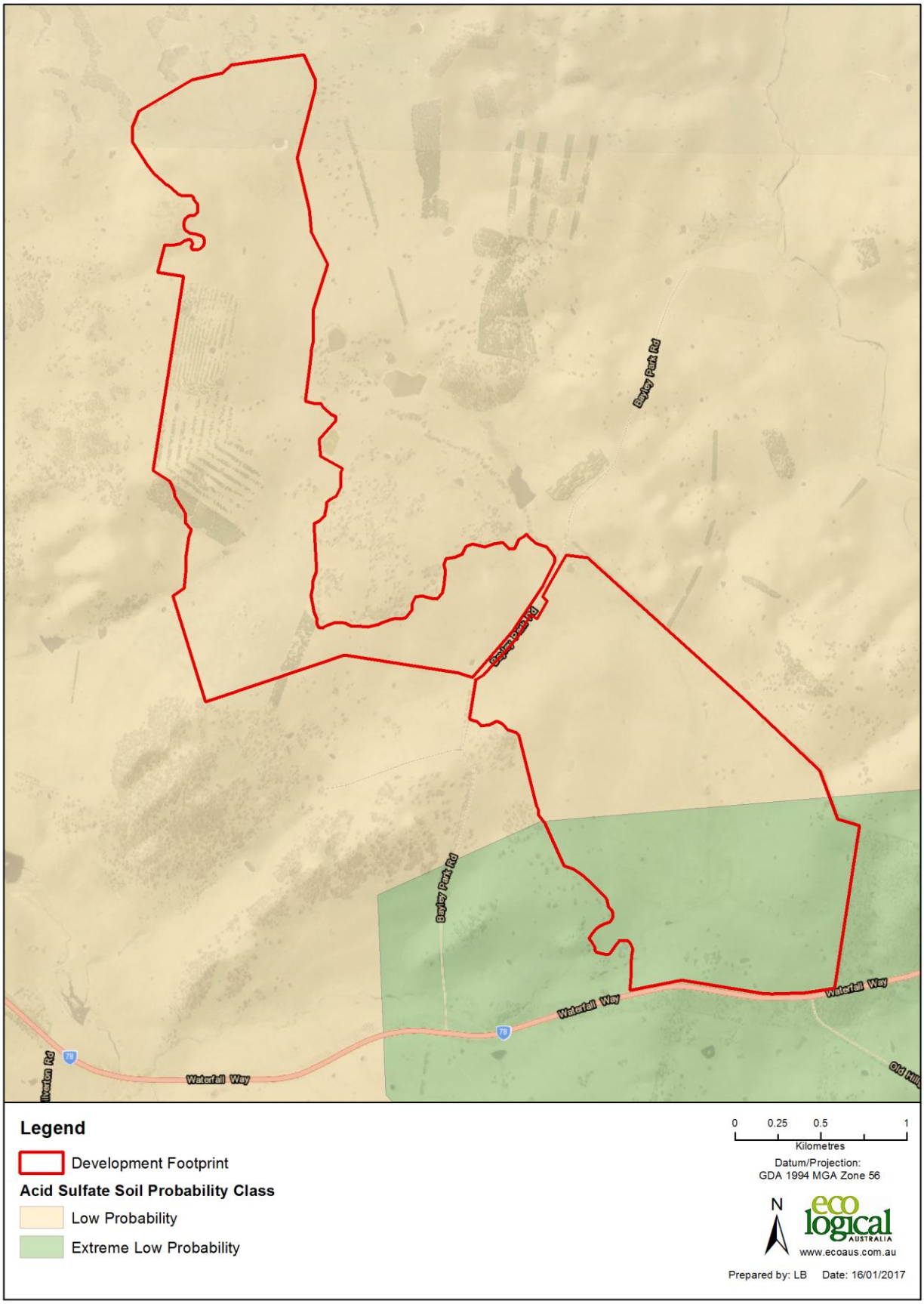

Figure 6-2: Probability of acid sulfate soils within the Development Footprint (Fitzpatrick, Powell & Marvanek, 2011)

6.2.3 Potential impacts

Land use conflicts

The Proposed Development will have a life span of approximately 30 years and will not involve permanent changes to the landscape. The size of the Development Footprint (507 ha) will not compromise or significantly diminish the availability of land for primary production purposes within the Armidale Regional LGA. Furthermore, due to sunshine harvesting being a passive land use, the Proposed Development will not reduce or impact any BSAL, or compromise the capacity for immediate neighbours to conduct existing or proposed primary production in the immediate vicinity. Once the Proposed Development is decommissioned, the land will be returned to a suitable state to permit a return to agricultural use.

Land use conflict assessment methodology

A land use conflict analysis based on the DPI's *Living and Working in Rural Areas* handbook (Learmonth, Whitehead, Boyd & Fletcher 2007) is presented in Table 6-2, with the resulting assessment outcomes for issues of land use conflict presented in Table 6-3.

Table 6-2: Land use conflict risk assessment matrix

		Likelihood of a dispute or conflict arising over the land use or activity		
		Very Likely	Likely	Unlikely
Likely consequences and impacts associated with a dispute or conflict arising over the land use or activity	Major consequences and impacts likely	High	High	Medium
	Modest or periodic consequences and impacts likely	High	Medium	Low
	Minimal consequences and impacts likely	Medium	Low	Low

Table 6-3: Land use conflict analysis

Issue	Assessment	Issue Management
Catchment management	Low	The Proposed Development would have no impact on natural resources of surrounding agricultural properties (see Section 6.8). The Developer will not be abstracting water under any Water Sharing Plan licence for construction or operational activities.
Dogs	N/A	
Drainage	Low	Installation of solar panels over the majority of site would not markedly affect drainage patterns (see Section 6.8).
Dust	Low	Construction activities could cause short term dust accretion on adjoining trees and pastures, although this risk is limited by mitigation measures proposed (see Section 6.12). There would be nil to minimal impact on production.

Issue	Assessment	Issue Management
Fencing	Low	The Landholding is already fenced, however a perimeter fence up to 2.5 m high will be constructed around the Proposed Development). All fences will need to be maintained to avoid the possibility of livestock straying onto the site from the Landholding or any adjoining properties.
Fire	Medium	The Site contains *Fire Prone Land*. However, the overall nature of the Site in combination with the Proposed Development poses a low risk, both in terms of fire originating onsite and escaping onto neighbouring land or fire that originates offsite entering the Site. To manage the risk of fire at the site: • A firebreak will be established around the perimeter of the Proposed Development that will meet requirements of the NSW RFS; • All electrical equipment will be earthed appropriately to limit the potential risk of fire from lightning strike; and • On site fuel loads will be managed. Fire management strategies will be included in an Operational Environmental Management Plan (OEMP) and an Emergency Response Plan (ERP) will be prepared for the site and distributed to NSW RFS and NSW Fire and Rescue (see Section 6.10).
Lights	Low	Construction activities will be undertaken predominantly during daylight hours from 7am – 6pm Monday to Friday, 8am – 1pm on Saturday. During the operational phase, lighting will be restricted to the substation and support buildings and will be only used as required. The low requirement for lighting, the distance from neighbouring properties and the use of vegetation buffers means that potential agricultural conflict is assessed as low.
Noise	Low	Noise impacts at sensitive receptors during the construction phase (approximately 9 - 12 months), are deemed to be acceptable with mitigation measures in place. Construction activities will be limited to standard working hours: • Monday to Friday, 7am to 6pm; • Saturday, 8am to 1pm; and • No construction work is to take place on Sundays or public holidays Noise during the operational phase will be low. Noise and associated impacts are discussed in Section 6.9.
Pesticides	Low	Pesticides will be used to control weeds at the site. Good management practices will be implemented to ensure that pesticide use is minimised (including the use of sheep to graze between the panel rows to manage vegetation loads). The application of any pesticides will be in accordance with the *Pesticides Act 1999*, such that only registered pesticides are used based on label instructions that are designed to minimise impacts on surrounding land. The distance from neighbouring properties means the potential conflict is

Issue	Assessment	Issue Management
		assessed as low.
Pollution	Low	Fuels and lubricants will be used on site. These potential contaminants will be managed within bunded areas, according to the CEMP, OEMP and DMP (see Sections 6.2.4 and 6.8.4).
Roads	Low	Potential impacts to road surface conditions and traffic safety are low, and will be managed by upgrading and maintaining Bayley Park Rd (see Section 6.6). An application to purchase and close Crown roads within the Development Footprint has been lodged with the NSW DPI Lands. Closure of these roads will not prevent access to adjoining properties.
Straying livestock	Low	See fencing.
Theft and vandalism	Low	The location of the Proposed Development means that the risk posed by theft/vandalism is considered low. The solar farm would be off limits to the general public, enclosed by an appropriate security fence (approximately 2.5 m high).
Visual amenity	Medium	The Proposed Development has variable levels of visibility, with the greatest visual impact to the south of the Site. Generous development setback buffers, vegetation screening and site specific infrastructure arrangements are proposed to minimise these impacts (see Section 6.7).
Weeds and pests	Low	Weed and pest control at the Site is the responsibility of the Proponent. The risk from noxious weeds and pests is low but would be subject to ongoing monitoring and management (Section 6.2 and 6.3)

Most land use conflicts have been assessed as low. Landuse conflict analysis indicates that visual amenity and bushfire pose a medium risk. The mitigation measures to reduce these potential conflicts are discussed in Sections 6.7 and 6.10 respectively.

Construction

Duplex soils associated with the Site are characterised by an abrupt change in texture between the sandy surface layer and the underlying clay horizons. Duplex soils present include Kudosols and Kandosols, which make up the majority of soils found. The subsoil of duplex soils has a moderate potential for dispersion and surface crusting. If the topsoil of these soil units is disturbed or removed and the subsoils are exposed, the potential for erosion may be increased.

Large scale bulk earthworks are not anticipated to be required to construct the Proposed Development. However, general construction activities would include excavation and trenching, and have potential to result in soil erosion (including wind erosion), decreased stability and sedimentation due to the local removal of groundcover and the disturbance of the soil profile.

Within the solar array, soil disturbance would be limited to the piles driven or screwed into the ground to support and orientate the PV panels, and trenching for cable installation. As such, much of the groundcover will be retained across the Site. Consequently, soil disturbance from localised excavation activities will be relatively small, isolated and temporary.

Where the ground surface is disturbed for the substation and support buildings, inverters, access tracks, the temporary construction compound, laydown and parking areas there is greater potential for increased runoff and/or soil erosion. Footings, access tracks and hardstanding areas that would require compaction and/or foundations would reduce soil permeability, leading to increased run off and potentially concentrated flows, which could result in soil erosion. Soil compaction from equipment will be small, due to the small and discrete footprint of the light equipment required for panel installation.

Fuels and lubricants will be used on site during construction activities and may pose a potential contamination risk to soils in the event of a spill. These chemicals may alter soil properties and can impact negatively on soil health and consequently plant growth or if absorbed by plants/animals could potentially enter the food chain with adverse impacts. Contaminants in the soil can be mobilised during rainfall events which may potentially spread contamination through the soil profile, or into surface or groundwater potentially impacting aquatic habitats.

As the Site contains 'Fire Prone Land' there is potential for fires. However, it is considered that the overall nature of the Site (cleared land) in combination with that of the Proposed Development poses a low risk. Further information is provided in Section 6.10.

Operation

Operational impacts to soil would be minimal as operation and maintenance activities would not result in additional soil disturbance and groundcover would be reinstated and maintained across the site. However, there is potential for concentrated runoff to occur during significant rainfall events as a consequence of:

- compacted and impervious access tracks; and
- impervious PV panels.

These concentrated flows could potentially result in the erosion of the access tracks and localised soil erosion below the panels.

The potential for wind erosion is considered to be to low due to areas of soil disturbance being rehabilitated post construction.

As discussed in the section above, fuels, lubricants and herbicides will be used for maintenance activities, and pose a potential contamination risk to soil, surface and groundwater as a consequence of misuse or a spill event.

The presence of Fire Prone Land at the Site poses a potential fire risk that needs to be considered during the construction phase of the development. However, the nature of the Proposed Development poses a low risk in terms of fire. Further information is provided in Section 6.10.

Decommissioning

At the end of the 30 year life of the lease, the Proposed Development shall be decommissioned, with the objective of returning the land capability to its pre-existing agricultural capacity.

Potential impacts associated with decommissioning will be generally similar to those for construction as there will be a need for some local excavation and the operation of heavy equipment. However, it is anticipated that impacts would be less significant than during construction. Reasons for this include:

- There shall be no further vegetation clearing;
- Access tracks and footings for infrastructure will not need to constructed; and

- The majority of subsurface infrastructure will remain in place.

Following decommissioning, the site will be returned to agricultural activities, minimising long term land use impacts and mitigating impacts to agriculture capacity.

6.2.4 Mitigation measures

Land use

Potential land use conflict management measures, where required, are outlined in Table 6.3.

Soils and Land Resources

Construction

The construction works are short term and would be managed in accordance with the *Managing Urban Stormwater: Soils and Construction* series, namely:

- *Managing Urban stormwater: Soils and Construction, Volume 1, 4th Edition* (known as the Blue Book) (Landcom, 2004);
- *Volume 2A Installation of Services* (DECC, 2008a); and
- *Volume 2C Unsealed Roads* (DECC, 2008b).

Soil and erosion control measures in accordance with the above guidelines would be described in a Construction Environmental Management Plan (CEMP) to be developed following project approval. The CEMP would include a requirement for the establishment of erosion and sedimentation controls at the commencement of works and throughout construction, including the following measures:

- Construction and/or installation of erosion and sediment control structures shall be in accordance with the specifications provided in the Blue Book;
- Regular inspection and programmed maintenance of erosion and sedimentation controls will be undertaken and documented in a register of inspections and actions;
- Cable trenches will be constructed in accordance with relevant regulations and ground conditions. Trenches will be excavated and filled progressively to ensure they are left open for the shortest period possible. Surface conditions will be rehabilitated as soon as practicable to prevent the formation of preferential flow pathways;
- Management of erosion generated by traffic shall include a driving code of practice, installation of appropriate drainage controls, inspection and maintenance of unsealed road surfaces and dust management strategies;
- Separation of topsoil and subsoil for stockpiling and correct reinstatement to ensure a suitable growth medium is retained;
- Appropriate stockpile management to ensure air and water erosion is minimised, soil health, organic matter and structure are retained and weed infestation minimised; and
- Account for climatic events during construction;
    - If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and
    - Works methods shall be modified during high wind conditions if excess dust is generated.

To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of off-site in accordance with DECC guidelines. Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery. All hazardous materials will be stored in accordance with relevant regulations. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills.

A Spill Response Plan (SRP) will be prepared as part of the CEMP and OEMP. The SRP will outline the procedures to respond to a spill event and the measures required to prevent the spread of spills to adjacent areas. It will also include an emergency response protocol, EPA notification procedures and remediation requirements.

Despite no recorded contaminated sites, the potential remains for unidentified contamination to be encountered during excavation. Should this be the case, works in the area would cease and the relevant authorities would be notified. Protocols for such an event would be included in the CEMP, OEMP and DMP

Potential fire hazard mitigation strategies are outlined in Section 6.10.

Operation

An OEMP will be prepared to guide operational environmental management following the final design of the Proposed Development, and would be approved by DPE.

Limited soil disturbance during the operational phase of the Proposed Development means that the potential for soil erosion would be limited to the exposed access tracks and areas below the solar array.

Maintaining access tracks in good condition and ensuring that associated drains and/or sedimentation traps are monitored and maintained will ensure that the potential erosion associated with the tracks is minimised. Water carts may be used to limit wind erosion and dust generation.

The maintenance of low levels of vegetation cover across the Site will assist in reducing potential erosion across the site. This will be especially important below the panels to prevent scouring following significant rainfall events. As such, to minimise the potential for erosion in the areas beneath the panels an inspection program following significant rainfall events would implemented and stabilisation works would be undertaken as required.

Further to this, any erosion prevention and/or sedimentation traps installed as part of the design of the Proposed Development will be monitored to ensure effectiveness is maintained.

Weed management strategies will be outlined in the OEMP. These strategies will aim to prevent and minimise the spread of weeds and will include:

- Management strategies for any declared noxious weeds according to the stipulations of the *Noxious Weeds Act 1993* during the construction and operational phases; and
- Protocols for weed hygiene in relation to plant and machinery entering and leaving site, and for the importation of fill to site.

In addition, sheep will be permitted to graze within the solar array to help keep vegetation levels down over the Site. This would contribute to weed control and fuel load reduction and the continuation of agricultural activities at a reduced scale.

To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of offsite in accordance with DECC guidelines. Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery. All contractors and staff will be appropriately trained through site induction and toolbox talks to prevent, minimise and manage accidental spills.

Fire management strategies would be included in an Operational Environmental Management Plan (OEMP) and an Emergency Response Plan (ERP) will be prepared for the Site and distributed to neighbours. Further information regarding fire risk mitigation is provided in Section 6.10.

Decommissioning

At the end of the 30 year life of the lease, the Proposed Development shall be decommissioned. Decommissioning activities, and hence mitigation, shall be similar to those for construction.

A Decommissioning Management Plan (DMP) will be prepared with the objective of returning the land capability to its pre-existing agricultural capacity. The DMP shall include appropriate mitigation strategies to manage potential environmental impacts.

6.3 Biodiversity

6.3.1 Introduction

The project has been declared SSD, and as such the environmental impacts of the Proposed Development are to be assessed under Division 4.1 of the EP&A Act.

As a SSD, the impacts of the Proposed Development must be assessed under the Framework for Biodiversity Assessment (FBA; OEH, 2014) and a Biodiversity Assessment Report (BAR) and a Biodiversity Offset Strategy (BOS) must be prepared. The purpose of the BAR is to assess the impacts to biodiversity, propose mitigating and ameliorating options, as well as calculate offsets for unavoidable impacts (Appendix B). The BOS identifies a strategy which if implemented would offset any unavoidable impacts (Appendix C).

The Biodiversity Assessment has been prepared in accordance with the SEARs issued for the project on 28 September 2016.

6.3.2 Existing environment

Biophysical

Landform at the Site consists of undulating hill sides with a relatively low gradient. The majority of the Site occurs at elevations from 990 to 1090 m above sea level. The landscape grades gently from hillsides with granite outcroppings, to alluvial basins with moderately fertile soils. The valleys are broad and there are no cliffs, escarpments, or gorges.

The Site lies within the New England Orogen and is located on the Hillgrove Adamellite and Sandon Beds, to a lesser extent Girrakool Beds underlie parts of the landscape. These soil landscapes have an erodibility potential ranging from moderate to very high. The site is dominated by Kurosols, Kandosols, and to a lesser extent Rudosols and Tenosols.

The hydrology of the Site is typified by ephemeral first order drainage lines. Several of these intersect each other to form Limerick Creek which is classed as a third order stream (Strahler, 1952). Limerick Creek and all drainage lines were dry at the time of field surveys.

Land use

The primary land use within the region is mixed agriculture including both sheep and cattle grazing, as well as cropping. Improvement of pastures is a common practice within the region, and the majority of the Site has been visibly cultivated within the 6 months prior to assessment.

The majority of paddocks within the Site had been sown with pasture grasses such as *Vulpia* sp. and *Bromus* sp. within recent months leading up to the site survey. Paddocks that had not been recently ploughed still showed evidence of ploughing and pasture improvement from previous years and had a species assemblage similar to that of currently ploughed paddocks.

Due to altitude, climate, and soil types, plantations of *Pinus radiata* are a common on pastoral leases within the region. Several large stands of *P. radiata* occur within the Site.

Native Vegetation

The Development Footprint is 507 ha in size which includes 8.38 ha of native vegetation and 499.1 ha of cleared land. The extent of native vegetation within the Site is shown in Figure 6-3. The extent of native vegetation was determined through aerial imagery, in conjunction with site assessments.

Three Plant Community Types (PCTs) were identified within the Development Footprint:

- NR127: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion;
- NR131: Broad-leaved Stringybark – Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion; and
- NR282: Yellow Box – Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion.

All PCTs are heavily impacted by the current agricultural practices used within the Site. The mid-storey has been removed from all PCTs and the ground layer has been extensively modified through ploughing, nutrient enrichment, and the sowing of pasture grasses such as *Lolium* sp. and *Bromus* sp.

All PCTs within the Site were stratified into vegetation zones. As the development occurs within a landscape of scattered trees, three PCTs comprising of four vegetation zones have been identified within the Site (Table 6-4).

Table 6-4: Summary of vegetation zones within Development Footprint (the 'Site')

Vegetation zone	PCT	Condition	Area (ha)	Site value score
1	NR127: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Moderate - Good	2.04	28.65
2	NR131: Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion	Moderate - Good	4.09	29.17
3	NR282: Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion	Moderate - Good	0.78	67.19
4	NR282: Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion	Moderate – Good (poor)	1.49	26.04

The current biodiversity values of the Site are relatively low, with only sparse individuals of native species persisting within shaded areas of canopy trees. Species such as *Calotis cuneifolia* (Purple Burr-daisy), *Crassula sieberiana* (Australian Stonecrop), and *Microlaena stipoides* (Weeping Grass), as well as others present, are likely to persist following construction of the Proposed Development.

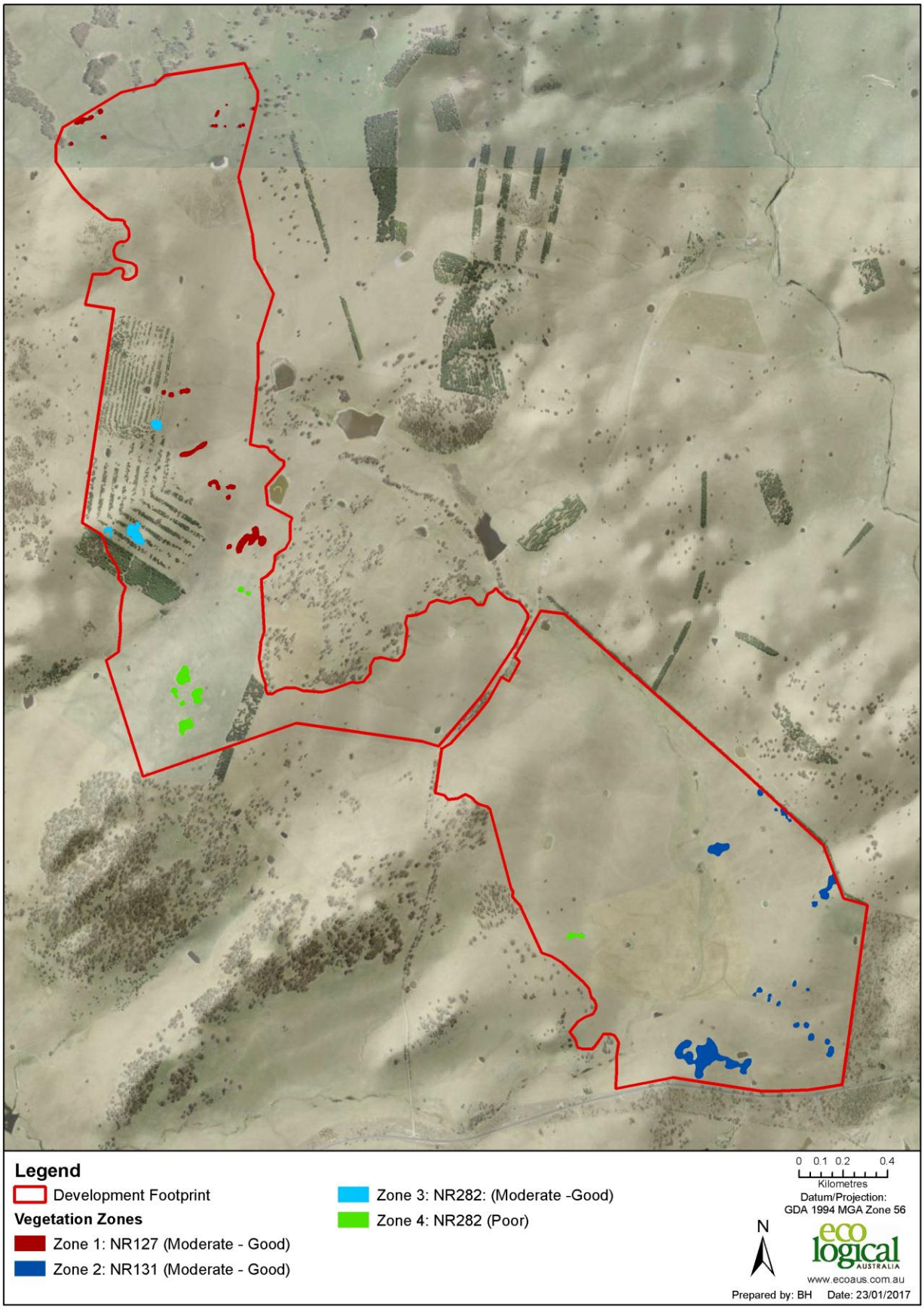

Figure 6-3: Extent of native vegetation within the Development Footprint

Habitat

Habitat within the Site is highly modified due to long-term impacts of agriculture. Canopy species within the Site have been retained as scattered paddock trees with little fauna habitat potential. There are very few hollow-bearing trees due to the dominance of species such as *Eucalyptus caliginosa* and *Angophora floribunda*, which do not form multiple hollows regularly. *Eucalyptus moluccana* at the north of the Site do not support many hollows. There are several small granite outcrops which do not have cracks, caves or fissures. The mid-storey is absent and the groundcover is almost exclusively exotic pasture grasses. There is no leaf litter present.

Threatened flora

Several *Eucalyptus nicholii* were observed adjacent to the Site, however none of these would be impacted by the Proposed Development.

Threatened fauna

The FBA process identifies the following threatened fauna species as potentially occurring at the Development Site:

- Eastern Pygmy Possum (*Cercartetus nanus*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Koala (*Phascolarctos cinereus*); and
- Regent Honeyeater (*Anthochaera phrygia*).

Of the species listed above, habitat surveys indicated suitable habitat for foraging, breeding or shelter habitat within the Development Site only for the Regent Honey Eater. However, no Regent Honeyeaters were recorded during targeted surveys. Whilst the vegetation within the Site may provide foraging habitat for the species on occasion, it is highly unlikely that the species utilises the Development Footprint for breeding.

Woodland birds recorded within the Site included *Cracticus tibicen* (Australian Magpie), *Rhipidura albiscapa* (Grey Fantail), *Pachycephala rufiventris* (Rufous Whistler), and *Acanthiza chrysorrhoa* (Yellow-rumped Thornbill). A complete list of all predicted and observed species is provided in Appendix B.

6.3.3 Potential impacts

The project will involve impacts to native vegetation and fauna habitat through the loss of scattered paddock trees.

The Proposed Development will impact up to 8.40 ha of native vegetation. None of the PCTs within the development footprint are consistent with the final determinations under the TSC Act, or listing advice under the EPBC Act. Based on the distribution, landscape position, and assemblage of species present, there are no EECs present within the development footprint. A summary of the potential areas to be directly impacted by the Proposed Development are shown in Table 6-5.

Table 6-5: Direct loss of native vegetation

Vegetation zone	PCT name	Area to be removed (ha)
NR127 Moderate – Good	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	2.04
NR131 Moderate – Good (poor)	Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion	4.09
NR282 Moderate – good	Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion	0.78
NR282 Moderate – good (poor)	Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tableland Bioregion	1.49
Total		**8.40**

6.3.4 Mitigation measures

Impact avoidance

Under the FBA methodology, the proponent must design the project to minimise impacts to biodiversity. Specifically, the FBA requires proponents to identify and avoid direct impacts to:

- Threatened Ecological Communities;
- PCTs that contain threatened species habitat;
- Threatened species that cannot be predicted by vegetation type;
- Declared critical habitat; and
- Regional and state significant biodiversity links.

A summary of the impact avoidance methods of the project are provided in Table 6-6.

Table 6-6: Avoidance of direct impacts

Direct impact to be avoided	Method to avoid impact
Impacts to Endangered Ecological Communities (EECs) and Critically Endangered Ecological Communities (CEECs).	The Development Footprint is located so as to avoid all impacts upon EECs. Impacts to EECs have been minimised by locating the Proposed Development on land that is currently cleared for cropping.
Impacts to PCTs that contain threatened species habitat.	All PCTs within the Site are identified as potential foraging habitat for highly mobile fauna species. There are limited hollow-bearing trees, no caves, and no rocky outcrops. The vegetation within the Site will be intermittently used by mobile fauna species, however it will not be used as breeding or refuge habitat for threatened species.
Impacts to areas that contain habitat for Vulnerable, Endangered, or Critically Endangered threatened species or populations in accordance with Step 5 in Section 6.5 of the FBA.	No threatened species have been identified within the Site and as such no species polygons or threatened species habitat has been identified within the Site.

Direct impact to be avoided	Method to avoid impact
Impacts to areas of land that the Minister for Environment has declared as critical habitat in accordance with s47 of the TSC Act.	Critical habitat has not been identified within the Site.
Impacts to riparian areas of 4th order or higher streams and rivers, important wetlands and estuaries.	The Development Footprint will not impact on riparian areas of rivers, wetlands, estuaries, or 4th order (or higher) streams.
Impacts to state significant biodiversity links.	No state significant biodiversity links have been identified within the Site.

Site selection was undertaken considering the extent of known biodiversity values, as well as the extent of current disturbance within the development footprint. A summary of considerations during the selection of the Site is shown in Table 6-7.

Table 6-7: Avoidance and minimisation of direct impacts through site selection

Site selection criteria	Method to avoid impact
Selecting a suitable Development Footprint for a Major Project or a route for linear projects, should be informed by knowledge of biodiversity values. An initial desktop assessment of biodiversity values would assist in identifying areas of native vegetation cover, EECs or CEECs, and potential habitat for threatened species.	An initial site inspection was undertaken in June 2016 to inform the PEA for the Major Project, to identify areas of native vegetation cover, EECs or CEECs, and potential habitat for threatened species. Site inspections were accompanied by desktop assessments. Desktop assessment included: • Atlas of NSW Wildlife (Bionet); and • Protected Matters Search Tool (PMST). Additional site inspections were conducted in November and December 2016 to gather formal BioBanking data within a reduced development footprint. Following this assessment the Development Footprint was reduced again to avoid impacts to EECs or CEECs, and potential habitat for threatened species.
Stage 1 of the FBA will provide the preliminary information necessary to inform project planning. Early consideration of biodiversity values is recommended in site selection, or route selection for linear projects, and the planning phase.	Biodiversity values were identified within the Development Footprint by ELA (2016) identifying areas of key biodiversity significance within the PEA. This document was reviewed when planning the development footprint, and refined through several iterations considering impacts to biodiversity values within the Site.
The site/route selection process should include consideration and analysis of the biodiversity constraints of the proposed Development Footprint and consider the suitability of the Major Project based on the types of biodiversity values present on the development footprint.	As identified above, the PEA was conducted to determine areas of biodiversity constraints by ELA in 2016. The current masterplan reflects the retention, where possible, of existing biodiversity within the Development Footprint.

Site selection criteria	Method to avoid impact
When considering and analysing the biodiversity constraints for the purpose of selecting a Development Footprint, the following matters should be addressed: (a) whether there are alternative sites within the property on which the Proposed Development is located where siting the proposed Major Project would avoid and minimise impacts on biodiversity values; (b) how the Development Footprint can be selected to avoid and minimise impacts on biodiversity values as far as practicable; and (c) whether an alternative Development Footprint to the Proposed Development footprint, which would avoid adversely impacting on biodiversity values, might be feasible.	Given the nature of the Proposed Development, the Site is largely situated within existing cleared areas, with the exception of scattered trees. Alternative locations outside of the Proposal Site were not considered during the FBA process having already been ruled out for other reasons. However, initial ecological studies were a major factor in determining the final location of the FBA study within the landholding. Given the nature of the existing uses within the Development Footprint, selection of an alternate site would not avoid any adverse impacts on biodiversity.
For linear projects, the route selection process must include consideration and an analysis of the biodiversity constraints of the various route options. In selecting a preferred option, loss of biodiversity values must be weighed up and justified against social and economic costs and benefits.	The Proposed Development is not a linear project.

Planning was considered during the selection of the development footprint. A summary of criteria utilised is shown in Table 6-8.

Table 6-8: Avoidance and minimisation of direct impacts through planning

Planning criteria	Method to avoid Impact
Siting of the project – the Major Project should be located in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower site value score) or which avoid an EEC or CEEC.	The siting of the project is mainly within existing cleared areas. No threatened species habitat or EEC or CEEC have been identified within the Site.
Minimise the amount of clearing or habitat loss – the Major Project (and associated construction infrastructure) should be located in areas that do not have native vegetation, or in areas that require the least amount of vegetation to be cleared (i.e. the Development Footprint is minimised), and/or in areas where other impacts to biodiversity will be the lowest.	The project is located primarily within existing cleared areas to minimise vegetation loss. Some impacts to vegetation will be required to facilitate the development, however the majority of biodiversity values can be retained in adjacent areas.
Loss of connectivity – some developments can impact on the connectivity and movement of species through areas of adjacent habitat. Minimisation measures may include providing structures that allow movement of species across barriers or hostile gaps.	There are no connecting links that pass through the Site. As such the Proposed Development will not cause a loss of connectivity and species movement across the site, nor adjacent habitat.

Impact mitigation

The proponent will implement measures to minimise the impacts of the project during both the construction and operational phase. A Biodiversity Management Plan (BMP) and CEMP will be drafted for the site following approval of the project, which will aim to put in place mechanisms to reduce impacts. The BMP will address impacts to flora and fauna such as delineation of clearing boundaries and minimising harm to fauna, whereas the CEMP will minimise other environmental impacts such as sediment control, dust, noise, lighting, and protection of waterways. The BMP will include operational measures to reduce impacts of the project such as:

- Pre-clearance surveys and clearance supervision;
- Replanting and vegetation management; and
- Weeding and ongoing measures.

Details of measures to minimise direct and indirect impacts during the construction (Table 6-9 and Table 6-10) and operational phase (Table 6-11) are described below.

Table 6-9: Minimisation of direct impacts during the construction phase

Matter considered to minimise impacts	Adopted matters within development footprint
Method of clearing – using a method of clearing during the construction phase that avoids damage to retained native vegetation and reduces soil disturbance. For example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed.	Retained vegetation is spatially separated from vegetation to be cleared as part of the project. Vegetation that is to be removed nearby to retained vegetation will be removed using chain-saw rather than heavy machinery to avoid any additional impacts of the project on adjacent vegetation.
Clearing operations – minimising direct harm to native fauna during construction operations through onsite measures such as undertaking pre-clearing surveys, daily fauna surveys and the presence of a trained ecologist during clearing events	Clearing of vegetation will be undertaken via a two stage clearing process. Clearing will not be undertaken until a pre-clearance assessment is conducted by qualified ecologists. Ecologists will be present for all vegetation clearing. Stage 1 of the clearing process will involve marking of habitat features, and removal of all vegetation except habitat features. Stage 2 will involve removal of habitat features under the supervision of ecologists to relocate resident fauna. A detailed methodology of the two stage clearing process will be included within the BMP. All clearing staff will be briefed about the two stage clearing process, and their responsibilities to minimise impacts to biodiversity.
Timing of construction – identifying reasonable measures that minimise the impacts on biodiversity. For example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting, can minimise the impacts of construction activities on biodiversity.	Timing of construction will not mitigate any impacts to biodiversity. The Site is occupied by limited fauna species and as such there is no specific timing constraints on the project.
Other measures that minimise inadvertent impacts of the Major Project on the biodiversity values – measures such as installing temporary fencing to protect	Other measures to minimise the impacts of the project on biodiversity will be detailed within the CEMP. These measures will include at a minimum:

Matter considered to minimise impacts	Adopted matters within development footprint
significant environmental features such as riparian zones, promoting the hygiene of construction vehicles to minimise spread of weeds or pathogens, appropriately training and inducting project staff and contractors so that they can implement all measures that minimise inadvertent adverse impacts of the Major Project on biodiversity values.	• Temporary fencing to delineate clearing boundaries; • Marking of trees for retention within open areas; • Cleaning of mobile plant prior to works to prevent the spread of weeds and pathogens; • Sediment controls along Limerick Creek to prevent impacts downstream; and • Signage within the works area to advise contractors of responsibilities.

Table 6-10: Minimisation of indirect impacts

Indirect impact	Method to avoid indirect impact
Sedimentation and run-off – sediment barriers or sedimentation ponds to minimise impacts of the Major Project on biodiversity values on land that is adjoining the Site, and waterways downstream of the Site.	Installation of sediment barriers, sediment ponds, stormwater management systems, delineation of works zones.
Noise, dust or light spill – adopting onsite measures that can minimise the impacts on biodiversity values from noise, dust or light spill during the construction phase. For example, only undertake construction during daylight hours to avoid impacts from light spill where this may be detrimental to species habitat on adjoining lands.	Construction works are to occur during daylight hours (7am to 6 pm) only.
Inadvertent impacts on adjacent habitat or vegetation – considering measures such as retaining vegetation on the Site as a buffer to protect significant environmental features (e.g. riparian zones, likely or known threatened species habitat).	Temporary fencing and signage to be installed prior to works, to delineate boundaries and protect retained vegetation.
Feral pest, weed and/or pathogen encroachment into vegetation on land adjoining the Site – one example is using protocols for hygiene that minimise the likelihood of construction vehicles spreading weeds or pathogens from the Site into native vegetation on land adjoining the Site.	A weed management plan will be included within the BMP for the Site which will include cleaning and inspection of light vehicles and mobile plant.
Impacts that are infrequent, cumulative or difficult to measure – where there are likely to be indirect impacts on biodiversity that are infrequent, cumulative or difficult to measure over time, consideration should be given to how an operational monitoring program can be used to assess the timing and/or extent of these impacts. A proposal for an operational monitoring program should be set out in the BAR. Development of a monitoring program may involve determining the base-line	A monitoring program will be drafted within the BMP to measure infrequent and cumulative impacts of the project. The monitoring program will include baseline data capture to measure any effects of the project over time. Given the low biodiversity values at the site, the monitoring program should focus on likely ongoing impacts of the development such as erosion.

Indirect impact	Method to avoid indirect impact
information that will be necessary to measure the impact over time. It should also consider how the results of the monitoring program could be used to inform ongoing operations in order to reduce the extent of indirect impacts.	
Impacts during the operational phase – measures to avoid or minimise the indirect impacts on threatened species, threatened species' habitat on land adjoining the Site, and migratory species or flight pathways as a result of the operation of the development. Such measures may include those adopted to avoid and minimise: (i) trampling of threatened flora species; (ii) rubbish dumping; (iii) noise; (iv) light spill; (v) weed encroachment; (vi) nutrient run-off; (vii) increased risk of fire; and (viii) pest animals.	There are no threatened flora species within the Site. Fences will be placed around key biodiversity areas to prevent rubbish dumping by contractors. Appropriate security measures will also be in place to reduce illegal dumping. Noise impacts will not be significantly increased from the current levels experienced on the Site and adjacent land. The project is not expected to increase light spill during the construction phase. Weed encroachment, and nutrient run off will be managed by a weed management plan within the BMP, and sediment and stormwater controls within the CEMP.

Table 6-11: Minimisation of impacts during the operation phase

Operational phase impact	Method to avoid Impact
Seasonal impacts – whether there are likely to be any impacts that occur during specific seasons. Minimisation measures may include amending operational times to minimise impacts on biodiversity during periods when seasonal events such as breeding or species migration occur.	There are unlikely to be any additional seasonal impacts during operation of the Proposed Development.
Artificial habitats – using 'artificial habitats' for fauna where they may be effective in minimising impacts on such fauna. These include nest boxes, glider-crossings or habitat bridges.	Nest boxes can be installed to minimise impacts to arboreal mammals. It is recommended to replace all removed hollows with artificial nest boxes at a ratio of 1:1 (removed: replaced).

Offsetting strategy

Depending on the final design, up to 8.40 ha of native vegetation requiring offsetting will be removed as part of the construction and operation phase of the project. The offsetting requirement has been calculated using the BioBanking Credit Calculator (BBCC). A summary of the vegetation zones, loss in landscape value, loss in site value, and ecosystem credits required to offset the impacts of the project are shown in Table 6-12. Impacts to cleared land within the Site do not require offsetting.

Table 6-12: Loss in landscape value, site value, and required ecosystem credits

Zone	PCT	Loss in landscape value	Loss in site value	Area (ha)	Required ecosystem credits
1	NR127: Moderate – good	10.20	12.50	2.04	24
2	NR131: Moderate – good	10.20	13.02	4.09	50
3	NR282: Moderate – good	10.20	51.04	0.78	24
4	NR282: Moderate – good (poor)	10.20	9.89	1.49	15
Total				**8.40**	**113**

Prior to the issue of construction certificate, the proponent will acquire and retire the full quantum of required ecosystem credits as described in Table 6-12 in accordance with the NSW biodiversity offsets policy for major projects (OEH, 2014, see Appendix C, FBA Biodiversity Offset Strategy).

It is noted that following detailed design (post consent), the final number of credits required may be reduced as, where possible, land that does not require clearing and would not generate credits would be prioritised over land that requires clearing and would generate credits (Table 6-12). Any recalculation of offsets would be subject to agreement with OEH.

6.4 Aboriginal Cultural Heritage

6.4.1 Introduction

Remnant Archaeology Pty Ltd (RA) undertook an Aboriginal Cultural Heritage Assessment (ACHA) for the Proposed Development. The assessment was undertaken to address the project SEARs. The draft assessment report is provided in Appendix D and summarised below.

The ACHA, has been guided by the specifications set out in the following documents:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH, 2011); and
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).

The ACHA addresses cultural, natural and archaeological significance for registered Aboriginal objects and/or sites, and for unregistered Aboriginal objects and/or sites found during the field component of the assessment.

Consultation with the local Aboriginal Community has been conducted in line with the DECCW (2010a) document *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*.

6.4.2 Existing environment

Searches of databases that list Aboriginal heritage objects and places were carried out including the Armidale Dumaresq LEP and Registered Aboriginal Parties (RAPs) were engaged in discussions regarding local sites of significance known to them. Through this process, RA's archaeologist was notified of the general significance of the area as it falls within a pathway to and from significant ceremonial sites to the east and west.

An Aboriginal Heritage Information Management System (AHIMS) database search with a four-kilometre radius centred on and including the Site was undertaken. Six registered sites were identified, all of which are located to the south of Waterfall Way, at Clarks Gully (Table 6-13 and Figure 6-4).

Table 6-13: Location of AHIMS sites within 4 kilometres of the centre of the Site.

Site ID	Area	Site name	Zone	Easting[1]	Northing[1]	Easting[2]	Northing[2]
21-4-0028	Clark's Gully	TH/JA7	56J	392750	6621170	392854	6621360
21-4-0127	Clark's Gully	CG Artefact 1	56J	-	-	392766	6621342
21-4-0128	Clark's Gully	CG Artefact 2	56J	-	-	392778	6621358
21-4-0129	Clark's Gully	CG Artefact 3	56J	-	-	392955	6621603
21-4-0130	Clark's Gully	CG Artefact 4	56J	-	-	393335	6621492
21-4-0131	Clark's Gully	CG Artefact 5	56J	-	-	393365	6620831

A search of the Armidale Dumaresq LEP showed one AHIMS site had been listed with Council, this site is located south of the Waterfall Way at Clark's Gully.

- AHIMS Site No. 21-4-0028 (Site Name TH/JA7) - Knapping floor containing silcrete debitage.

Figure 6-4: The location of sites on the AHIMS database. Image source: Google Earth Pro (2016). (Remnant Archaeology, 2017)

The following archaeological finds were identified during field investigations undertaken as part of the ACHA during December 2016:

- Three low-density (n=2, n=2, n=3) artefact concentrations;
- Thirty eight isolated (individual) artefacts;
- Two scarred trees (Waypoint (Wpt) 60 and Wpt 65); and
- A stone arrangement (Wpt 62).

The location of individual archaeological finds are shown in Figure 6-5 to Figure 6-7.

Figure 6-5: The location of archaeological objects and/or places in the northern portion of the archaeological survey area. Image source: Google Earth Pro 2016. (Remnant Archaeology, 2017)

Figure 6-6: The location of archaeological objects and/or places in the central portion of the archaeological survey area. Image source: Google Earth Pro 2016. (Remnant Archaeology, 2017)

Figure 6-7: The location of archaeological objects and/or places in the southern portion of the archaeological survey area. Image source: Google Earth Pro 2016. (Remnant Archaeology, 2017)

Assessment of significance, following consultation with Aboriginal stakeholders, considering each item's historic value, aesthetic value, social-cultural value, scientific value, research potential, representativeness, rarity and educational potential, provided the following significance:

- Artefact concentrations – Low;
- Isolated artefacts – Medium;
- Scarred trees – Medium/High; and
- Stone arrangement – High.

The ACHA has determined that:

- The Site lies within a corridor of high cultural importance to the Aboriginal Community;
- The tangible (archaeological) evidence supporting that significance has been extensively modified, if not completely removed, across those study areas;
- Tangible evidence that does remain is of moderate to high value;

- The Proposed Development will have a direct impact upon the cultural landscape, however impacts to the scar trees and stone arrangement can be avoided; and
- Impacts to other items may need to be mitigated, if impacted by construction and/or operational activities.

6.4.3 Potential impacts

The potential impacts on Aboriginal cultural heritage items and places posed by the Proposed Development include:

- Direct impact to Aboriginal items and/or places within the Site:
  - brought about by solar panel array installation and construction activities;
  - as a result of modifications to the landscape relating to on-site support infrastructure; or
  - from modifications to the landscape relating to access track construction and/or existing road upgrades; and
- Indirect impact to Aboriginal items and/or places within the identified work zones as the result of altered vegetation structures and/or altered wind/water erosion patterns.

Four artefacts recorded fall outside the Site. All others fall within it and, as such, all have the potential to be subject to direct and total harm, the consequence of which would be total loss of information and value.

6.4.4 Mitigation measures

The OEH aims to ensure impacts to Aboriginal objects and places are avoided or reduced and that where possible Aboriginal sites should be conserved. The guiding principle is that, wherever possible, avoidance should be the primary management option, but if avoidance is not feasible, measures shall be taken to mitigate against impacts to Aboriginal items and/or places.

Avoidance

In accordance with the recommendations of the ACHA, the proponent commits to avoid potential impacts to the following sites:

- Each of the two scar trees; and
- The stone arrangement.

A 10 m design buffer shall be applied to each site (Figure 2-5). These sites shall be protected from on-ground impacts through the installation of high visibility barricade fencing placed around each site prior to the commencement of pre-construction activities and be retained for the duration of the construction period. A similar approach is proposed for the management of risks associated with the decommissioning phase. At the completion of construction activities, stock-proof fencing shall replace the barricade around the stone arrangement, and all other indicators of its presence shall be removed.

Due to the flexible modular design and construction of the solar arrays, potential impacts to other individual artefacts and sites cannot be predicted until detail design is completed (post approval). Nonetheless, in accordance with the recommendations of the ACHA, the proponent commits to implement strategies to avoid wherever possible direct impacts to items of Aboriginal cultural heritage.

Mitigation

In cases, where avoidance is not an option, recorded artefacts should be collected prior to commencement of initial ground disturbance and in consultation with the RAPs removed, either to a safe location on-site and reburied, or to some keeping place as nominated by the RAPs.

The collection of artefacts shall be carried out in accordance with Requirement 26 of the *Code Of Practice For The Archaeological Investigation Of Aboriginal Objects In New South Wales* (DECCW, 2010b).

ACHA recommendations

In order to minimize impacts to Aboriginal cultural heritage, the following recommendations shall be adopted:

- No further archaeological investigation is required at the artefact locations (find spots) identified as falling within "Bayley Park" Study Areas 1 – 3. A Cultural Heritage Management Plan (CHMP) will be developed following the detailed design of the Proposed Development (post consent), indicating where avoidance is possible and where impact is unavoidable. The CHMP will detail the procedures required to safeguard artefacts to be avoided and the protocols to collect those artefacts that cannot be avoided and shall explain the methodology for removal, who will be involved, and where any object that is to be moved will be stored permanently.
- No further archaeological investigation is required at the scarred tree locations that fall within the Development Footprint. Scarred trees, regardless of whether they are alive or dead shall be avoided; initial ground surface disturbance and project construction activity should be excluded from within 10m of these trees.
- No further archaeological investigation is required at the stone arrangement that falls within the Development Footprint. This site shall be avoided and a 10m exclusion zone placed around it, into which no vehicles (including rubber-tyred light vehicles) must travel.
- For the duration of construction, 10m buffer zones need to be established around the two identified scar trees and stone arrangement using star pickets and high visibility barrier fencing.
- At completion of construction the barrier fencing may be removed from around the scarred trees.
- At completion of the construction phase the high visibility barrier fencing is to be removed from around the stone arrangement and is replaced with a stock-proof fence.
- If, through future development planning, impacts are proposed for any land outside the Development Footprint, cultural heritage assessment of the area(s) proposed shall be undertaken.
- Once the detailed construction footprint has been established within Study Areas 1 – 3 any artefact concentration or isolate locations that remain within the impact zone will need to be marked with a star picket and appropriate flagging for the interim period between construction footprint finalisation and CHMP approval.
- Monitoring of tree removal will be carried out on a needs basis, the number of monitors present equal to the number of machines engaged in tree removal.
- The RAPs have requested and it is recommended here, that they be involved in monitoring vegetation removal in the pine plantation located along the western margin of Study Area 2.

- Appropriate communication protocols between the proponent (and/or their contractors) and Aboriginal stakeholders will agreed and set out in the CHMP. During initial ground surface disturbance it is recommended that the proponent (and/or their contractors) communicate the progress and/or any developments concerning Aboriginal cultural heritage.
- In the event of an unanticipated find all works shall cease in the immediate area (10m buffer) and the find spot marked with high visibility barrier fencing. A qualified archaeologist and representatives from the Aboriginal community are to be contacted to verify the status of the find and to determine its significance. If verified, the site is to be registered with OEH in the AHIMS database. Approval shall be required to impact the find prior to recommencement of works.
- Draft copies of the ACHA have been sent to each of the RAPs for review and feedback, and a digital copy of the final report shall be submitted to the OEH for inclusion in the AHIMS database.

6.5 Historic Heritage

6.5.1 Introduction

The historic heritage assessment was undertaken in accordance with the *NSW Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996), specifically the guidelines *Assessing Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch Department of Planning, 2009), and with reference to the Burra Charter (the Australian ICOMOS Charter for Places of Cultural Significance) (ICOMOS (Australia), 2013).

The primary objectives of the historical heritage assessment were:

- To identify, through heritage register searches, historical research and targeted archaeological investigations, the historical heritage values of the land within the study area;
- To assess the significance of potentially impacted historic heritage items in accordance with the NSW Heritage Branch guidelines: *Assessing Heritage Significance* (NSW Heritage Office, 2001); and
- To provide, on the basis of significance and impact assessments against the Proposed Development, appropriate management and mitigation strategies for all identified and potential historic heritage items.

This involved the following key tasks:

- A search of relevant historic heritage registers, databases and lists, including:
    - World Heritage List (WHL);
    - National Heritage List (NHL);
    - Commonwealth Heritage List (CHL);
    - Register of the National Estate (non-statutory archive);
    - National Trust of Australia NSW Heritage Database (non-statutory);
    - NSW State Heritage Register;
    - NSW State Heritage Inventory; and
    - Schedule 5 of the Armidale Dumaresq Local Environmental Plan 2012;
- Background research concerning land within, and in the vicinity of, the study area in order to identify historic heritage items;
- Comprehensive field survey of the Site to identify potential historic items;
- Identify potential direct and indirect impacts to historic items; and
- Undertake a significance assessment for potentially impacted items in accordance with the guidelines *Assessing Heritage Significance* (NSW Heritage Office, 2001) to establish why a particular site or item is of significance and, if necessary, to enable appropriate mitigation strategies to be developed.

6.5.2 Existing environment

The proposed Site sits within the Bayley Park property, and is located approximately 1 km to the west of the Bayley Park Homestead. The Bayley Park property was once owned by Frances Mulligan who took up the selection once the *Crown Lands Acts 1861* (NSW) was passed (Freemans Journal, 20 November 1913; 37).

Bayley Park is not listed as a heritage item and no items of heritage significance were identified within the Development Footprint during the database searches or during the field survey (Appendix D).

Items of significance that were identified within the area surrounding the Site are listed in Table 6-14.

Table 6-14: Historic items within the vicinity of the project area

Register	Item Name	Item ID	Status	Item Location	Distance to Proposal Site
World Heritage List	None identified	N/A	N/A	N/A	N/A
Commonwealth Heritage List	None identified	N/A	N/A	N/A	N/A
National Heritage List	None identified	N/A	N/A	N/A	N/A
NSW State Heritage Register	None identified	N/A	N/A	N/A	N/A
Section 170 Registers	None identified	N/A	N/A	N/A	N/A
Armidale Dumaresq LEP 2012	Eleanora Mine – Chimney	I199	Local Significance	130 Brackin Street Lot 2, DP 597107	The item and associated curtilage is located 4,800 m from the Site.
	Baker's Creek Mine – Chimney	I200	Local Significance	132B Brackin Street Part of Lot 7300, DP 1139642	The item and associated curtilage is located 4,400 m from the Site.
	Baker's Creek Mine – Surface Buildings	I202	Local Significance	132B Brackin Street Part of Lot 7300 DP 1139642	The item and associated curtilage is located 4,400 m from the Site.
	Baker's Creek Mine – Winding Engine House	I201	Local Significance	132B and 132f Brackin Street Lot 407, DP 755834; Part of Lot 7300 DP 1139642	The item and associated curtilage is located 4,400 m from the Site.
	Garibaldi Mine – Chimney	I203	Local Significance	132B Brackin Street Part of Lot 7300, DP 1139642	The item and associated curtilage is located 4,400 m from the Site.
	Shearing Shed, "Hillgrove Station"	I204	Local Significance	2457 Grafton Road Lot 1, DP 556558	The item is located 2,000 m to the east of the Site.
	Homestead, "St Helena"	I209	Local Significance	3138 Grafton Road Lot 3, DP 1145435; Lots 9,10,12-18,26,32,42,53,57,58, 73,75,and 96, DP	The item and associated curtilage is located 8,900 m from the Site.

Register	Item Name	Item ID	Status	Item Location	Distance to Proposal Site
				755828	
	Cemetery	I227	Local Significance	55 Hillgrove Cemetery Road Lot 7304, DP 1137270	The item is located 3,000 m to the east of the Site.
Non-Statutory					
Register of the National Estate	Hillgrove Antimony Mine	Place ID 312	Indicative Place	Stockton Road, Hillgrove, NSW	The item and associated curtilage is located 4,400 m from the Site.
	Hillgrove Goldmining Area	Place ID 311	Indicative Place	Approximately 24ha, Stockton Road, Hillgrove, NSW	The item and associated curtilage is located 4,400 m from the Site.
	Metz Goldmining Area	Place ID 313	Indicative Place	Approximately 24ha, Chinamans Gully Road, Metz NSW	The item and associated curtilage is located 4,800 m from the Site.
	Oxley Wild Rivers National Park	Place ID 382	Indicative Place	Approximately 120,000ha, Oxley Highway, Wollomombi, NSW	The item and associated curtilage is located 9,000 m from the Site.
National Trust of Australia	Hillgrove Antimony Site		National Trust Industrial Archaeology Site	Stockton Road, Hillgrove, NSW	The item and associated curtilage is located 4,400 m from the Site.
	Hillgrove Goldmining Area		National Trust Industrial Archaeology Site	Stockton Road, Hillgrove, NSW	The item and associated curtilage is located 4,400 m from the Site.
	Metz Goldmining Area		National Trust Industrial Archaeology Site	Chinamans Gully Road, Metz, NSW	The item and associated curtilage is located 4,800 m from the Site.

6.5.3 Potential impacts

The Proposed Development will not have any direct impacts on known historic heritage items.

It is considered highly unlikely any items of historic significance remain unidentified within the Site. The proposed works are therefore unlikely to directly impact on any unknown items of historic significance.

Potential indirect impacts were considered for registered heritage items located within 5 km of the Site. Due to the nature of the Proposed Development, beyond this distance potential indirect impacts are considered to be insignificant.

The following items of historic heritage significance will not be impacted, either directly or indirectly, by the Proposed Development:

- Eleanora Mine – Chimney (item 199);
- Baker's Creek Mine – Chimney (item 200);
- Baker's Creek Mine – Surface Buildings (item 202);
- Baker's Creek Mine – Winding Engine House (item 201); and
- Garibaldi Mine – Chimney (item 203).

Similarly no impact is anticipated for the following places:

- Hillgrove Antimony Mine
- Hillgrove Antimony Site
- Hillgrove Goldmining Area
- Metz Goldmining Area
- Oxley Wild Rivers National Park

Each of these items/places is located more than 4.5 km from the Site on the southern side of Hillgrove. Studies undertaken for each of the potential indirect impacts (visual amenity, noise and traffic and air quality) conclude low or insignificant impacts at these locations.

Further consideration is given to the following items due to their closer proximity to the site and potentially more sensitive nature:

- Shearing Shed, "Hillgrove Station"; and
- Hillgrove Cemetery.

In order to understand and appropriately manage the potential impacts of the proposed development on a heritage item, it is necessary to understand why the item is considered to be of historic heritage significance. A significance assessment has been undertaken in accordance with the guidelines *Assessing Heritage Significance* (NSW Heritage Office 2001) to establish why a particular site or item is of significance and, if necessary, to enable appropriate mitigation strategies to be developed.

Shearing Shed, "Hillgrove Station"

The shearing shed was constructed c. 1900. The building appears to have been constructed in two stages. The larger, earlier timber section is a simple rectangular building constructed of timber slabs with a corrugated iron roof. The later building is constructed of corrugated iron and of lower scale than the main timber building. There is also a detached shearers quarters and cookhouse located close to the nearby creek. In the 1930s an additional bay was added to accommodate the diesel engine that drives the shears. The item is in good condition with a high degree of fabric intact.

Statement of Significance

The shearing shed is a landmark building located close to the Armidale-Grafton Road. It is a good example of a farm building dating from the turn of last century that demonstrates construction techniques, materials and detailing no longer existing in the area and makes a positive contribution to its prominent landscape setting.

Statement of Impact

The Hillgrove Station Shearing Shed lies approximately 2 km east of the Proposed Development. The Proposed Development presents no direct impact to the sheering shed. Studies for visual amenity indicates that the Proposed Development will not be visible from Hillgrove Station Shearing Shed, and that noise, traffic and air quality impacts are not significant.

Accordingly, it is concluded that no indirect impacts are considered likely to impact the heritage values of the Site.

Hillgrove Cemetery

Hillgrove Cemetery dates from the key period of settlement and development of the mining village of Hillgrove and is a good example of a small rural cemetery. The cemetery is in good condition, although records indicate that there are a significant number of people buried there without identifying headstones.

Statement of Significance

The cemetery dates from the key period of settlement and development of the mining village of Hillgrove and is a good example of a small rural cemetery. The cemetery is publically accessible and still in operation.

Statement of Impact

Hillgrove Cemetery lies outside of the Development Footprint, approximately 3 km south east of the Proposed Development. Based on the studies undertaken to assess likely environmental impacts, it is determined that the Proposed Development presents no direct impact to the cemetery. Zone of Theoretical Visibility assessments for visual amenity indicate that although there are theoretically views of the Proposed Development from the cemetery, these are in practice completely obscured due to vegetation within and adjacent to the cemetery itself. Noise, traffic and air quality assessments indicate that no indirect impacts are considered likely to impact the heritage values of the site.

Accordingly, it is concluded that no indirect impacts are considered likely to impact the heritage values of the site.

6.5.4 Mitigation measures

The above historic heritage assessment indicates that no direct or indirect impacts to known heritage items are anticipated as a result of the Proposed Development, and accordingly, mitigation strategies are not proposed.

In the event that unidentified potential historic heritage items are found during construction activities, works in that area shall cease until an assessment is made by an appropriately qualified archaeologist and OEH has been consulted. Contractors and staff working on site will be advised of this requirement through site induction and toolbox talks.

6.6 Traffic and Access

6.6.1 Introduction

A traffic assessment in accordance with the requirements outlined in the SEARs was undertaken by TTM Consulting Pty Ltd (TTM). This included an independently prepared Traffic Impact Assessment as well as a Road Safety Audit associated with both the construction and operational phases of the Proposed Development (Appendix E and Appendix F). The impacts for decommissioning have not been assessed as the traffic flows on Waterfall Way, and its condition in 30 years cannot be determined. However, the impacts are anticipated to be similar to those identified for the construction phase.

The scope of the transport aspects investigated included:

- Likely traffic generation and impacts;
- Traffic Impact Assessment;
- Access arrangements for staff and deliveries;
- Assessment of the implications and recommendations arising from a Road Safety Audit prepared independently of this report; and
- Identification of any roads or intersections which need to be upgraded, in addition to mitigations for pavement impacts.

To inform the proposed transport arrangements, the Proposed Development has been assessed against the following guidelines and planning documents:

- RMS (RTA) Guide to Traffic Generating Developments Version 2.2 (2002);
- RMS (RTA) Road Design Guide (as amended);
- Austroads Guide to Road Design (and RMS supplements);
- Austroads Guide to Traffic Management (and RMS supplements);
- Austroads Guide to Road Safety: Part 6; Road Safety Audit Third Edition (2009); and
- RMS (RTA) Traffic Control at Work Sites Version 4 (June 2010).

6.6.2 Existing environment

The Site is located north of Waterfall Way (Grafton Road) and is accessed via Bayley Park Road. The characteristics and classifications of these roads are provided in Table 6-15.

Table 6-15: Road classifications

Road	Speed Limit	Lanes	Authority
Waterfall Way (Grafton Road	100 km/h	2 (undivided, sealed)	RMS
Bayley Park Road	Unrestricted	2 (undivided, gravel)	Council

The intersection of Waterfall Way and Bayley Park Road is a priority-controlled T-intersection as shown in Figure 6-8. A private driveway to the property Kiama joins Waterfall Way directly opposite Bayley Park Road. Through traffic does not cross Waterfall Way at this junction.

Figure 6-8: Intersection of Waterfall Way and Bayley Park Road (private access to 'Kiama' can be seen directly opposite Bayley Park Road).

Waterfall Way is under the care and control of RMS. It functions as a State Road from the Pacific Highway at Raleigh, via Bellingen, Dorrigo, Ebor and Wollomombi to the New England Highway at Armidale. Waterfall Way is a two-lane highway with a speed limit of 100 km/h. Average daily traffic flows vary from around 2,000 vehicles east of Armidale to 8,000 vehicles west of Bellingen.

Bayley Park Road is a local road under the care and control of ARC. Bayley Park Road is an unsealed rural road except for a distance of approximately 10 m in from Waterfall Way.

The NSW Road & Maritime Services have provided records of traffic counts on Waterfall Way at the following locations:

- Waterfall Way at Gara River, 6.5 km west of Bayley Park Road (RMS Count Station 92.394);
- Waterfall Way at Bakers Creek Bridge, 4 km east of Bayley Park Road; and
- Waterfall Way at Wollombi, approximately 19.5 km east of Bayley Park Road.

Available traffic counts are provided in Table 6-16.

Table 6-16: Average daily traffic counts at locations near proposal site

Location	Year							
	1998	2001	2004	2005	2006	2007	2009	2010
Waterfall Way at Gara River	1,287	1,314	1,406	1,404	1,379	1,466		
Waterfall Way at Bakers Creek Bridge							1,198	
Waterfall Way at Wollombi								1,189

Daily traffic flows recorded on Waterfall Way are relatively low and well within the capacity of the road, leaving ample spare capacity to accommodate additional traffic.

The historical records on Waterfall Way at Gara River as shown in Table 6-16 show a compound growth rate of 1.5% between 1998 and 2007. This rate has been applied to the count on Waterfall Way at Gara River to forecast current traffic flows (2016) and ten years hence. This results in:

- 1,676 vehicles per day on Waterfall Way in 2016; and
- 1,945 vehicles per day on Waterfall Way in 2026.

Bayley Park Road is a no through road providing access to two residences located on the Bayley Park property as well as access for agricultural production, such as stock handling and general contractor activities. Bayley Park Road may require maintenance activities to support construction activities.

Records of road traffic crashes along Waterfall Way between Old Hillgrove Road and Metz Road, inclusive of Bayley Park Road, were obtained from the NSW Roads and Maritime Services (Appendix F). The records cover the five year period from 01/04/2011 to 31/03/2016. A total of three crashes were reported on Waterfall Way:

- 1 fatal crash involving a single vehicle leaving the road at 10:45 pm on a Sunday evening;
- 1 crash involved a vehicle striking a kangaroo; and
- 1 crash involved hitting an object with serious injury to the occupant of the car.

No crashes were recorded on Bayley Park Road.

An independent road safety audit prepared to support the Traffic Assessment concludes that the crash data does not identify a historical road safety issue related to the Bayley Park intersection.

6.6.3 Potential impacts

Construction and operational access for staff and material deliveries to the site shall be via Bayley Park Road from the intersection of Waterfall Way and Bayley Park Road (Figure 6-9). Staffing arrangements during construction will depend on the staging of the development. Peak staffing estimates are provided in Table 6-17.

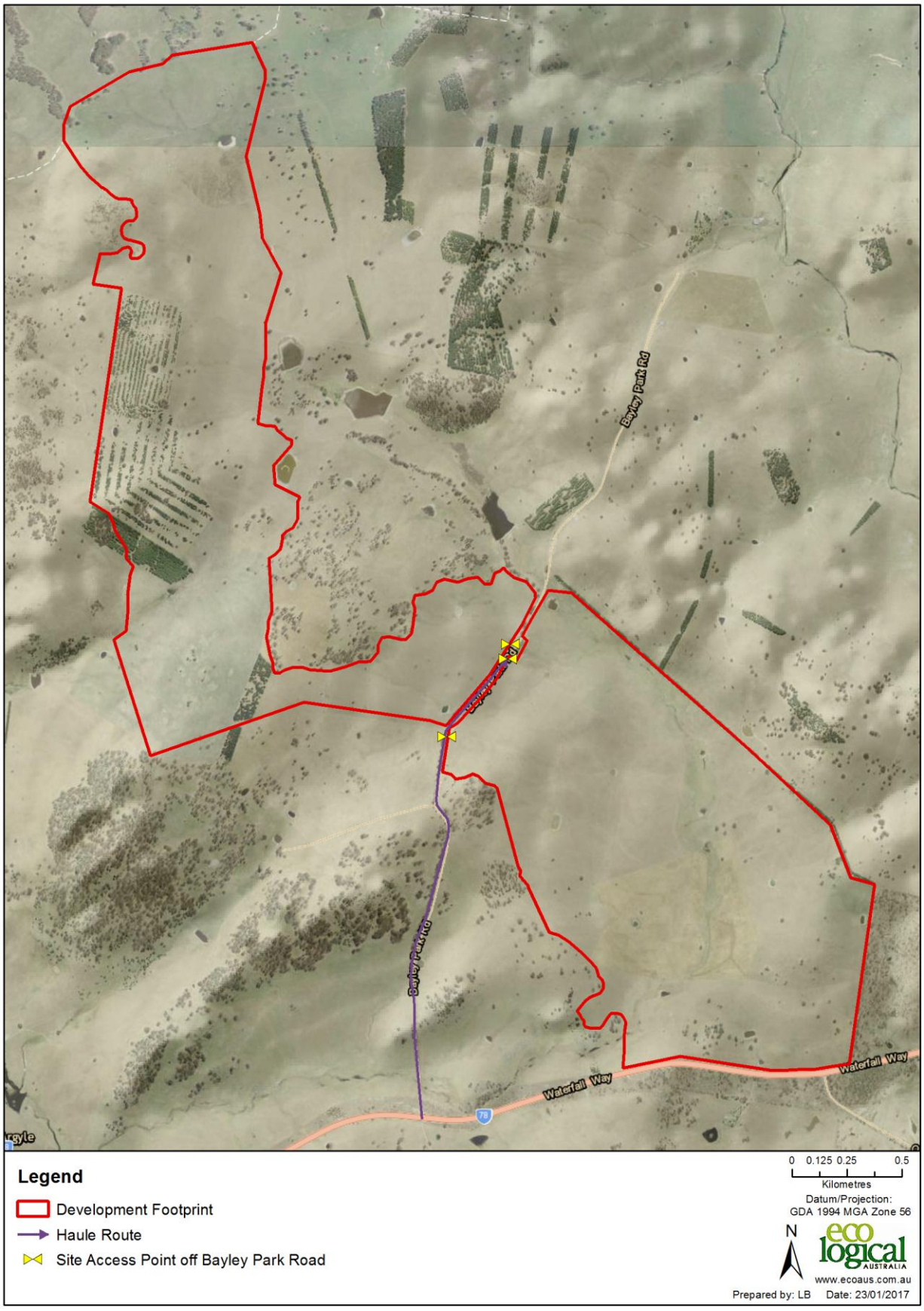

Figure 6-9: Site access and haul road route

Table 6-17: Estimated peak staff numbers for construction and operation activities

Stage	Duration	Estimated number of staff per day	Hours of Operation
Construction	9-12 months	150 (peak)	Monday to Friday 7am to 6pm; Saturday 8am to 1pm; and No work on Sunday or public holidays.
Operation	30 years	4 – 8	All times – only as required

Construction deliveries will depend on the stage and phase of construction activities. Heavy vehicles into the Site are estimated to be up to 27 vehicles per day at the start of the construction activities. As the construction phase progresses the number of heavy vehicles will decline.

Based on this information, it is estimated that overall traffic movements during construction will be up to 75 light vehicles and 27 heavy vehicles daily. For the purpose of assessment, it is assumed that a minimum of 2 construction staff would travel in each light vehicle.

Additional vehicle movements associated with the operational phase are considered negligible.

6.6.4 Mitigation measures

The independent road safety audit (Appendix F) identifies four road safety mitigation measures to improve road safety associated with the proposed project, these are:

- Advance truck warning signs to be installed on Waterfall Way;
- Double white lines should be extended past the intersection of Waterfall Way and Bayley Park Road;
- Guide posts with reflective markers should be installed at regular intervals (100 m spacing) and at specific roadside hazards such as on bends and culverts along Bayley Park Road; and
- Upgrading Bayley Park Road with improvements to the unsealed gravel pavement in accordance with the ARRB *Unsealed Roads Manual* (2009).

All four safety measures are considered to be directly related to the construction phase and shall be addressed prior to commencement of construction activities.

Car-pooling shall be encouraged among contractors during the construction phase with information regarding the benefits of carpooling included in the CEMP.

6.7 Visual Impact

6.7.1 Introduction

The purpose of the visual impact assessment is to identify and outline the existing landscape character and identify the visual amenity receptors within the study area and, as a consequence of the introduction of the Proposed Development, to assess the potential impacts. The assessment then considers how mitigation measures could be implemented to reduce the effect of any identified impacts. A full copy of the visual impact assessment can be found in Appendix G.

The Proponent has taken an adaptive approach to design in order to minimise environmental impacts. The assessment adopts a conservative approach, considering potential impacts across the entire Development Footprint area (the 'Site'), rather than considering individual components separately. Key visual components associated with the Proposed Development include:

- Installation of solar panels (the 'solar array') providing a combined output of approximately 100MW; and
- On-site substation and support buildings.

The assessment area boundaries vary depending upon which of the following assessments are being considered (Figure 6-10):

- Landscape character assessment area – covers the Proposed Development area and its surrounds out to a distance of 2 km. Due to the undulating nature of the landscape, the single character type that defines the area and its widespread nature (discussed below), landscape character impacts beyond this distance would be limited; and
- Visual amenity assessment area – focuses on an area out to 5 km from the Site, beyond this the visual change would be of such a low nature that impacts would be negligible. This area includes local/mid-ground or foreground views within 1 km of the Proposed Development, where any visual change and potential impacts are of most concern, along with mid-ground or subregional views.

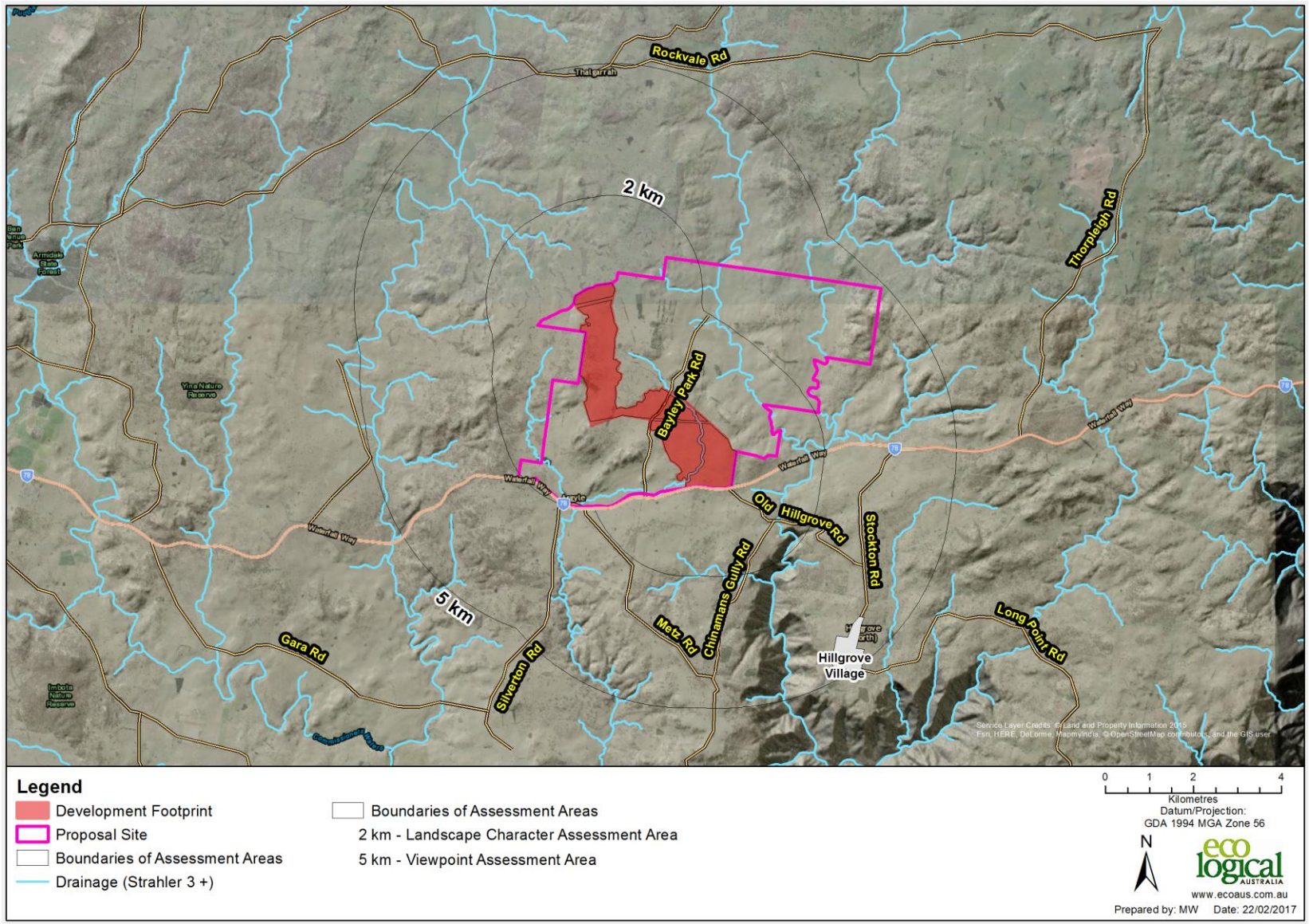

Figure 6-10: Study areas and wider site context.

6.7.2 Existing environment

The Proposed Development is located in a sparsely populated rural setting approximately 4.5 km north west of the village of Hillgrove with a population of less than 100 people. Although there are a number of residences located on the Landholding itself, the only non-associated, residences within 2 km with potential views of the Proposed Development are:

- "Cubba Cubbah" – Lot 5 DP 606050 – 240 m from southern boundary
- "Kiama" – Lot 1 DP 598741 – 1,035 m from south western boundary

The Proposed Development lies adjacent to Waterfall Way, a state highway that joins the Pacific Highway on the NSW North Coast to the New England Highway in Armidale. Waterfall Way is 165 km long and, as noted, provides the main route to site and is also the major highway connecting the inland centre of Armidale with the northern NSW coast, where it ends at the Pacific Highway. The route passes through scenic countryside in places and has become recognised as a tourist drive providing access to National Parks and spectacular waterfalls, from which it takes its name. Seven national parks, three of which are listed as World Heritage Areas are located on or close to the route. Daily traffic numbers in the vicinity of the Proposed Development site are estimated at 1,676 vehicles per day (TTM, 2017a).

Within the broader 5 km study area there are a number of minor roads off Waterfall Way providing access to properties and to the village of Hillgrove. Access to the development site is via Bayley Park Road, an unpaved, no through local road that provides property access to the landholding.

Close by is Bakers Creek Gorge and Bakers Creek Falls, with the main lookout located approximately 1.8 km from the development site along Old Hillgrove Road. The nearest national park is Oxley Wild Rivers National Park, located 11 km downstream of Bakers Creek Falls.

The Site covers approximately 507 ha of rural land, the majority of which has been cleared for grazing purposes and sown with improved pastures. A number of small *Pinus radiata* (Radiata Pine) plantations are located within the site and there are patches of retained native woodland scattered throughout. The site slopes gently toward the south east, following Limerick Creek, and there are a number of farm dams within the Site boundary.

Landform within the Site consists of undulating hills with a relatively low gradient. The majority of the development occurs at elevations between 990 to 1090 m above sea level. The landscape grades gently from hillsides with granite outcroppings, to alluvial basins with moderately fertile soils. The valleys are broad, there are no cliffs, escarpments, or gorges within the Site, but such features are located within close vicinity.

The geology of the Site consists of fine grained Permo-Carboniferous sedimentary rocks, granites and multiple Tertiary basalt flows. Soils across the development site contrast on sedimentary rocks and granite, mellow (soft and friable) and well drained on upper slopes, to harsh and poorly drained on lower slopes. Variable stony loams to deep black earths occur over basalt in valley floors.

The hydrology of the Site is typified by ephemeral first order drainage lines. Several of these drainage lines intersect each other across the development Site to form Limerick Creek which is classed as a third order stream (Strahler, 1952). Limerick Creek joins Cooney Creek approximately 1.5 km downstream of the proposed Site. Cooney Creek flows into Gara Gorge, part of the Oxley Wild Rivers National Park, before joining Salisbury Waters to eventually join the Macleay River and flow to the Pacific Ocean near South West Rocks.

Landscape Character

The landscape character of the Site and the wider study area can be classified as a single Landscape Character Unit (LCU1) dominated by wide undulating to rolling hills which form part of the broader Armidale Plateau sub-region (OEH, 2016). The LCU is rural, with a few homesteads scattered across the wider landscape. Due to historic clearing for agriculture, vegetation cover is generally low except along ridgetops, within road reserves, in isolated patches in paddocks and gullies and within gardens surrounding homesteads. The sensitivity of LCU1 is assessed as **low**, for it is of a type that is widespread and common in the local area and does not have any notable landscape features or attributes that set it apart. Typical images of this landscape are shown in Figure 6-11 and Figure 6-12.

Contrasting LCU1 is the Bakers Creek Gorge (LCU2) which lies to the south of Old Hillgrove Road, with its dense native vegetation, dramatic gorge landform and the Bakers Creek Falls. This in turn leads to the World Heritage Listed Oxley Wild Rivers National Park (LCU3) a further 11 km downstream and although outside the study area has been considered due to its importance at the National scale. However, while the landscape sensitivity of each of these LCUs is **high**, as the Proposed Development will not visible from these LCUs they have not been considered further in this report.

Figure 6-11: Typical regional views showing the rolling rural landscape and cleared vegetation.

Figure 6-12: Southern boundary of the Proposed Development viewed from Waterfall Way looking east (far right)

General sensitivity

The site of the Proposed Development has a relatively confined area of visibility due to it being positioned within a narrow valley that runs in a general north-east/south-west direction that is at a similar elevation to the surrounding landscape. The Proposed Development is located along the valley floor and slopes within the upper reaches of the Limerick Creek catchment. The hills defining the Limerick Creek catchment limit views of the majority of the site, which generally only becomes visible in the southern most sections near Waterfall Way.

The Proposed Development site has a 1.1 km frontage to Waterfall Way. Topography and vegetation in this area naturally obscures potential views of the development Site. The potential area of visibility along Waterfall Way extends from east of Bailey Park Road to just east of the junction with Old Hillgrove Road (see Figure 6-17). Distant view and glimpses of the site are possible from Stockton Road and Hillgrove village.

6.7.3 Potential impacts

Landscape character impact assessment

The landscape impact assessment considers the direct and indirect impacts of the Proposed Development on LCUs associated with the Site. In this case, due to the contained nature of landscape in which the Proposed Development is located, this assessment is limited to the potential impacts on the single landscape character unit (LCU1) identified within the 2 km study area.

An assessment, taking into account the relationship between 'visual sensitivity' (the ability of a landscape character area to absorb a development) and the 'magnitude of visual change' is used to determine the potential impact of the Proposed Development on LCU1.

The visual sensitivity of LUC1 has been assessed as **low**, for although it is an attractive rural landscape, it is of a type and scale that is widespread in the local area and which does not display

particular defining qualities of note. LUC1 is not covered by a designated landscape classification such as a State Forest, National Park or a World Heritage Area.

The magnitude of visual change to LCU1 during the construction and operation of the Proposed Development is considered to be **high**, as the introduction of a solar farm constitutes a large scale change to the visual characteristics of the site and the surrounding area. This is largely due to the otherwise rural nature of LUC1. There will also be relatively minor changes to vegetation cover and landform as a consequence of the development.

It should be noted, that due to the location of the Proposed Development, within an undulating valley, it is never possible to view the solar farm in its entirety. In addition, the magnitude of visual change decreases with distance from the site, as shielding from the topography of the landscape and vegetation interact to reduce views of the Proposed Development, such that, it is no longer the defining feature.

Following decommissioning, all above-ground infrastructure would be removed and the site would be returned to agricultural production. Thereafter, the magnitude of visual change is considered to be **insignificant** due to the very minor residual changes to landform and vegetation that would remain (such as access tracks, and site drainage).

Based on these findings (and with reference to Table 3 in Appendix G) the overall impact on the landscape character within the study area is assessed as **low**. With the addition of mitigation, which is discussed in Section 6.7.4 below, the overall assessment does not change and residual effects are also assessed as **low**.

Viewshed analysis

A series of Zone of Theoretical Visibility (ZTV) maps have been generated to understand the potential extent of the visibility of the Proposed Development within the study area (5 km). The ZTVs for the Site and the Substation and support buildings are presented in Figure 6-13 and Figure 6-14 respectively.

The ZTV for the Development Footprint clearly illustrates that, despite the large scale of the Proposed Development (Figure 6-13), theoretical visibility is limited by the undulating topography that characterises the landscape within which it sits. The landscape's ability to contain the visual influence of the development was a key factor in the selection of the Site. Within the study area (5 km), the main extent of visibility (the areas in purple) are the areas immediately surrounding the Proposed Development out to approximately 500 metres, after this visibility drops away significantly.

The southern section of the Proposed Development is generally more visible than the northern section. Topography, vegetation cover and the absence of sensitive receptors (residences, roads or public access areas) limit potential impacts in other directions. Potential visibility to the north is limited to the highest points in the landscape, which are generally vegetated and due to the vegetation cover are unlikely to have views towards the site, while visibility to the east and west is shielded by the relatively steep hills on either side of the proposed Site.

The ZTV for the substation and support buildings (Figure 6-14), indicate that despite being considerably taller than the solar arrays, they are noticeably less visible due to careful site selection (including a micro-siting allowance). The most likely views of the Substation and support buildings are to the west of the Site, but again this is only in areas of high elevation without residential receptors or public access. Furthermore, the narrow field of potential visibility lends itself to effective vegetation screening options if it considered necessary.

The 20 m communication tower would have more theoretical visibility than other features due to its height. However, due to its solitary nature and lattice design, coupled with the large degree of shielding from surrounding topography, its visual impact is judged to be low to insignificant within the context of its setting.

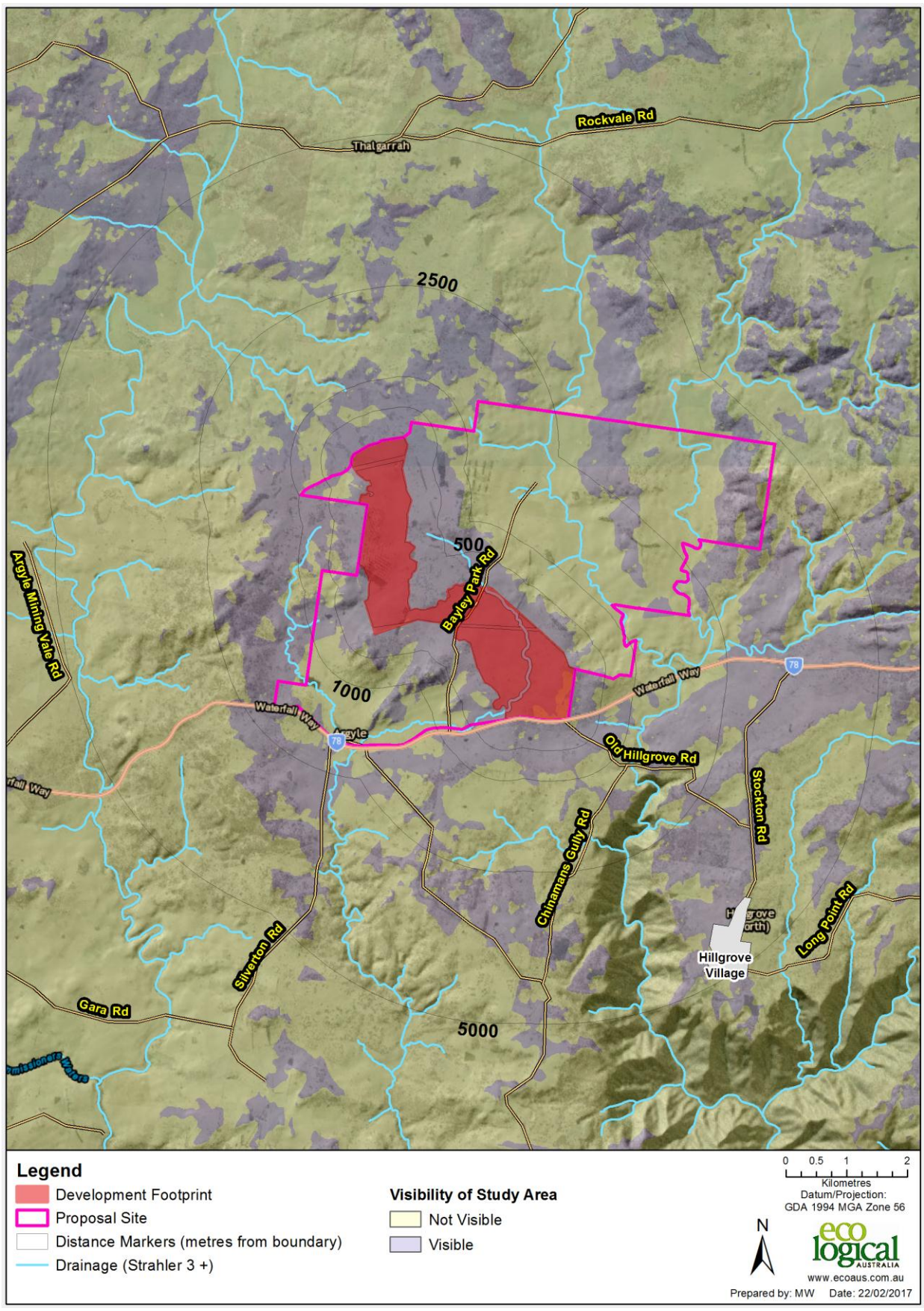

Figure 6-13: ZTV model indicating Development Footprint visibility at a sub-regional level.

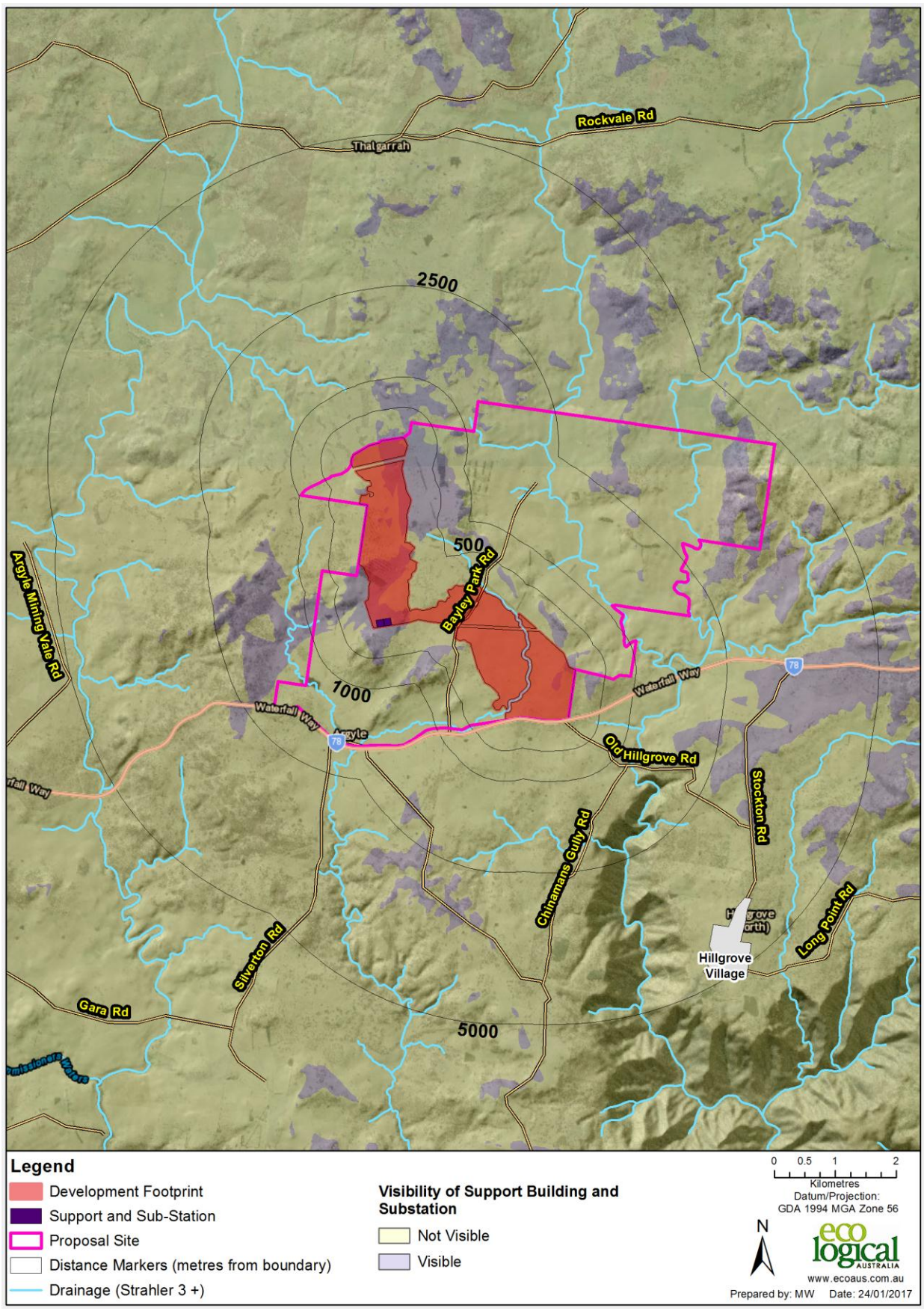

Figure 6-14: ZTV results illustrating theoretical substation and support building visibility at a sub-regional level.

Six viewpoints have been selected to inform the visual amenity assessment and to help determine and describe the potential impact of the Proposed Development on visual amenity. The viewpoints represent the most 'exposed' views of the Proposed Development, from the most 'sensitive' receptors, broadly from within the study area (Figure 6-15).

To illustrate the predicted views of the Proposed Development, photographic views have been produced for each viewpoint. All photographs were taken at 1.7 m above ground.

Overview of viewpoints selected for assessment

Table 6-18 below, describes the viewpoints selected for assessment, the potential visibility of the Proposed Development from each viewpoint and the assessed visual sensitivity.

Table 6-18: Overview of viewpoints selected for assessment

Viewpoint	Approximate distance from the Development Footprint boundary	Viewpoint description and potential visibility of the Proposed Development	Viewpoint sensitivity
A – Waterfall Way	10 m	Waterfall Way is the main through road between Armidale and the NSW Coast. The Proposed Development would be highly visible along a stretch of approximately 1.3 km of the road. Due to changes in topography and vegetation within the road reserve and broader landscape, the site would generally not be visible elsewhere from Waterfall Way.	Despite limited visibility of the Proposed Development over the road as a whole, and that viewers are likely to be in transit, its proximity to Waterfall Way within the Study Area has the potential for extensive views of the Proposed Development by a high number of road users each day. Therefore the sensitivity of the viewpoint is **high**.
B – Old Hillgrove Road	400 m	Old Hillgrove Rd intersects with Waterfall way to the Proposed Development's south east and is the old route to Hillgrove Village. A small part of the southern Development Footprint is visible for approximately 750 m when travelling in a north westerly direction along Old Hillgrove Road. However, views are obscured by vegetation within Waterfall Way road corridor (Figure 6-17).	Visual sensitivity of Old Hillgrove Road is assessed as **moderate** due to potential views being limited by existing vegetation and the road being of only local significance, and potential viewers are likely to be in transit.
C – Stockton Road	3.5 km	Stockton Road intersects Waterfall Way providing the main access to Hillgrove Village. The southern part of the Development Footprint would have some visibility for northbound traffic, albeit distant and oblique to the direction travelled.	Visual sensitivity of Stockton Road is assessed as **low** due to the distance of more than 3.5 km limiting potential views of the Proposed Development, and potential viewers are likely to be in transit.
D – Hillgrove	4.5 km	Hillgrove Common is a publically accessible common at the northern side	Visual sensitivity of Hillgrove Common is assessed as **low** due

Viewpoint	Approximate distance from the Development Footprint boundary	Viewpoint description and potential visibility of the Proposed Development	Viewpoint sensitivity
Common		of Hillgrove. It would have distant views of the southern parts of the Proposed Development although views would be considerably limited through existing vegetation and the narrow vertical band of visibility of the development within the landscape.	to the considerable distance from the Proposed Development, meaning that potential views would form only a small portion of an expansive rural view.
R1 – Cubba Cubbah	240 m	This residence is located 240 m south of the southern boundary of the Proposed Development and would have views upwards over part of the south eastern portion of the Proposed Development. The house itself is orientated towards Waterfall Way, a highway that lies between it and the Proposed Development. Site visibility is partially obscured due to well established vegetation surrounding the residence itself, as well as moderate vegetation densities within the 134 m wide road corridor. Vegetation screenings have been planted by the landholder along 700 m of the property boundary adjoining the road corridor, with mixed results and generally slow patterns of growth.	The local topography and existing screening provide some limitation of views, However, the sensitivity of the viewer (residential) and its close proximity to the Proposed Development results in a **high** visual sensitivity assessment.
R2 – Kiama	1000 m	This residence is located approximately 1 km south west of the southern boundary of the development area. From this location the Proposed Development occupies a reasonably small portion of the mid ground view (Figure 6-20). The residence is at a similar elevation to the development however, a low ridge significantly obscures visibility of the development footprint from the residence. Well- developed gardens surrounding the house would further limit views towards the Proposed Development.	Due to potential views being limited through distance and screening, the visual sensitivity ranking of this receptor is considered to be **moderate**.

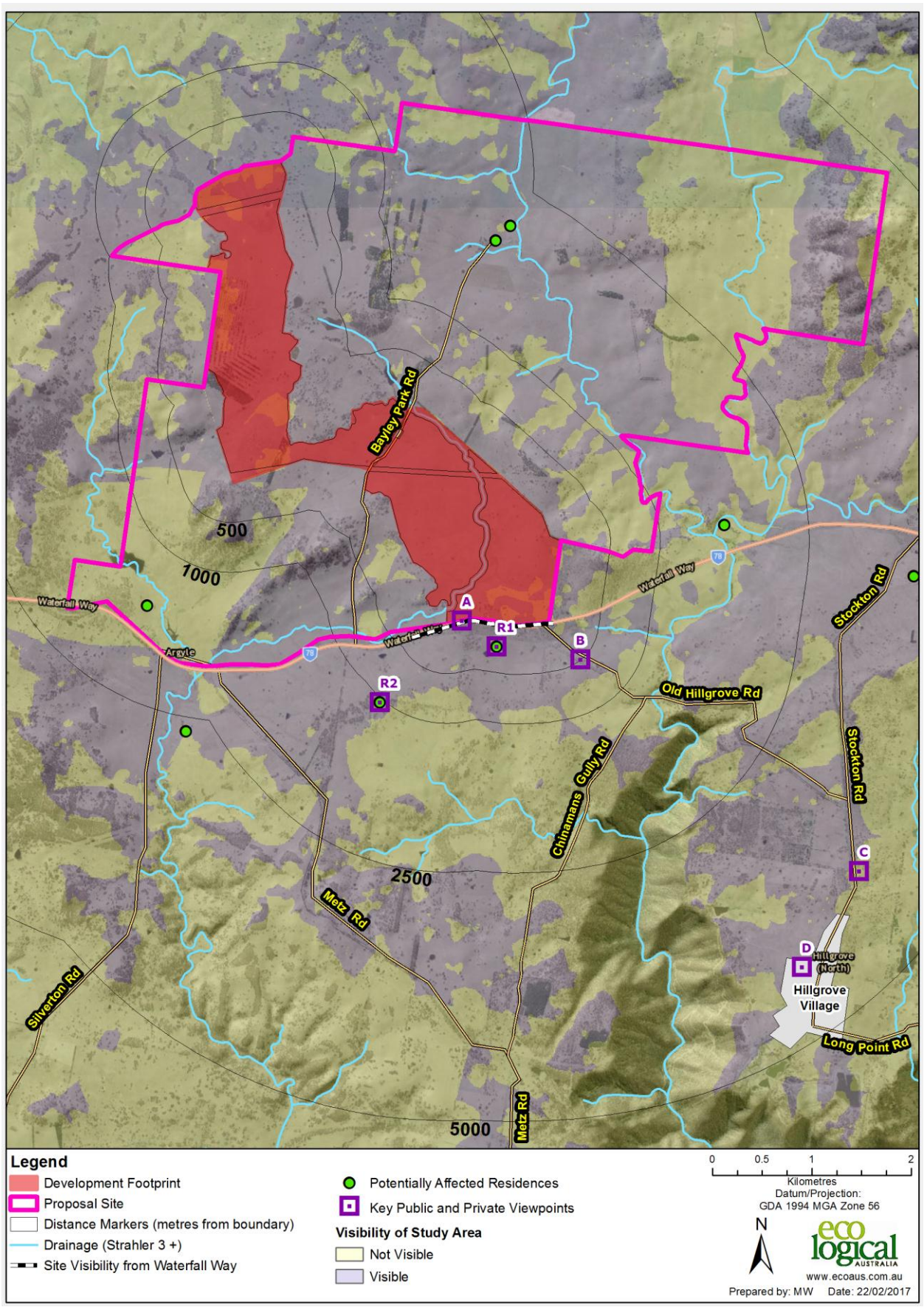

Figure 6-15: Key Public and Private viewpoints selected for visual amenity impact assessment.

Public viewpoints

A - Waterfall Way

Waterfall Way is a main route that links the Pacific Highway on the coast to the New England Highway at Armidale in NSW. Promoted as a tourist drive the road supports both regional and local road users. The view from this viewpoint is typical of the undulating to rolling rural landscape of this area. Due to historic clearing for agriculture, vegetation cover from this viewpoint is generally low except along ridgetops and in isolated patches in both the foreground and mid-ground view.

The Proposed Development is located immediately to the north of Waterfall Way which directly borders the site for approximately 1.1 km (Figure 6-16). The south east section of the solar array would be highly visible to road uses traveling in an easterly direction from Armidale for approximately 1.3 km. However, the vertical depth of the view would be relatively narrow, limiting the perception of the scale of the development from this viewpoint.

A ZTV from this viewpoint (Appendix A within the full visual amenity landscape assessment, Appendix G), has been generated to understand the extent of views towards the proposed Site within which the Proposed Development would be located. It confirms that visibility of the Proposed Development would be confined to the southern part of the Site in line with the findings of the viewpoint assessment above.

Figure 6-16: Viewpoint A – Proposed Development from Waterfall Way (arrows indicate extent of solar array visibility). Aspect – north-east.

Based on the findings of the viewpoint assessment the magnitude of visual change as a consequence of the Proposed Development is considered to be **high** due to the substantial views of the southern

area of the solar array that would be observed from this viewpoint. The visual sensitivity of the viewpoint has been assessed as **high** (Table 6-19), therefore; with reference to Table 3 in Appendix G, the visual amenity impact of the Proposed Development from this viewpoint would be **high**.

Mitigation comprising infrastructure setbacks and visual screening using vegetation is proposed to reduce impacts from this viewpoint (discussed in Section 6.7.4).

B - Old Hillgrove Road

Old Hillgrove Road intersects with Waterfall Way to the south east of the Proposed Development and is the old route to Hillgrove Village. This road would predominantly be used by local road users. Again, the view from this viewpoint is typical of the undulating agricultural landscape of the area. The landscape rises gently towards a ridge which defines the extent of the site that can be seen from this viewpoint. Vegetation in the area is concentrated in the road corridors and within the traveling stock reserve to the east of the Site.

The southern end of the proposed Site is visible for approximately 750 m when travelling in a north westerly direction along Old Hillgrove Road. However, the extent of the potential views from this viewpoint is restricted by the topography of the Site as illustrated by the ZTV generated for this viewpoint (Appendix A within the full visual amenity landscape assessment, Appendix G). Additionally, views are further obscured by vegetation within the road corridor of Waterfall Way (Figure 6-17).

Figure 6-17: Viewpoint B – Proposed Development from Old Hillgrove Road (arrows indicate extent of solar array visibility). Aspect – north.

Based on the findings of the viewpoint assessment, the magnitude of visual change as a consequence of the introduction of the Proposed Development is considered to be **moderate** due to the topography

of the site limiting views of the Proposed Development and the existing roadside vegetation that would obscure views towards the site. The visual sensitivity of the viewpoint has been assessed as **moderate** (Table 6-19); therefore, (and with reference to Table 3 in Appendix G), the visual amenity impact of the Proposed Development from this viewpoint would be **Moderate**.

C - Stockton Road

Stockton Road intersects Waterfall Way providing the main access route to Hillgrove Village. This road is primarily used by local residents and people travelling in vehicles to the mining operation at Hillgrove Mine. Again, the view from this viewpoint is typical of the undulating agricultural landscape of the area. The landscape is extensively cleared with vegetation cover concentrated along ridgetops and in isolated patches in gullies and along waterways and roads. Powerlines linking Hillgrove to the national grid run through the foreground of the view.

Distant views with a limited vertical range of the southern portion of the Proposed Development would be observed from this viewpoint (Figure 6-18). As the Site is more than 3.5 km away from the viewpoint, views of the Proposed Development would only form a small portion of this expansive rural view.

Based on the findings of the assessment for this viewpoint, the magnitude of visual change that would occur as a consequence of the introduction of the Proposed Development is considered to be **low** due to the distance of the site from the Proposed Development and the intervening vegetation that would obscure views towards the Site. The visual sensitivity of the viewpoint has been assessed as **low** (Table 6-19); therefore, (and with reference to Table 3 in Appendix G), the visual amenity impact of the Proposed Development from this viewpoint would be **Low/insignificant**.

Figure 6-18: Viewpoint C – Proposed Development from Stockton Road near Hillgrove Cemetery (arrows indicate extent of solar array visibility). Aspect – north-west.

D - Hillgrove Common

Hillgrove Common is a publically accessible common at the northern side of the Hillgrove Village. The view from this elevated viewpoint is more expansive and open than views obtained from locations closer to the site (Figure 6-19). Again, the undulating agricultural nature of the landscape is typical of the area. However, vegetation cover is more dominant in this view as the vegetation concentrated along ridgetops obscures views of some of the areas of land which have been cleared for agriculture.

Very distant views of the southern part of the Proposed Development would be visible from this viewpoint. As the viewpoint is more than 4.5 km from the Site the Proposed Development would only be perceived as a narrow vertical band in the background of an otherwise expansive rural view.

Based on the findings of the viewpoint assessment, the magnitude of visual change as a consequence of the introduction of the Proposed Development is considered to be **low** due to the distance between the viewpoint and the Site limiting potential views. The visual sensitivity of the viewpoint has been assessed as **Low** (Table 6-19); therefore, (and with reference to Table 3 in Appendix G) the visual amenity impact of the Proposed Development from this viewpoint would be **Low/insignificant.**

Figure 6-19: Viewpoint D – Proposed Development from Hillgrove Common (arrows indicate extent of solar array visibility). Aspect – north-west.

The nearest affected residences are located south of Waterfall Way. Each residence was visited in order to assess the relative visibility of the Proposed Development, and to assess and discuss the viability of potential mitigation actions in reducing potential impacts.

R1 - Cubba Cubbah

Located approximately 240 m south of the southern boundary of the Proposed Development, the Cubba Cubbah residence is situated at a lower elevation than the majority of the proposed Site. The house itself is orientated towards Waterfall Way, a highway that lies between the residence and the proposed Site. The view from this viewpoint is dominated in the foreground by a garden that surrounds the property which partly filters views beyond the property boundary (Figure 6-20 and Figure 6-21). The view then extends over the road corridor (134m), which includes stands of mainly native trees which further filter views up towards the top of a small rise that is mostly cleared and forms part of the proposed Site. In the background, it is possible to see obscured views of the vegetated ridges of the surrounding hills. The landowner has planted a tree line (approximately 700 m) along the property boundary boarding Waterfall Way to the west of the residence. Overall, the view is categorized as agricultural with a manmade feature (the highway) intersecting the mid-ground.

A detailed assessment of the extent of the likely views of the Proposed Development from this viewpoint indicate that, despite its close proximity, views would be limited to a relatively small section of the southernmost area of the proposed Site. This is clearly illustrated by the ZTV map generated to help understand the extent of potential views of the Proposed Development from this viewpoint (Appendix A, Figure A-3, within the full visual amenity landscape assessment, Appendix G). The purple shading on the ZTV map indicates areas that would be potentially visible within the proposed Site boundary. However, it should be noted that ZTVs do not take into account the screening effect of local features such as subtle variations in landform, or vegetation cover noted in the viewpoint description that would filter and screen views from this viewpoint.

The proposed solar array would be observed from this viewpoint in the mid-ground filtered through existing vegetation in the garden and the road corridor. This provides a good opportunity to mitigate potential impacts by maximising the distance infrastructure is setback from the Site boundary and developing effective vegetation buffers designed specifically to maximise visual screening at this viewpoint (see Section 6.7.4).

Based on the findings of the viewpoint assessment, unmitigated, the Proposed Development would be visible filtered through current vegetation in mid-ground views. This, coupled with its proximity to the Site results in a magnitude of visual change that is **high.** The visual sensitivity of the viewpoint has been assessed as **high** (Table 6-19); therefore, (and with reference to Table 3 in Appendix G), the visual amenity impact of the Proposed Development from this viewpoint would be **high**.

Figure 6-20: Viewpoint R1 – north east view towards Proposed Development from outer garden area of Cubba Cubbah (arrows indicate extent of solar array visibility). Aspect – north-east.

During consultation, the landholder indicated two additional potential future home development sites located within the property and subject to differing levels of site preparation. Although on separate titles (*pers. comm.* 6/01/2016), it is understood that no further planning application of consent has been prepared for either site. Although further from the Proposed Development, both sites are located higher in the landscape than the southern part of it.

Without further mitigation, the Proposed Development would be visible from each site, however, in the absence of a formal development strategy, neither site is considered further within this report. It is, however, recommended that the landholder and the proponent maintain a dialogue with the intention of minimising potential adverse impacts to visual amenity from the site, through the agreement of suitable screening locations.

Figure 6-21: Viewpoint R1 – north view towards Proposed Development from outer garden area of Cubba Cubbah (arrows indicate extent of solar array visibility). Aspect – north.

R2 - Kiama

Located approximately 1 km south west of the southern boundary of the Proposed Development the Kiama residence is situated at a similar elevation to the majority of the development Site. The house itself is orientated towards Waterfall Way and set well back from the road. This viewpoint (Figure 6-22) is located in the eastern corner of the established garden surrounding the Kiama residence looking out towards the Proposed Development. The view is typical of the wide, mostly cleared and undulating agricultural landscape of the area. In the foreground the landscape slopes away from the house over the road corridor and down into a small valley before rising up to a ridge which defines the extent of the boundary of the Proposed Development from this viewpoint. The mid-ground and background views are characterised by cleared land punctuated by scattered mostly native paddock trees and clusters of introduced and native trees.

While the Kiama residence is at a similar elevation to the Proposed Development, the topography of the landscape shields most of the Site from this viewpoint. The ZTV map generated to understand the potential extent of views, confirms that views of the Proposed Development would be contained to a relatively small area of the solar array running along Limerick Creek (Appendix A, Figure A-4, within the full visual amenity landscape assessment, Appendix G). These potential views would be limited to a fairly narrow vertical range due to the flat nature of the Proposed Development. It should be noted that ZTVs do not take into account the screening effect of local features such as subtle variations in landform, or vegetation cover noted in the viewpoint description that would filter and screen views from this viewpoint.

As the Proposed Development would be observed from this viewpoint in the mid-ground, filtered through existing vegetation in the garden and the wider landscape, it is proposed that there is potential to further mitigate impacts by developing effective vegetation screens within the development boundary designed to maximise visual screening from this viewpoint (see Section 6.7.4).

Figure 6-22: Viewpoint R2 – Proposed Development from Kiama (arrows indicate extent of solar array visibility). Aspect – north-east.

Based on the findings of the viewpoint assessment, unmitigated, the magnitude of visual change is considered to be **moderate** due to the distance of the Proposed Development and topographical screening that limits the scale of the impact within the broader view. The visual sensitivity of the viewpoint has been assessed as **moderate** (Table 6-19); therefore, (and with reference to Table 3 in Appendix G), the visual amenity impact of the Proposed Development from this viewpoint would be **moderate**.

Other considered viewpoints

The Site is generally obscured or screened from sight from other residences located within 5 km of it, particularly to the east and west. However, the southern portion of the solar farm will be distantly visible from residences within Hillgrove, particularly those on the western side of Brackin Street. Given that Hillgrove is approximately 4.5 km from the Site, it is not anticipated that there will be significant changes to views from any residences at Hillgrove, which are represented in terms of impact by viewpoint D.

The Proposed Development is not visible from Bakers Creek Falls or Oxley Wild Rivers National Park and accordingly, these sites were not assessed further as either viewpoints or as part of the broader landscape assessment.

Table 6-19 summarises the predicted visual amenity impacts at key public and private viewpoints and recommended mitigation strategies.

Table 6-19: Summary of impacts to visual amenity and recommended mitigation actions

Viewpoint	Approximate distance	Visual sensitivity	Magnitude of visual change	Visual impact	Recommended Mitigation
A – Waterfall Way	100 m	High	High	High	• Maximise infrastructure setback; and • Establish vegetation screenings to minimise visibility of solar arrays. • Establish further vegetation screens post construction should they be required.
B – Old Hillgrove Road	400 m	Moderate	Moderate	Moderate	• Establish vegetation screenings to minimise visibility of solar arrays; and • Promote regeneration of vegetation in road corridor in consultation with ARC and other relevant authorities (Waterfall Way).
C – Stockton Road	3.5 km	Low	Low	Low/ Insignificant	None required.
D – Hillgrove Common	4.5 km	Low	Low	Low/ Insignificant	None required.
R1 – Cubba Cubbah	240 m	Very High	High	High	• Maximise infrastructure setback; • Establish vegetation screenings to minimise visibility of solar arrays; and • Promote regeneration of vegetation in road corridor in consultation with ARC and other relevant authorities (Waterfall Way). • Establish further vegetation screens post construction should they be required.
R2 – Kiama	1000 m	Moderate	Moderate	Moderate	• Establish vegetation screening to minimise visibility of solar arrays within the development

Viewpoint	Approximate distance	Visual sensitivity	Magnitude of visual change	Visual impact	Recommended Mitigation
					boundary; and • Establish further vegetation screens post construction should this be required.

At Viewpoints assessed to have moderate or high visual amenity impacts, the extent of potential views of the Proposed Development were modelled using a GIS viewpoint model (Appendix G). This provides an indication of the extent of theoretical views of the Proposed Development from each viewpoint and is a useful tool for developing and accessing potential mitigation strategies. From each of the assessed viewpoints, only parts of the southern section of the Development Footprint would be visible and, in most cases, this would be a relatively small proportion of the total development area.

Other considerations

Night lighting

There is no requirement to light the solar farm at night. The only facilities with provisions for night lighting will be associated with the substation and the support buildings. Lighting at these locations will be on-demand only. The viewshed analysis indicates that the substation and the support buildings areas are well shielded and not visible from potential sensitive receivers (see main report for full details (Appendix G). As such, visual impact assessment is not required.

Glint, glare and reflections

When the sun is reflected off a smooth surface, it can result in a glint (a quick reflection) or glare (longer reflection). In both cases, the intensity of light will depend upon the reflectiveness of the surface from which the sun is being reflected.

Solar farms are not considered to be reflective, since PV panels are designed to absorb as much sunlight as possible to convert it into electricity. Solar panels feature low-iron glass that is designed to minimise reflection and maximise the transmission of light through the glass. Low-iron glass reflects between 4% and 7% of light (Spaven Consulting, 2011). As part of the Capital Solar Farm visual impact assessment, it was estimated that reflectivity of a PV solar panel is similar to, though slightly lower than levels of reflectivity of grasslands, crops and forested areas associated with rural landscapes (NGH, 2010).

Air traffic

The nearest public airport is Armidale Regional Airport located approximately 25 km west of the Site. However, interpretation or topographical maps and aerial imagery indicates a number of private rural landing strips on properties within the surrounding district. Commercial north-south flightpaths are spread across northern NSW, including within the vicinity of the Proposed Development.

Generally speaking, concerns regarding glare from solar farms has focussed on solar facilities on, or adjacent to airfields. Spaven Consulting (2011) concluded that off-airfield ("*en route*") facilities are unlikely to present glare problems to pilots, for the following reasons:

- Glare is likely to present a hazard only during critical phases of flight, especially approach and landing, the *en route* phase is not normally a critical phase;
- Glare occurs almost exclusively at low angles of elevation, aircraft in the *en route* phase of flight will be at higher angles of elevation;
- Pilots in the *en route* phase are already subjected to glare from a number of existing sources such as large assemblies of parked cars, major glasshouse facilities and large bodies of water, etc; and
- The pilot's view from most cockpits, is severely limited in the downward direction by the aircraft structure, thus blocking the line of sight to any source of glare on the ground.

The presence of the Proposed Development is anticipated to have an insignificant visual impact on local airfields traffic. PV panels are no more reflective than areas of vegetation such as forests, crops or grasslands and far less reflective than standing water such as water in dams, rivers and lakes, all features which pilots regularly fly over or adjacent to (NGH, 2010).

Further evidence of the limited risks posed by reflections from PV panels is the increasing installation of large solar arrays within airports in order to take advantage of large open areas and high local day-time electricity demand. Australian examples include Adelaide Airport, Alice Springs Airport, Newman (WA) Airport and Ballarat Airport (Solar Choice, 2013).

Road traffic

As discussed above, reflectivity of solar panels is generally similar, or lower, than surrounding landscape features so would not have a visual impact on road uses. Potential glint and glare impacts to road traffic shall be further minimised through:

- Selection of muted and non-reflective construction materials; and
- Installation of security fencing and screening vegetation between road users and infrastructure.

Cumulative visual impacts

A Development Application has been submitted by Hillgrove Mines Ltd for the establishment of an underground gold and antimony mine at Clarks Gully, near the junction of Old Hillgrove Road and Waterfall Way.

Cumulative visual impacts may result from certain viewpoints, should concurrent development and/or operation of the proposed Metz solar farm and the proposed Clarks Gully Mine occur, particularly:

- R1 – Cubba Cubbah;
- A – Waterfall Way; and
- B – Old Hillgrove Road.

The visual amenity assessment prepared for the Clarks Gully Mine (Envisage, 2016) indicates that the proposed Clarks Gully Mine shall be partially visible from the existing residence at Cubba Cubbah and assessed the overall impact to visual amenity as high. It is considered likely, that from the same vantage point it may be possible to view parts of the Proposed Development, although not necessarily within the same vista due to separation distance and angle. Potential cumulative impacts at this site have been considered and addressed in developing a comprehensive mitigation strategy aimed at significantly reducing the visibility of the Proposed Development from the existing residence at Cubba Cubbah as is discussed below.

The proposed Clarks Gully Mine is not visible to eastbound travellers on Waterfall Way adjacent to the Proposed Development (Envisage, 2015), however, partial views of both developments may occur in rapid succession creating a perceived cumulative visual impact. Proposed mitigation measures (setback and vegetation screening) have been developed to minimise this perception.

Combined views of both Clarks Gully Mine and the Proposed Development may be apparent to westbound travellers on Old Hillgrove Road. In this case, the recommended general and site specific mitigation strategies for Metz Solar Farm will assist to reduce impacts to visual amenity associated with this development.

6.7.4 Mitigation measures

The following mitigation measures will be implemented over the life of the project. Specifically they are targeted at mitigating impacts from Viewpoints 'A' (Waterfall Way, high potential impact), 'B' (Old Hillgrove Rd, moderate potential impact), 'R1' (Cubba Cubbah, high potential impact) and 'R2' (Kiama, moderate potential impact). However, the measures will have the overall effect of reducing severity of impacts at all representative viewpoints and as such, visual impacts throughout the local area:

- Establish an infrastructure free Visual Buffer Zone (Figure 6-23) that will, as far as practical, maximise infrastructure setbacks from areas along Waterfall Way that can be viewed by the public (50 m minimum setback from the Site boundary, increasing to 160 m from the site boundary in areas visible from Cubba Cubbah);
- Minimum setback distances of 160 m (from the Site boundary) proposed in areas that can be viewed from Cubba Cubbah (providing a total set back from the residence of 400m);
- Establish a vegetation buffer within the Visual Buffer Zone where Waterfall Way borders the southern boundary of the Proposed Development (Figure 6-23);
- Establish vegetation buffers within the Site boundary to help screen views from Kiama (Figure 6-23);
- Ensure the establishment of the vegetation buffers are commissioned as one of the first activities of site construction;
- Continue to consult with neighbouring landholders to identify, where possible, the location of mutually agreeable vegetation screening both pre and post construction. Ensure actual screening meets mitigation expectations and broaden planting if it does not;
- Promote management of road corridor vegetation to allow natural regeneration of native plant species in consultation with ARC and other relevant authorities;
- Use muted, low contrast colours for infrastructure, so that they blend into the landscape as far as possible;
- Select infrastructure to minimise potential for reflectivity and glare;
- Locate substation, support buildings, construction site compound and lay down areas away from visual receptors and apply visual screening if necessary;
- Minimise night lighting at the substation and associated support buildings; and
- Minimise vegetation clearing and earthworks and rehabilitate progressively.

Draft Landscaping Plan

The draft landscaping plan has been developed in response to the findings of this assessment and in consultation with affected landholders, with the objective of minimising visual impacts at sensitive receptors, particularly viewpoints 'A', 'R1' and 'R2'.

The draft landscaping plan responds directly to concerns raised during stakeholder consultation undertaken by Eco Logical Australia staff on the 6th of January 2017 and by Infinergy Pacific personnel on the 10th of August 2016 and 11th of January 2017.

The proposed planting area comprises a 20 m vegetation buffer running the entire length of the frontage with Waterfall Way and up along the edge of the Site boundary which faces R2. The buffer is located to compliment changes in topography, with the intention of maximising the effectiveness of the Visual Buffer Zone from impacted viewpoints (Figure 6-23). It is proposed that the planting screens be revaluated both pre and post-construction to ensure that the effects of screening are optimised with respect to the final design.

The following preparation, planting, care and maintenance program will maximise the effectiveness of the proposed vegetation screening:

- Tree planting is to be carried out as early as possible in the construction process to maximise growth over this period;
- Tree planting within the buffer areas should be undertaken in prepared planting beds with a density to achieve roughly one tree every 5 m;
- Bed preparation shall include weed removal and cultivation to a depth of at least 300 mm;
- Selected plants should be at least 700 mm high at the time of planting and protected with plant guards suitable to enhance plant growth and protection from vertebrate pests;
- Watering and maintenance shall be undertaken for at least 3 years, including weed management to ensure a weed-free area of 1 m around each trunk;
- Plant species establishment success shall assessed following planting and modified as appropriate;
- Plants that fail shall be replaced, and alternative species considered if plant failure is an ongoing issue throughout the operational period; and
- Local endemic plants should be selected in consultation with Armidale Tree Group or a similar organisation. Suitable species could include:
    - *Eucalyptus blakelyi*;
    - *Eucalyptus melliodora*;
    - *Eucalyptus bridgesiana*;
    - *Acacia filicifolia*;
    - *Acacia rubida*; and
    - *Jacksonia scoparia*.

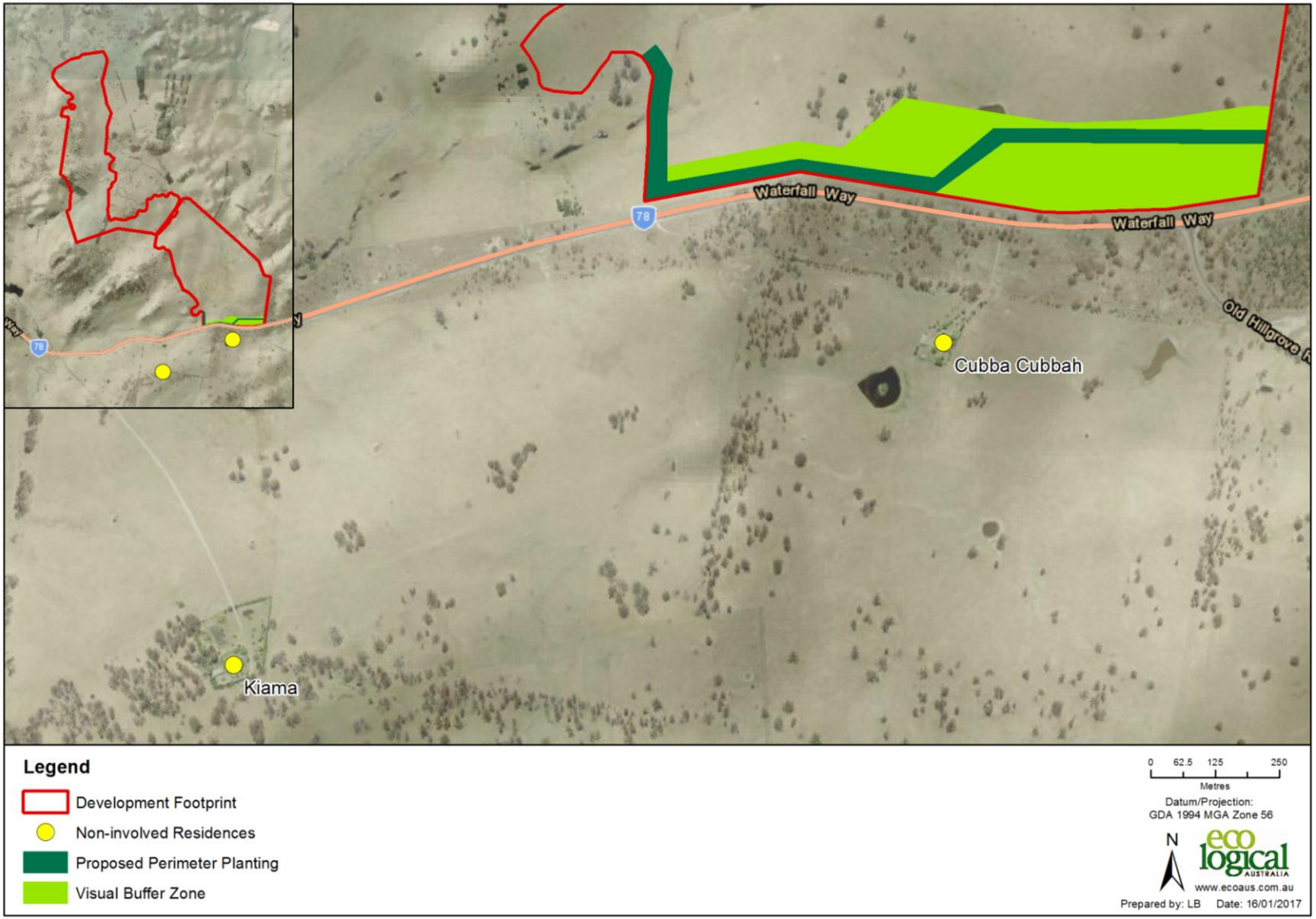

Figure 6-23: Draft perimeter landscaping plan (green buffer strip adjacent to Waterfall Way – nearby residences circled red).

Predicted residual impacts following the introduction of mitigation measures discussed above are outlined in Table 6-20 below.

Table 6-20: Summary of residual effects

Assessment area	Impact Assessment	Anticipated residual effect following mitigation
Landscape character	**Low**	**Low.** Vegetation screening will, over time, further reduce changes within the landscape in proximity to Proposed Development.
A – Waterfall Way	**High**	**Moderate,** reducing to **low** as tree planting is established and combines with existing vegetation to obscure views.
B – Old Hillgrove Road	**Moderate**	**Moderate,** reducing to **Low** as tree planting is established and combines with existing vegetation to obscure views.
C – Stockton Road	**Low**	**Low / Insignificant.**
D – Hillgrove Common	**Low**	**Low / Insignificant.**
R1 – Cubba Cubbah	**High**	Reducing to **High/Moderate** with infrastructure setback, and further reducing to **Moderate and then Low** over time as tree planting will almost entirely shield development.
R2 – Kiama	**Moderate**	**Moderate,** reducing to **low** as tree planting is established and combines with existing vegetation to obscure views (should this be required from the landowner).

6.8 Water Resources

6.8.1 Introduction

The water resources assessment has been developed to in accordance with the requirements of the SEARs for the Proposed Development. The assessment included the following steps:

- Desktop assessment;
- Field assessment;
- Consideration of existing environmental conditions;
- Flood modelling (Appendix H);
- Impact assessment; and
- Identification of mitigation and management measures.

The SEARs require *"an assessment of the likely impacts of the construction, operation and decommissioning of the development on:*

- *The quality and quantity of groundwater and surface water resources (including nearby water courses), adjacent water users, riparian land, and aquatic and groundwater dependent ecosystems, and measures that would be implemented to mitigate any impacts;*
- *Annual volumes of surface water and groundwater required, details of water supply arrangements, 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 and construction (Landcom, 2004); and*
- *Details on proposed creek crossing locations and designs (if required)".*

Further details of OEH's requirements are provided in the SEARs (Appendix A) and are addressed, as relevant, in following sections. A summary of responses is provided in Appendix I.

6.8.2 Existing environment

The Proposed Development is located within the Macleay River Catchment. This catchment occupies 11,450 km^2, and incorporates extensive areas of the northern tablelands, a sparsely populated escarpment area of the Great Dividing Range and a coastal area ranging from foothills to coastal floodplains. The majority of the rivers in the Macleay catchment are unregulated, and most water users rely on small structures for their water supplies. Flows are most affected during dry periods where water availability is low and demand is high.

Surface Water

Limerick Creek, a 3rd order (Strahler) drainage line, intersects the study area and is fed by a number of 1st and 2nd order drainage lines found throughout the Site (Figure 6-24). The catchment area of Limerick Creek above and including the Site is approximately 800 ha. Limerick Creek joins Cooney Creek approximately 1.5 km downstream of the Proposal Site. Cooney Creek flows into Gara Gorge, part of the Oxley Wild Rivers National Park, before joining Salisbury Waters to eventually join the Macleay River which then flows to the Pacific Ocean near South West Rocks. At the time of the field assessment Limerick Creek and the feeding drainage lines were dry, or near dry across the Site.

Small portions of the Site (72 ha) drain directly to Cooney Creek to the west, and Bakers Creek to the east (45 ha). A search of relevant databases did not identify any existing hydrological or water quality data relating to Limerick Creek, Cooney Creek or the Gara River downstream of the Site. Accordingly, information provided below is based on hydrological modelling, the findings of Site reconnaissance, results for nearby streams, and expert knowledge.

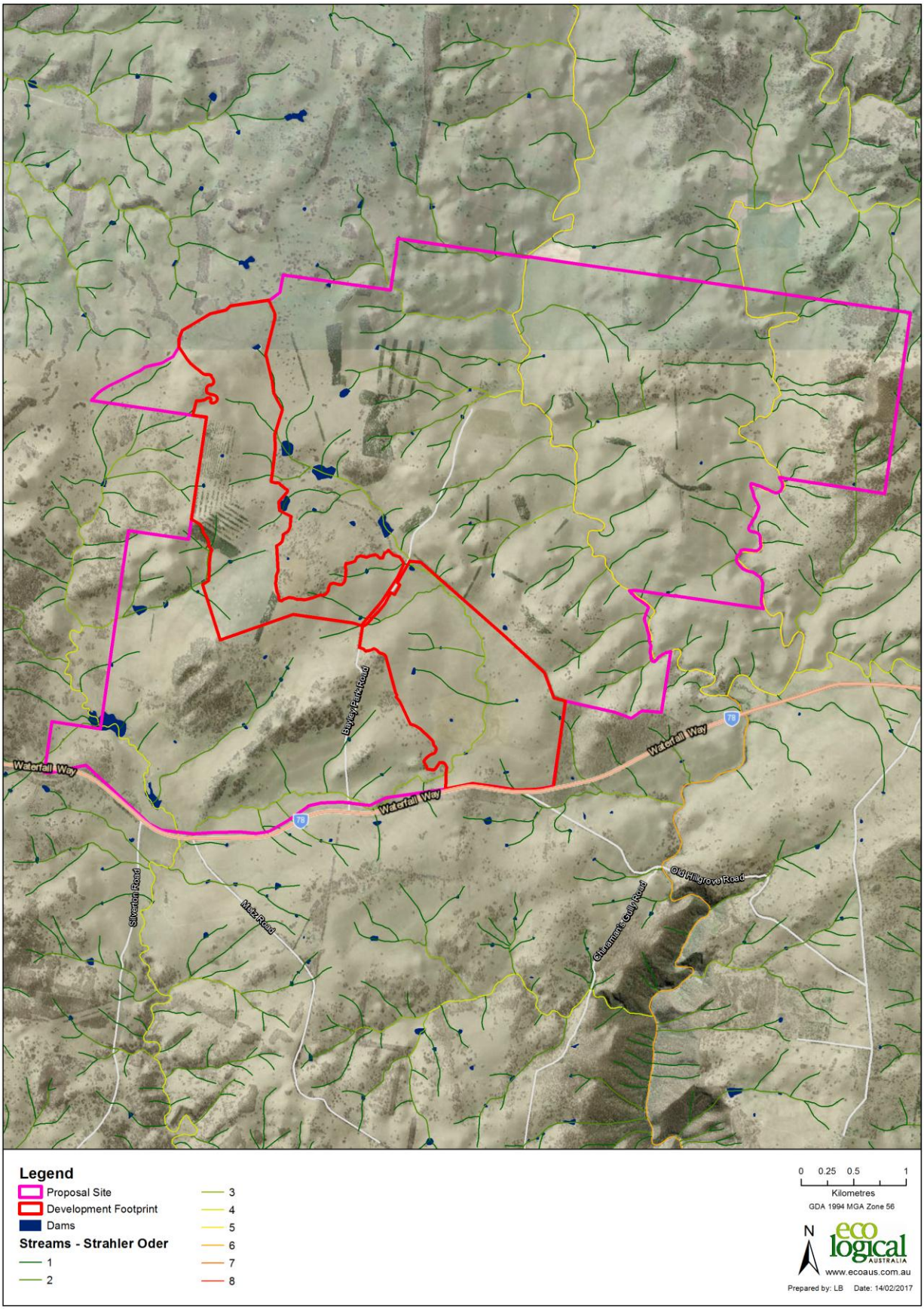

Figure 6-24: Surface water resources, showing Strahler stream order, within and adjacent to the Development Footprint

Water access at the Site is in accordance with the Draft Water Sharing Plan for the Macleay River (unregulated and alluvial water sources). The Report Card for the Gara River catchment indicates an 80th percentile flow volume of 0 ML/day, indicating the highly ephemeral nature of the water source. Water quality objectives for the Macleay include:

- Aquatic ecosystems;
- Visual amenity;
- Primary and secondary contact recreation;
- Livestock water supply;
- Irrigation water supply;
- Homestead water supply;
- Drinking water (Disinfection only/clarification and disinfection/groundwater);
- Aquatic foods; and
- Industrial water supplies.

Water quality data is not available for the Site, however, Hillgrove Mines have been monitoring water quality monthly in the adjacent Bakers Creek catchment since January 2013 (monitoring site MW22 – Bakers Creek at Waterfall Way). The Bakers Creek catchment is considered to be relatively analogous to Limerick in terms of size, geology, vegetation and landuse and, therefore, provides a good indication of likely water quality at the Site. Mean water quality testing results for this Bakers Creek are provided in Table 6-21 below.

Table 6-21: Mean monthly surface water quality testing results, Bakers Creek at Waterfall Way (January 2013 – March 2015) and Trigger Values for freshwater (mg/L) ANZECC 2000 (adapted from ELA, 2015).

Analyte	MW22 – Bakers Creek at Waterfall Way (mg/L)	ANZECC Trigger Values for Freshwater ecosystem health (mg/L)
Antimony	0.006	-
Arsenic	0.003	0.0034
Cadmium	0.0001	0.002
Chromium	<0.001	0.001
Copper	0.0012	0.0014
Lead	0.0005	0.0034
Selenium	0.005	0.011
Zinc	0.010	0.008
Mercury	0.00005	0.0006
Total cyanide	0.002	0.007
Ammonia as N	0.029	0.9
Nitrate and Nitrite as N	0.010	0.7
pH (field)	7.89	-
Flow (mL/day)	0.008	-

Analytes tested, reflect mineralisation and heavy metal concerns associated with the Bakers Creek catchment area and prior mining operations at Hillgrove Mines. Aside from background zinc levels, all mean monthly water quality results are below Australian and New Zealand Environment Conservation Council (ANZECC) trigger values for the protection of aquatic ecosystems. Based on these results water quality in Limerick Creek is assumed to be of similar or better quality.

Groundwater

Groundwater systems in the vicinity of the proposal include:

- Weathered deposits of the Hillgrove Adamellite;
- Fractured Hillgrove Adamellite (granitiferous rocks); and
- Girrakool beds (metasedimentary greywackes and extrusive volcanics).

The Hillgrove Adamellite is fractured granite and tends to exhibit negligible primary porosity within the rock matrix itself. The occurrence and movement of groundwater through this rock is considered to be dependent on secondary porosity (principally fractures) (ELA, 2015).

The Site does not contain any groundwater bores, however a review of the NSW Office of Water (NOW) online *All Groundwater Map* identifies two bores within a 2 km radius of the Site used for stock and domestic purposes (Figure 6-25; NOW, n.nd). Data for these bores (GW034940 and GW302230) indicate relatively deep groundwater levels, with the depth of the upper limit of the groundwater bearing zones being 11 m and 37 m, respectively (Table 6-22). The groundwater in these bores is hosted by granite and basalt respectively.

Table 6-22: Observed yields and depths of nearby bores (adapted from NOW, n.d.).

Bore ID	Registered use	Bore depth (m)	Water bearing zone	Groundwater bearing depth (m)	Slotted Section Depth (mbgl)	Standing water level (mbgl)	Yield (l/s)
GW034940	Stock, domestic	45.7	Fractured basalt (Girrakool Formation)	11 m	5.7 – 45.7	Unknown	-
GW302230	Domestic stock	42	Granite (Hillgrove Adamellite)	37 m	37 - 42	6.0	0.505

Limited baseline groundwater quality data is available. That which is, tends to focus on Hillgrove mining activities and is of little significance to the current study. The use of groundwater for stock and domestic purposes, although limited, implies “fitness for purpose”.

Aquatic Ecosystems

The Bureau of Meteorology’s (BOM) *Groundwater Dependent Ecosystem Atlas* (BOM 2012) indicates there are areas in the vicinity of the Site that have low potential for Groundwater Dependent Ecosystems (GDE) reliant on subsurface groundwater (vegetation) (Figure 6-25). However, these mapped areas lie outside of the Development Footprint and ground-surveys confirm that these areas are unlikely to be impacted by the Proposed Development.

In practice, Limerick Creek forms a series of shallow ponds, reflecting its low hydrological energy and upland setting. Around the Site, local wetlands are present in the form of riparian soaks and springs, and adjacent to areas of granite outcropping downstream of the Site. These areas are likely to be fed, at least partially, by very shallow lateral groundwater movement through the soil profile and accordingly are consistent with the definition given for groundwater dependent ecosystems (Geoscience Australia, 2017). However, these areas are restricted to Limerick Creek itself and low lying areas within the riparian zone. Despite the presence of these small, local wetlands, no *Nationally Important Wetlands* or *Upland Wetlands of the New England Tablelands EEC* are present within the Development Footprint or downstream of it.

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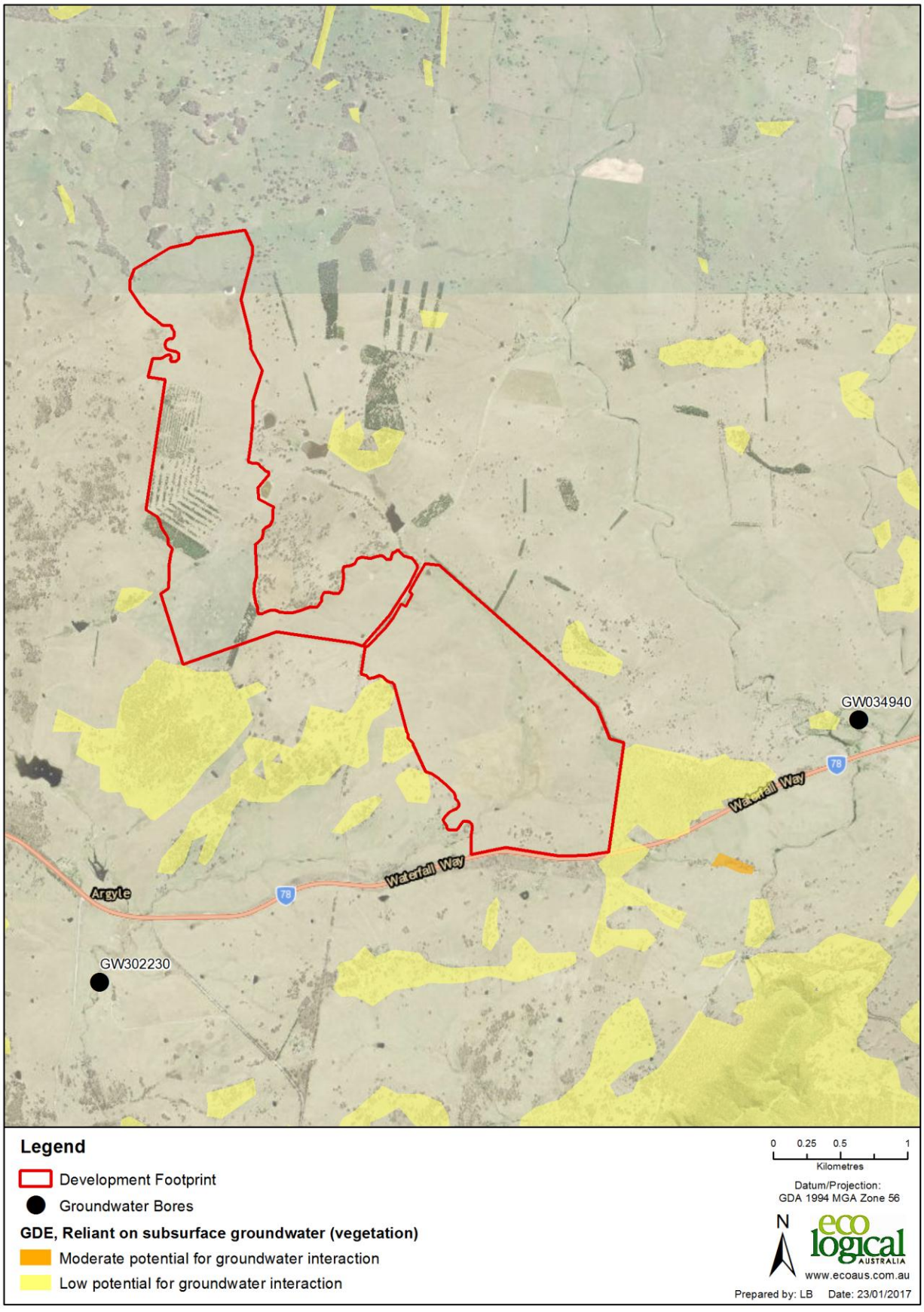

Figure 6-25: GDEs in proximity of the Development Footprint (BOM, 2012; NOW, n.d.)

Within the wider site boundary, Limerick Creek is classified as *unlikely fish habitat* (Class 4 waterway - Fairfull & Witheridge, 2003). Riparian vegetation and the riparian zone is highly degraded, having been completely cleared, grazed, sown and modified to support agricultural practices (Figure 6-26).

Figure 6-26: Highly degraded riparian zone and vegetation of Limerick Creek (photograph taken during December 2016)

Flood Hydrology

The study area is located in the headwaters of the Limerick Creek catchment, an area of approximately 800 ha, and is characterised by low rolling hills and undulating plains with no areas of floodplain identified within the Site or immediately downstream. The Site is not considered to be Flood Prone Land and it is not included as land mapped as Flood Prone Land (ADC, 2012).

Flood modelling was undertaken to assess the impacts of the Proposed Development (Appendix H). Given that the installed solar panels will be raised above the ground (and therefore not an obstruction to the flow of water across the Site), the flow and water level analysis focused on whether the change in impervious area (hard surfaces) within the catchment would change the critical (peak) design flood flows. No benchmark information is available to calibrate these outputs as no relevant flow gauging data is available for the Site or downstream. The nearest downstream NOW gauging station is 206024 (Macleay D/S Georges), and has a catchment area of 7,930 km^2.

To categorise the existing design, flood conditions for the area of interest required the use of regionalised flood models as no appropriate rainfall, water level or flow information exists in or near the catchment of interest. Flood frequency was determined using the RFFE model (Western Sydney

University), flow voumes using RORB (Monash University and Hydrology and Risk Consulting) and water levels using HEC-RAS (U.S. Army Corps of Engineers) programs. This means that the flow volumes and water depths determined by the models should be examined in a comparative sense, not in absolute terms.

Event durations from 10 minute to 7 days were run through the models to determine the critical flood duration and volume for the 10% Annual Exceedance Probability (AEP), 2% AEP, 1% AEP, 0.5% AEP, 0.2% AEP and 0.1% AEP events.

As the catchment in question is rural without any impervious areas, a large amount of rainfall is required to cause the critical flood (the flood with the highest peak flow). That flood for this region is the 6 day event and the modelled peak flows and water depths immediately downstream of the Proposed Development are outlined in (Table 6-23).

Table 6-23: Peak flows (6 day event) for existing conditions

AEP (%)	Peak flow (m^3/s)	Peak water level depth (m)
10%	770	2.46
2%	1,117	2.86
1%	1,248	3.03
0.5%	1,360	3.22
0.2%	1,565	3.46
0.1%	1,701	3.53

The design flows and corresponding water depths from the 6 day critical event represent an extreme conceptual event and on analysis appear to be larger than likely to be experienced, based on expert review of the landscape and geomorphic characteristics of this catchment and stream, such as:

- The catchment is small;
- The development Site is located at the top of the catchment;
- The landform within the catchment is wide and gently sloping;
- There is no indication of flood plain development;
- Limerick Creek exhibits:
    - A low gradient;
    - A chain-of-ponds sequence;
    - No apparent scour or erosion; and
- Flood wrack deposition is low.

However, results do provide a sound basis to compare the flood risk under existing levels of development (current conditions) with those under the Proposed Development.

6.8.3 Potential impacts

Potential impacts to water quality and quantity for both surface and ground water resources during construction (including decommissioning) and operational phases are considered in following sections.

Construction and decommissioning

Surface Water Quality

The proposed works involve a range of activities that could disturb soils and potentially lead to sediment laden runoff, affecting local water ways, during rainfall events. These activities include:

- Excavations for the construction of internal roads, substation, support buildings, construction compound, laydown and parking areas;
- Ground preparations associated with the installation of PV panels and inverters;
- Ground preparations for overhead cable installation; and
- Trenching for belowground cable installation.

Soil compaction would occur as hardstanding and access tracks are created, which would reduce soil permeability, thereby increasing run off and the potential for concentrated flows over a limited area of the Site. This could potentially lead to an increase in sediment laden runoff, affecting local water ways, during rainfall events.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals commonly used onsite would include fuels, lubricants and herbicides.

Surface Water Quantity

The Proposed Development will require non-potable water for dust suppression and cleaning purposes during the construction phase. This water would be sourced offsite or from existing farm dams if available. As such, there could be a potential decrease in surface water at the Site during the construction phase of the development.

Potential impacts during decommissioning would be similar to those outlined for the construction phase.

Surface water access and use is authorised under the WM Act, in accordance with the provisions of the Macleay River Water Sharing Plan. This water would be sourced from existing farm dams located within the Site. The volumes likely to be used as a consequence of the Proposed Development would not exceed 10 % of the annual surface water total permitted under surface water harvesting rights, and therefore would not require a water access licence under the plan. If required, any additional non-potable water would be sourced offsite.

Groundwater Quality and Quantity

Subsurface disturbances would be limited to trenching, shallow excavation, and piling activities during the construction phase of the development. Interference of the groundwater resource during construction is considered to be negligible. This is due to the fact that construction activities at a maximum depth of 1.6m would not intersect groundwater at the Site (Table 6.22). Potential groundwater quality impacts will be managed through the surface water quality measures described in the mitigation section below.

The use of fuels and other chemicals on site pose a risk of ground water contamination in the event of a spill. Chemicals commonly used onsite would include fuels, lubricants and herbicides. There will be no requirement to source groundwater for construction activities. Therefore, the Proposed Development is not considered likely to influence groundwater systems or the water balance of the Site, nor would an

aquifer interference approval as per the *NSW Aquifer Interference Policy* be required. Accordingly, groundwater monitoring is neither warranted, nor proposed.

Potential impacts during decommissioning would be similar to those outlined for the construction phase.

Operation

Surface Water Quality

Operational impacts to surface water resources are considered negligible.

The post-construction land use as a solar farm would reduce the potential for impacts to water quality, compared to current agricultural landuse practices. Potential water quality benefits would include a decrease in soil disturbance as the current agricultural practice is to cultivate the Site on an annual basis, increasing the potential for sediments to enter surface water. A reduction in stocking rates would also reduce erosion, sedimentation and riparian disturbance at the Site and hence impacts on surface water. In addition a decrease in fertiliser use and stocking rates would reduce the potential for nutrients to enter surface waters.

Although the installation of PV panels presents a large non-pervious surface, the shape of the panels, and the separation distance between rows (approximately 5 – 7 m, see Figures 3-4 and 4-4 for visual examples) will quickly return rainfall as runoff to the natural ground to allow surface penetration and/or run-off to occur in a typical manner (Appendix H). Disturbed areas would be revegetated in order to stabilise the ground surface. This should prevent soil erosion and, thus, sedimentation impacts to surface water. However, it is acknowledged that as a consequence of a large rainfall event soil scarring could occur under the panels which may, if left untreated, result in soil erosion and potential impacts to surface water.

Surface water quality could also be impacted through sedimentation during the operational phase as a consequence of increased runoff due to the impervious nature of the permanent access tracks and hardstanding areas.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals commonly used onsite would include fuels, lubricants and herbicides.

Surface Water Quantity

Surface water use during the operational phase of the Proposed Development would be negligable, and sourced from existing farm dams only as necessary. Water required for staff amenities shall be sourced from on-site rainwater tanks or delivered to site as potable water.

Panel cleaning requirements depend on prevailing weather conditions at the Site. Some solar plants are never cleaned, while others require multiple cleanings per year. Given the vegetated landscape and climate associated with the Site (141 days of rain average per annum), resulting in generally low levels of dust (Section 6.12 for further detail), it is anticipated that the Proposed Development will require infrequent cleaning. If required, it is anticipated that water requirements for panel cleaning would be secured through commercial arrangements with a local water supply company and trucked to site. The volumes of water used for individual panel cleaning shall be insufficient to pose an erosion threat, given the proposed erosion and sedimentation mitigation discussed below.

Groundwater Quality and Quantity

No operational activities would affect groundwater at the Site. No groundwater is proposed to be sourced during operation of the Proposed Development. No groundwater is proposed to be sourced during the operation of the Proposed Development.

Impacts to Riparian, Aquatic and Groundwater Dependent Ecosystems

Direct impacts

Construction and decommissioning

Construction and decommissioning activities have the potential to cause direct physical disturbance to small areas of riparian, aquatic and partially groundwater dependent ecosystems associated with constructing crossings (maximum of four) over Limerick Creek, and the laying of electrical cables.

Operations

Operational activities will have negligible direct impacts on riparian, aquatic and ground water dependent ecosystems. The design of the Proposed Development shall generally negate the need for access to these environments, except to undertake environmental improvements works such as weed, pest and vegetation management activities.

The removal of stock and reduced agricultural pressure would improve the ecology of riparian and aquatic habitats relative to current conditions.

Indirect impacts

Construction and decommissioning

Through the same processes described above ('*impact to surface water quality*"), the construction and decommissioning of the Proposed Development has the potential to indirectly impact riparian, aquatic and ground water dependent ecosystems. While impacts are considered to be minor and it is concluded that indirect impacts do not pose a threat to the aquatic environment (in effect, the reduction in grazing and cropping pressure is likely to result in an improvement to the aquatic environment), mitigation measures to reduce risk of runoff induced sedimentation to existing riparian, aquatic and ground water dependent ecosystems, as well as to reduce impacts from potential chemical spills are proposed in Section 6.8.4.

The Proposed Development would not alter the hydrology of Limerick Creek such that there would be significant changes to the quantity, timing or duration of flows available to riparian, aquatic or ground water dependent ecosystems.

Operations

As there would be no significant change in the overall hydrology of the Site during the operational period of the Proposed Development, Operational activities would have negligible direct impacts on riparian, aquatic and ground water dependent ecosystems.

Impacts on Adjacent Water Users

Water quality and quantity

As indicated in the sections above, the Proposed Development would not impact on water quality or the quantity of water available at the Site. Therefore there would be no impact on water quality or quantity for adjacent water users.

Flooding

To determine the impact of the Proposed Development on flooding, the increase in the impervious area was applied to the RORB model to represent the solar panels and the associated hard standing areas (e.g. roadways and sub-station buildings). The solar panels are mounted on steel piles above the ground and are not sensitive to flooding, as:

- The bottom of the PV panels are located approximately 1 m above ground level (depending on the final choice of mounting technology), and hence would be designed to be out of floodwaters;
- The piles are water resistant and would not impede the movement of floodwaters; and
- Cabling and other electrical equipment would not be affected.

Similarly, inverters within the possible flood area would be sited to avoid impacts from potential flood waters. Accordingly the solar array may be located in areas subject to occasional inundation with no impact to operation, safety or flood behaviour.

As with the existing conditions, event durations from 10 minute to 7 days were run through the model to determine the critical flood duration and volume for the 10% AEP, 2% AEP and 1% AEP 0.5% AEP, 0.2% AEP and 0.1% AEP events.

For the events modelled in RORB, the critical flood for the catchment was again either the 6 or 7 day event with the peak flows showing either negligible decreases or increases (Table 6-24). These changes are due to the increase in impervious area (~1% in each of the catchments is now impervious) resulting in the water running off in different patterns and changing when peak flows occur compared to the existing conditions (fully pervious).

Table 6-24: Peak flows and water depths for Proposed Development and change from existing conditions

AEP (%)	Peak flow (m^3/s)	Difference from existing (%)	Peak water level depth (m)	Difference from existing (%)
10%	804	4.3%	2.33	1.7%
2%	1,108	-0.8%	2.71	0.0%
1%	1,252	0.3%	2.86	0.0%
0.5%	1,369	0.6%	2.99	0.3%
0.2%	1,566	0.1%	3.18	0.0%
0.1%	1,757	3.3%	3.33	1.5%

The difference between the existing conditions and the conditions that arise as a consequence of the Proposed Development show that there will be no change (negligible impact) or a slight reduction (negligible impact) in the flows and water levels from a critical storm (detailed in the Appendix H).

Potential impacts associated with climate change were modelled based on the Australian Rainfall and Runoff guidelines. This approach recommends applying a 5% change in design rainfall per degree of global warming. Predicted changes in temperature data is provided by the Australian Government through the Climate Change in Australia website (https://www.climatechangeinaustralia.gov.au).

The assessment of the RCP 6 climate change scenario (median greenhouse gas emissions) for 2050 projected conditions (representing the design life of the solar farm) using the CMIP 5 global climate models (latest global climate models) produced a mean change in temperature of 1.5 Degrees Celsius. Therefore the IFD information used as part of the initial assessment was adjusted by 8% and the RORB models re-run. The results are outlined in Table 6-25 and show that the peak flows increase by between 6.3% and 10.5% over the flows calculated without climate change impacts.

Table 6-25: Comparison of climate change flow results for RORB model

AEP (%)	Peak existing development climate change flow (m^3/s)	Difference to base design flows (%)	Peak Proposed Development climate change flow (m^3/s)	Difference to base design flows (%)
10%	843	9.4%	867	7.8%
2%	1,188	6.3%	1,203	8.6%
1%	1,337	7.1%	1,372	9.6%
0.5%	1,503	10.5%	1,481	8.2%
0.2%	1,695	8.4%	1,694	8.2%
0.1%	1,875	10.2%	1,908	8.6%

These flows were applied to the HEC-RAS model to determine the effects of climate change on the water levels. The results show that for the critical duration storm event, the water levels will increase due to climate change. At the downstream end of the Site the levels are expected to increase by between 3.0% and 4.7% for the existing conditions' events and between 3.6% and 4.5% for the proposed conditions' events due to climate change (Table 6-26).

Comparing the climate change results within an event shows that there is a slight decrease in the water levels for the 0.5% AEP event between the existing and proposed condition models and a slight increase in levels for the other AEP events.

The difference between the existing conditions and the Proposed Development under current and climate change rainfalls show that there will be negligible impact or a slight reduction in the flows and water levels from the critical storm within the catchment.

Table 6-26 Comparison of climate change water level results for the HEC-RAS model

AEP (%)	Peak existing development climate change water level (m)	Difference to base design water level (%)	Peak Proposed Development climate change water level (m)	Difference to base design water level (%)
10%	2.39	4.0%	2.42	3.9%
2%	2.79	3.0%	2.81	3.7%
1%	2.95	3.1%	2.99	4.5%
0.5%	3.12	4.7%	3.1	3.7%
0.2%	3.31	4.1%	3.31	4.1%
0.1%	3.43	4.5%	3.45	3.6%

Overall results show the Proposed Development would have minimal impact on flooding associated with the critical storm for the catchment. It is therefore considered that the Proposed Development does not pose a significant flood threat to the environment, specifically because:

- There is no upstream environment, as it is located at the top of the Limerick Creek catchment;
- Downstream effects are not sufficient to significantly alter either flow rates or maximum inundation levels associated with the peak flood; and
- Modelled low level potential changes in sub-peak flood behaviour are considered to be not significant.to overall flood behaviour.

Given the relative lack of risk, no further action in managing floods is warranted.

6.8.4 Mitigation measures

General

The Proposed Development has been designed to minimise potential impacts to water resources and aquatic ecosystems. Potential environmental constraints within the Development Footprint have been excluded from developable land. As a result of a design philosophy that in the first instance seeks to avoid impacts, the following environmental protections apply:

- Exclusion of 3rd order streams from the Development Footprint (except internal site crossings);
- Application of a 30 m buffer zone for 3rd order riparian zones;
- Exclusion of all local partially GDEs associated with Limerick Creek;
- Avoidance of footings and pilings within 1st and 2nd drainage lines;
- Minimisation of creek crossings for internal access and electrical cabling;
- Sourcing of non-potable water from rainwater tanks and existing farm dams where available, otherwise sourced from offsite; and
- Sourcing from offsite all potable water requirements.

Specific mitigation to potential impacts by topic are outlined below.

Construction and Decommissioning

Water Quality

Protocols for erosion and sediment mitigation to protect water quality at the Site would be including in the CEMP for the Proposed Development. A similar plan would be developed within the DMP to guide decommissioning activities in accordance with relevant requirements at the time.

Erosion and sedimentation impacts associated with soil disturbance from construction activities can be minimised by undertaking works in accordance with provisions of the *Managing Urban Stormwater: Soils and Construction* series, in particular:

- *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition* (Landcom, 2004), known as 'the Blue Book';
- *Volume 2A Installation of Services* (DECC, 2008a); and
- *Volume 2C Unsealed Roads* (DECC, 2008b).

Procedures shall be adopted to minimise the risk of water quality impacts associated with contamination of surface water resources (Section 6.2.4, 'Mitigation', in 'Landuse and Soils', provides detail on erosion control measures).

Management of waste and sewage would be detailed in the CEMP. Waste produced from toilets shall be stored until it is trucked off site and disposed of in accordance with DECC requirements. All hazardous materials will be classified and appropriately stored away from Limerick Creek and its drainage lines.

To avoid release to the environment, and contamination of water systems, all hazardous materials (fuels, lubricants, herbicides, etc.) will be transported off site in accordance with DECC guidelines (see Section 6.13, which details commitments for responsible disposal of this material under the POEO regulations and the WARR Act). Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are not leaking from the machinery. All contractors and staff will be appropriate trained through toolbox talks to prevent, minimise and manage accidental spills.

A Spill Response Plan (SPR) will be included in CEMP. All contractors and staff will be trained regarding the implementation of the SRP. Should a spill event occur, incident management procedures provided in the SRP will be implemented and the EPA will be notified of incidents that cause harm to the environment, pursuant to sections 147 – 153 of the POEO Act.

Water Quantity

To avoid any potential impacts on surface water quantity, and in accordance with surface water harvesting rights, the Proponent will source no more than 10 % of the total surface water from existing farm dams located within the Site. Rainwater tanks installed to support buildings provide an additional source of non-potable construction water. Any additional non-potable water required for the Proposed Development would be sourced offsite.

Accordingly, a water access licence from DPI Water would not be required for construction activities. Potable water will be sourced off-site, via registered water suppliers.

If required, water management structures specific to the array layout, designed to manage surface water during construction and decommissioning will be detailed in the CEMP and DMP (Section 6.2 provides more detail).

Riparian, aquatic, and groundwater dependent ecosystems

Construction and decommissioning activities will avoid impacts to riparian and aquatic ecology, avoiding direct impacts where possible and adopting best practice where necessary.

To minimise impacts to riparian, aquatic and groundwater dependent ecosystems, excavation activities will be located away from drainage lines where possible. However, vehicular culvert crossings and cables required for the array area will cross Limerick Creek in up to four discrete locations. Aside from these four crossing points, no other construction activities will occur within a 30 m riparian buffer zone surrounding the 3rd order (Strahler) Limerick Creek. This will ensure against direct impacts to riparian, aquatic and groundwater dependent ecosystems.

Where vehicular crossings are required over Limerick Creek, a culvert would be used in line with the requirements of Class 4 waterway recommendations under the *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2004) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003).

Although approval under the WM Act is not required for SSD, installation of cables across Limerick Creek is a controlled activity. As such, relevant design considerations will be followed as per the NSW Office of Water's *Controlled Activities: Guidelines for laying pipes and cables in watercourses*. These measure will avoid negative impacts to the aquatic environment.

Operations

The OEMP shall assess and identify appropriate operational protocols to ensure the protection of surface and groundwater quality, maintenance of water supplies and rights of access, and the protection of riparian, aquatic and groundwater dependant ecosystems.

Water Quality

Protocols would include maintaining groundcover across the Proposed Development to minimise the potential for erosion and sedimentation impacts to water quality. This requirement will be balanced with grazing management strategies and bushfire management strategies to avoid a build-up in combustible vegetation.

Maintaining access tracks in good condition and ensuring that associated drains and/or sedimentation traps are monitored and maintained would ensure that the potential erosion that could lead to impacts on water quality associated with the tracks is minimised. The maintenance of low levels of vegetation cover across the Site would also assist in reducing potential erosion associated with scouring beneath the panels following significant rainfall events. Further to this, any erosion prevention and/or sedimentation traps installed as part of the design of the Proposed Development would be monitored to ensure effectiveness is maintained.

To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of offsite in accordance with DECC guidelines (see also Section 6.13, 'Waste and resource use' which details waste disposal commitments). Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area. Machinery will be inspected daily to ensure no oil, fuel or lubricants are not leaking from the machinery. All

contractors and staff will be appropriately trained through toolbox talks to prevent, minimise and manage accidental spills.

A SRP will be included in OEMP. All contractors and staff will be trained regarding the implementation of the SRP. Should a spill event occur, incident management procedures provided in the SRP will be implemented and the EPA will be notified of incidents that cause harm to the environment, pursuant to sections 147 – 153 of the POEO Act.

Water Quantity

No water quantity impacts were identified as a consequence of the Proposed Development during the operational period, therefore no mitigation is proposed.

6.9 Noise

6.9.1 Introduction

TTM Consulting Pty Ltd (TTM) previously conducted ambient noise monitoring at a location close to the Proposed Development and its surroundings for the Clarks Gully Underground Mine, Hillgrove (ELA, 2015). No major developments have been observed since noise monitoring was conducted at NSR1, therefore similar ambient noise levels are expected at the proposed Solar Farm site compared to the noise levels measured for the Clarks Gully Underground Mine, Hillgrove.

A full copy of the noise assessment is provided in Appendix J. This chapter provides a summary of the existing environment, methods, results and discussion of the noise impact assessment.

6.9.2 Existing environment

The site is located within a rural landscape with residential areas of Hillgrove village approximately 4.5 km to the south east. The nearest noise sensitive receivers (NSR) have been identified and are as follows:

- NSR1 – Residential property at 2196 Grafton Road, Argyle; and
- NSR2 – Residential property south of site and Grafton Road, Argyle.

The location of the NSRs are shown in Figure 6-27.

As observed at the residential property at NSR1, the ambient noise levels are typical of a rural area with the dominant noise source being road traffic noise from Waterfall Way. The ambient noise environment also includes noise from farm trucks, birds and insects.

Both attended and unattended noise measurements were conducted at NSR1 generally in accordance with the recommendations outlined in the Australian Standard AS 1055. The results of both the attended and unattended measurements at NSR1 are summarised in Table 6-27.

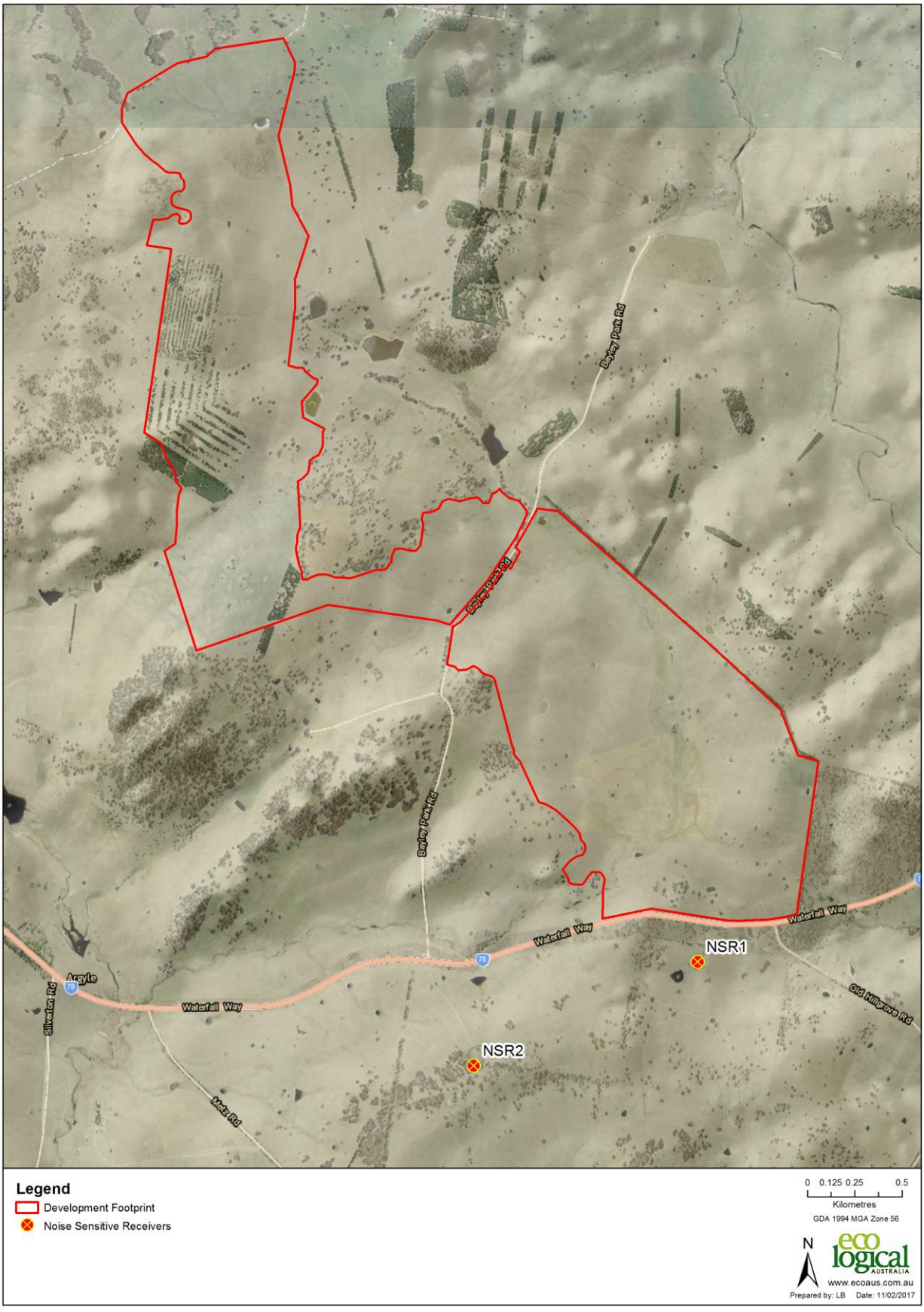

Figure 6-27: Location of noise sensitive receivers

Table 6-27: Summary of unattended and attended noise monitoring results at L1

Period	Rating Background Noise Levels, RBL (L_{A90}) in dB(A)	Existing Noise Levels in dB(A)		
		L_{Aeq}	L_{A10}	L_{A1}
Unattended				
Day	31	47	52	61
Evening	24	46	53	61
Night	25	43	49	62
Attended				
Day (6th May 2015 from 12.22pm to 12.37pm)	37	46	51	55

Note:
- Day-time period is from 7am to 6pm (Monday to Saturday) and 8am to 6pm (Sundays and public holidays)
- Evening period is from 6pm to 10pm
- Night-time period is from 10pm to 7am (Monday to Saturday) and 10pm to 8am (Sundays and public holidays)

The unattended and attended measurement results show typical background noise levels for a rural area where traffic on local roads is the dominant noise source.

During the attended measurements, road traffic was observed to be the dominant noise source in the area. Other typical rural noise sources such as tractors, ride-on mowers, birds and insects were also audible.

NSR1 is potentially the most affected receiver based on its proximity to the Proposed Development. The ambient noise levels at NSR2 are expected to be similar to NSR1.

6.9.3 Construction Noise Assessment

DECC Interim Construction Noise Guideline (ICNG)

The DECC *Interim Construction Noise Guideline* (ICNG) provides guidelines for the assessment and management of noise from construction works. Construction activities and associated duration for the Proposed Development mean that it is considered a major construction project. Therefore, the quantitative approach has been adopted for the construction noise assessment.

The ICNG suggests the following standard hours for construction activities where noise is audible at residential premises:

- Monday to Friday, 7am to 6pm;
- Saturday, 8am to 1pm; and
- No construction work is to take place on Sundays or public holidays.

Time restrictions on construction works are the primary management tool of the ICNG. The construction working hours of the Proposed Development are expected to be in line with the above standard hours.

The guideline also provides noise management levels for residential premises for both the recommended, and outside standard hours of construction. The noise management levels recommended for residential receivers have been extracted from the ICNG and are summarised in Table 6-28.

Table 6-28: Residential receivers – ICNG noise management levels

Time of day	Management level, $L_{Aeq\ (15\ min)}$ *	How to apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level; and • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: a. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; and b. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours; • The proponent should apply all feasible and reasonable work practices to meet the noise affected level; • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community; and • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Note: * Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

The main construction activities/stages are as follows:

- Site establishment and preparation for construction (vegetation clearing, preliminary civil works and drainage, including access road construction);
- Installation of mounting system to support the PV modules;
- PV module attachment;
- Installation of inverters, transformers and other electrical infrastructure;
- Grid connection;
- Commissioning and testing; and
- Removal of temporary construction facilities.

The stages listed above are in approximate order of construction. In practice individual components will be run in parallel to allow groups of solar blocks to be commissioned throughout the construction phase. For each construction activity and stage, the expected plant and machinery to be used are summarised in Table 6-29. The table also includes an estimated percentage of use per day which reflects the transient and changing nature of the construction noise activities, dependent upon site-conditions, timelines, delays and other unexpected occurrences, as well as, the source sound levels for each of the items of plant and equipment.

Table 6-29: Summary of construction activity/stage and noise sources

Construction activity/stage	Noise impact	Equipment	% use per day	Sound Power Level, dB(A)	Reference
Site establishment and preparation for construction	Assessed below	Material delivery truck	40	107	AS 2436
Installation of mounting system to support the PV modules	Assessed below	Vibratory piling (Small)	80	116 (Minimum)	AS 2436
PV module attachment	Not expected	-	-	-	-
Installation of inverters, transformers and other electrical infrastructure	Assessed below	Material delivery truck	40	107	AS 2436 & site measurements (Trencher only)
		Mobile crane	50	104	
		Vibratory rollers	40	108	
		Grader	50	110	
		Trencher	50	118	
		Excavator	40	107	
		Generator	100	99	
		Air compressor (silenced)	40	101	
Grid connection	Not expected	-	-	-	-
Commissioning and testing	Not expected	-	-	-	-

Construction activity/stage	Noise impact	Equipment	% use per day	Sound Power Level, dB(A)	Reference
Removal of temporary construction facilities	Assessed below	Material delivery truck	40	107	AS 2436

The noise impact of construction activities for each applicable construction phase has been predicted for a worst-case scenario and average-case scenario. The noise prediction has been based on the following:

- Plant and equipment source sound power level information given in Table 6-29;
- Distance loss; and
- Air absorption.

The **worst-case** scenario represents the use of all the plant and equipment for each activity at the same time at one single point. This scenario represents an unrealistic scenario, but does represent the maximum possible impact of construction noise for a short duration before the work moves to another location.

For the purpose of the construction noise assessment, buffer distances have been predicted between the noise source and the noise sensitive receivers to meet the noise management levels contained in Table 6-27.

Noise predictions have been made using the CONCAWE prediction method. CONCAWE is a noise prediction method developed for assessing environmental noise propagation, drawn from both acoustic theory and extensive field noise measurements. The CONCAWE predictions consider atmospheric, meteorological and ground attenuation. A worst-case scenario has been modelled to conservatively predict the propagation of noise from source to receiver. The worst-case scenario includes the effects of temperature inversions and favourable winds onto the noise, which is equivalent to CONCAWE Category 6.

Based on the unattended noise measurements as shown in Table 6-27, the ICNG noise management levels is derived to be 41 dB(A). The buffer distances for each of the construction activities have been predicted to meet the ICNG noise management levels and highly noise affected limit and are summarised in Table 6-30.

Table 6-30: Construction noise assessment – Buffer distances

Construction activity/stage	Equipment	Approximate buffer distance (m)	
		Management levels, 41 dB(A)	Highly noise affected, 75 dB(A)
Site establishment and preparation for construction	Material delivery truck	380	< 100
Installation of mounting system to support the PV modules	Vibratory piling (Small)	900	< 100
PV module attachment	-	-	-

Construction activity/stage	Equipment	Approximate buffer distance (m)	
		Management levels, 41 dB(A)	Highly noise affected, 75 dB(A)
Installation of inverters, transformers and other electrical infrastructure	Material delivery truck Mobile crane Vibratory rollers Grader Trencher Excavator Generator Air compressor (Silenced)	800	< 100
Grid connection	-	-	-
Commissioning and testing	-	-	-
Removal of temporary construction facilities	Material delivery truck	380	< 100

The buffer distances in Table 6-30 show that the Noise Affected Management Level of the RBL + 10dB is exceeded at distances greater than the minimum distance between the nearest site boundary and the nearest noise sensitive receiver (NSR 1 – 247 m). However, it should be noted that the Site is large and the vast majority of the site is greater than 900 m from NSR 1 and NSR 2 respectively. This means that there will only be a small period of the overall construction time when these activities are taking place within the buffer distances required to meet the Noise Affected Management Level.

Furthermore, it should be recognised that Noise Affected Management Level of 41 dB(A) is a low absolute environmental noise level and is a result of the background level being so low. It is highly unlikely that a construction noise level of 41 dB(A) will be intrusive for most people.

The Highly Noise Affected Management Level of 75 dB(A) requires buffer distances of less than 100 m. The nearest receiver (NSR 1) is approximately 247 m from the nearest site boundary. This would result in a worst-case noise level at NSR 1 of less than 70 dB(A) for the nosiest piling activity and significantly less for all other activities. In practice, due to identified site constraints and the inclusion of the Visual Buffer Zone, piling will not take place on, or near to the site boundary. Based on the Indicative Site Layout, it is anticipated that piling and associated construction activities shall be approximately 400 m from NSR1, achieving management level buffer distances for site establishment, preparation and clean-up activities. Accordingly, worst-case noise impacts, while not meeting the Noise Affected Management Level of 41 dB(A), will be well below the highly noise affected limit of 75 dB(A).

In addition, the transient nature of construction noise means that construction activities will only take place for a short period of time at the nearest boundary before moving further away to other parts of the Site, reducing noise impact levels as they move.

The construction noise is expected to be audible and there is likely to be some degree of adverse impact, as is typical with construction projects in close proximity to noise sensitive areas. However, by incorporating noise control measures, the noise impact to residents and other NSRs surrounding the Site can be significantly reduced. Therefore, construction noise can be managed through a

Construction Noise and Vibration Management Plan (CNVMP) to minimise the adverse impact to acceptable levels.

Mitigation measures for construction noise

The opportunities for practical physical noise control are few given the transient and constantly moving nature of the construction work. However, it is recommended to use mobile noise barriers/enclosures during certain construction work, such as around stationary work activities and plant.

In addition to physical noise control or in situations where this is not practical, management measures should be employed to minimise the construction noise impact for residential and commercial premises. These should include all feasible and reasonable measures employed by the contractor such as:

- Informing and consulting residents and interested parties, as far as practicable, regarding impending or current events that may cause high levels of noise and how long they are expected to take. This may take the form of letter drops, or community notices;
- Provide a complaints telephone number prominently displayed where the works are taking place and on any letter drops or community notices;
- Respite hours agreed with residents when noisy works will not take place if necessary;
- Investigate complaints when received to establish the cause, and where possible implement a corrective action such as, provide a respite period or other practical measure;
- Minimising the operating noise of machinery brought on to the Site;
- If there is excessive noise from any process, or a complaint is received, that process will be stopped and if possible that noise attenuated to acceptable levels. Where there is no alternative the process will be rescheduled to non-sensitive hours;
- Ensuring that plant is not left idling when not in use;
- Ensuring that plant is well maintained and in good working order and not causing unnecessary noise, such as damaged mufflers on plant;
- All access hatches for plant to be kept closed;
- Provision of a toolbox talk to personnel on-site so that everyone understands the importance of controlling noise and vibration; and
- To provide a framework for construction noise management on-site, it is recommended that a CNVMP is produced by the contractor. This should include all pertinent information regarding the control and management of noise and vibration, and would be used as a working document on-site by contractors and sub-contractors so that everyone is aware of their responsibilities.

6.9.4 Operational Noise Assessment

This section addresses the operational noise impact of the Proposed Development on noise sensitive receivers. The assessment includes:

- Prediction of noise emissions from substation, transformers and inverters to noise sensitive receivers; and
- Compare predicted noise emissions to noise criteria derived from the NSW *Industrial Noise Policy* (INP).

NSW Industrial Noise Policy (INP)

For noise emissions generated on the Site resulting from the operational activities at the Proposed Development, the relevant noise criteria are defined in the INP.

The policy offers guidelines to minimise noise impacts to NSRs not associated with the development. Project-specific noise levels (PSNLs) are determined and set at the boundary of relevant NSRs which are not to be exceeded.

The policy states that the most stringent of the intrusive and amenity criteria, described below, sets the PSNL.

Intrusiveness criterion

The INP states:

> *The intrusiveness of an industrial noise may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period does not exceed the background noise level measured in absence of the source by more than 5dB.*

The INP recommends methods for determining background noise level. At the planning and approval stage, the long-term method is used which is designed to ensure that the criterion for intrusive noise will be achieved for at least 90% of the time periods (day/evening/night), known as the Rating Background Level (RBL).

The intrusiveness criterion can thus be summarised by:

$L_{Aeq,\ 15\ minute}$ ≤ Rating Background Level plus 5dB

Amenity criterion

The INP sets Acceptable Noise Levels (ANLs) for areas impacted by industrial noise that should ideally not be exceeded to protect against impacts such as speech interference and community annoyance. Any new industrial noise sources should not increase overall industrial noise in an area and cause 'background creep', where background noise levels rise overtime as each new noise source is introduced. Where all practical and reasonable noise mitigation has been applied and still the ANL cannot be achieved, the INP suggests a Recommended Maximum noise level which is 5 dB above the ANL.

Where there is an existing level of industrial noise affecting the NSRs, modifications to the ANL are required as defined in Section 2.2 of the INP.

For the Proposed Development, the noise sensitive receivers are situated in an area, which would be classified as "Rural" under the INP, and the relevant recommended "acceptable" amenity criteria for $L_{Aeq,period}$ are 50 dB(A), 45 dB(A) and 40 dB(A) for day-time, evening and night-time periods respectively.

Project-specific noise levels

The PSNL is the target noise emission level from the new noise source as a result of the new development at the boundaries of the identified NSRs. The PSNL is taken to be the lowest and most stringent of the intrusiveness and amenity noise criteria.

Assessment methodology

The assessment involves predicting buffer distances for the substation, transformers and inverters to meet the NSW INP criteria. The predicted buffer distances consider the following:

- Source sound levels of the substations and the inverters;
- Distance attenuation; and
- Atmospheric, meteorological and ground attenuation using the CONCAWE method for distances between the source and receiver greater than 100 m.

Further, the following assumptions have been made in the calculations:

- The source sound levels used in the calculations are as follows:
  - Substations – 2 x power transformers for solar farms 60 MVA Sound pressure level 75 dB(A) @ 1 m each i.e. 78 dB(A) for both;.
  - Inverters – SMA type SC 2200-US – Sound power level 94 LWA;
- The substation area is 2500 m from the nearest noise sensitive receiver (NSR2);
- In a worst case scenario there are approximately up to 50 inverters spread over the whole site. Given the significant size of the Site the noise source used in the predictions include two inverters, with other inverters being sufficient distance away as not to result in a cumulative noise level at the noise sensitive receivers;
- In an effort to provide "worst case" results, two inverters have been assumed to be located on the closest boundary to a noise sensitive receiver (NSR1) being approximately 250 m away; and
- As with the construction noise assessment, a worst-case meteorological scenario has been modelled using CONCAWE Met Category 6 (worst-case) for the substations, and also with Category 4 (zero meteorological influence - neutral/average case) for the inverters given their closer proximity to the noise sensitive receivers.

The final locations of the inverters shall be confirmed during a detailed design process post consent. The inverters will not be positioned close to each other and will be spread across the Site (see Figure 2-5). Therefore, cumulative noise impact has not been investigated.

NSW INP – Evaluated noise criteria

Based on the unattended noise measurements, the INP noise criteria have been evaluated and are summarised in Table 6-31.

Table 6-31: NSW INP – Evaluated noise criteria

Assessment period	Intrusiveness Criterion, $L_{Aeq,}$15min, dB(A)	Amenity Criterion $L_{Aeq,15min}$, dB(A)	Project-Specific Noise Levels (PSNLs), dB(A)
Day	36	50#	36
Evening	35*	45#	35
Night	35*	40#	35

Note:

- Day-time period is from 7am to 6pm (Monday to Saturday) and 8am to 6pm (Sundays and public holidays)

- Evening period is from 6pm to 10pm

- Night-time period is from 10pm to 7am (Monday to Saturday) and 10pm to 8am (Sundays and public holidays)

* The INP states in Section 3.1.2 Rating Background Level, that, 'Where the rating background level is found to be less than 30 dB(A), then it is set to 30dB(A)

There is no existing industrial noise. Therefore, the amenity Acceptable noise level is as recommended in Table 2.1 Amenity Criteria, of the INP

Table 6-31 shows that the intrusiveness criterion is the most stringent for all time periods and are therefore the PSNLs. By meeting the PSNLs at the identified NSRs, all other residential properties located further away from the Site are expected to comply with the INP noise criteria.

The Proposed Development will operate during daylight periods only. However, depending on the seasons, daylight may occur in the early morning hours or late afternoon hours, which falls in the night-time and evening periods in accordance with the INP. Referring to Table 6-31, the most stringent PSNL is in the evening period at 35 dB(A), and will therefore be used to predict the buffer distances.

Results and discussion

Operational noise levels have been predicted at various distances from substations and inverters to show the impact of buffer distances with respect to the criterion (Table 6-32 and Table 6-33). For distances greater than 100 m, in addition to distance attenuation the CONCAWE environmental prediction methods for atmospheric, meteorological (category 6 – greatest increase in noise) and ground attenuation has been applied to the prediction.

Table 6-32: Predicted substation noise levels at various buffer distances versus the NSW INP criterion

Plant Type	Source noise level, dB(A)	Distance from plant, m	Predicted noise level dB(A) Met Category 6 (worst-case)	Compliance with NSW INP? 35 dB L_{Aeq}
Substations	**81 dB(A) at 1 m Combined main substation and two minor substations**	50	47	×
		100	40	×
		160	35	✓
		200	32	✓
	Distance of nearest site boundary to receiver (NSR1)	250	30	✓
		300	28	✓
		400	25	✓
		500	23	✓
		1000	14	✓
	Approximate distance of substation area from nearest receiver (NSR2)	2500	4*	✓

Table 6-32 shows that substation meets the INP noise criterion of 35 dB(A) at approximately 160 m. Given that the substation area on the Site is approximately 2500 m from the nearest noise sensitive receiver (NSR2), no noise impact is expected. Therefore, no buffer distance is recommended.

Table 6-33: Predicted inverter noise levels at various buffer distance versus the NSW INP criterion

Plant Type	Source noise level, dB(A)	Distance from plant (m)	Predicted noise level dB(A) Met Category 6 (worst-case)	Predicted noise level dB(A) Met Category 4 (neutral/average case)	Compliance with NSW INP? 35 dB L_{Aeq}	
					Met Category 6	Met Category 4
Inverter	**97 dB L_{WA} 2 x inverters**	50	55	55	✗	✗
		100	48	48	✗	✗
		200	41	38	✗	✗
INP criterion met for Met Category 4 (neutral/average case)	Distance of nearest site boundary to receiver (NSR1)	250	38	35	✗	✓
		300	36	33	✗	✓
INP criterion met for Met Category 6 (worst-case)		350	35	31	✓	✓
		400	34	29	✓	✓
		500	31	26	✓	✓
		1000	24	18	✓	✓
		2500	12	6	✓	✓

Table 6-33 shows that when assuming the worst-case meteorological category 6 in the noise prediction for two inverters the INP noise criterion is met at approximately 350 m. When the neutral/average case meteorological category 4 is used, where there is assumed to be no meteorological influence on noise propagation the INP criterion is met at 250 m.

Therefore, it is recommended that to meet the INP at all times under the worst-case conditions that a buffer distance of 350 m is maintained between the nearest inverters and the noise sensitive receivers.

The above predictions and recommendations for buffer distances are contingent of the noise source level data for the substations and inverters supplied to TTM being accurate. Should these change from those supplied, the buffer distances should be reviewed accordingly.

6.9.5 Road Traffic Noise Assessment

NSW Road Noise Policy

The NSW *Road Noise Policy* sets out noise assessment criteria for existing residences affected by additional road traffic noise on existing freeways/arterial/sub-arterial roads generated by land use development, which are summarised in Table 6-34.

Table 6-34: NSW Road Noise Policy noise assessment criteria

Road Type	Period	Criteria
Existing freeways/arterial/sub-arterial roads generated by land use development	Day (7am - 10pm)	60 dB(A) $L_{eq,1\ hour}$ (external)
	Night (10pm - 7am)	55 dB(A) $L_{eq,1\ hour}$ (external)

Construction phase

During the construction phase of Proposed Development, the main traffic will be generated from staff and deliveries as detailed in the Traffic Assessment report (Appendix E). Heavy vehicles related to the construction activities are expected to be a maximum of 27 vehicles per day. As the construction phase progresses, the number of heavy vehicles will reduce.

Based on the low additional number of vehicles generated per day associated with the Proposed Development, road traffic noise impact onto nearby residential properties is expected to be insignificant.

Operational phase

The Proposed Development, during its operational phase, will generate additional road traffic on Waterfall Way and Bayley Park Road. Traffic generation data has been obtained from the Traffic Assessment report (Appendix E). The report states that the Proposed Development is forecast to generate up to twelve vehicle movements daily when operational.

Consequently, it is concluded that the generated traffic flows from the operation of the Proposed Development to be relatively minor and road traffic noise impact will be insignificant.

6.9.6 Cumulative Impacts

Potential cumulative noise impacts may result should the construction of the Proposed Development overlap the construction of the proposed Clarks Gully Underground Mine. Due to the complexity of the resulting interactions, and their potential impacts at NSRs, it is recommended that a combined noise management agreement be developed in conjunction with Hillgrove Mines aimed to minimise and mitigate potential impacts.

6.10 Bushfire and Electrical Fire

6.10.1 Introduction

This section provides an assessment of potential hazards associated with bushfire and electrical fire. It first considers relevant guidance within NSW, then presents an overview of the existing environment. Next it considers potential fire hazards associated with the Site, throughout the lifecycle of the Proposed Development. Finally, in line with the appropriate standards, it provides a coordinated response to fire risks.

Fire presents a threat to human life, property, infrastructure and ecology. Risk can be considered in terms of environmental hazards that increase the risk or severity of fire (vegetation, topography and weather patterns), as well as specific activities and infrastructure that increase combustion or ignition risks.

Section 100B of the *Rural Fires Act 1997* requires that the Commissioner of the NSW Rural Fire Service (NSW RFS) issue a Bush Fire Safety Authority (BFSA) for residential, rural residential or rural subdivision and special fire protection purpose developments on bushfire prone land. Special Fire Protection Purpose Developments include:

- a school;
- a child care center;
- a hospital (including a hospital for the mentally ill or mentally disordered);
- a hotel, motel or other tourist accommodation;
- a building wholly or principally used as a home or other establishment for mentally incapacitated persons;
- housing for older people or people with disabilities within the meaning of State Environmental Planning Policy No 5—Housing for Older People or People with a Disability (now SEPP (Seniors Living));
- a group home within the meaning of State Environmental Planning Policy No 9—Group Homes;
- a retirement village; and
- any other purpose prescribed by the regulations.

The Proposed Development is classified as SSD, is not a subdivision for residential or rural residential purposes, nor is it a development for a special fire protection purpose, hence issue of a bush fire safety authority under section 100B of the Rural Fires Act is not formally required. Nonetheless, the Rural Fires Act places a duty of care on land owners/managers to prevent fire spreading on and from their land, which is a principle that will be adhered to through all phases of the Proposed Development.

6.10.2 Existing environment

Small portions of the Site and its surrounds are mapped as Bushfire Prone Land on the Armidale Dumaresq LGA Bushfire Prone Land Map (NSW RFS, 2008).

The Site covers approximately 507 ha of rural land, the majority of which has been cleared for grazing and sown with improved pastures. A number of small *Pinus radiata* (Radiata Pine) plantations are located within the Site and there are patches of retained native woodland scattered throughout. The Site slopes gently toward the south east, following Limerick Creek.

In the wider area, due to historic clearing for agriculture, vegetation cover is generally low except along ridgetops, within road reserves, in isolated patches in paddocks and gullies and within gardens surrounding the homesteads which are scattered across the landscape.

In terms of existing fire hazards, there are small areas of native vegetation and two Radiata Pine plantations within the Site boundary. Ground cover at the Site is dominated by grazed pastures and crops and while managed, it could be susceptible to grass fires in hot, dry and windy conditions. Other onsite ignition sources include:

- Machinery operating in long grass;
- Lightning strikes;
- Agricultural activities; and
- Carelessly discarded cigarette butts.

The existing overhead electricity transmission lines also pose a potential hazard, however, TransGrid is required to maintain line infrastructure to minimise fire risk.

The statutory Bush Fire Danger Period is between October and March reflecting seasonal fire hazards; however, this will vary from year to year depending on the prevailing conditions in the region.

All NSW Fire and Rescue stations are equipped with the resources and trained personnel required to deal with fire (and hazmat incidents). The nearest NSW Fire Brigade is the Armidale Fire Station, 18 km from the site. The nearest RFS Brigade is 13 km from the Site on the edge of Armidale.

In terms of onsite resources, there are numerous farm dams across the site which provides a ready supply of water for fire management if required. The Site is well serviced by a graded road which affords direct access to the centre of the Site.

Existing receivers and assets at risk from fire include two dwellings located within 'Bayley Park' (outside the Site boundary), as well as a single adjacent residence located to the south of the Proposed Development, on the other side of Waterfall Way. Additional dwellings and infrastructure are located within 5 km of the Site.

6.10.3 Potential impacts

Fire could damage structures and impact the safety of employees and contractors at the Site. Fire leaving the Site poses a human safety and property threat and imperils native flora, fauna and ecosystems.

Woodland fragments are sparse across the Site and will be cleared within the area of the array as detailed in Section 6.3, hence it is considered unlikely the Proposed Development will pose a significant bushfire risk. Further, the flammability of a solar farm is very low as they are predominantly constructed of glass, silicon, steel and aluminium. However, the risk of grassfires would remain.

Construction and decommissioning

Potential ignition sources during the construction and decommissioning phases of the Proposed Development would include:

- Machinery movement in long grass;
- Hot work activities, including welders and grinders;
- The storage of waste and combustible materials onsite;
- Storage of flammable liquids;
- Electrical faults;
- Lightning strikes; and
- Cigarette butts disposed of carelessly on-site and from cars travelling along Waterfall Way.

Considering the sparse vegetation cover over the Site and other factors discussed above, it is considered unlikely that the Proposed Development would pose a significant bush fire risk. The bush fire hazard associated with the activities listed above is considered highly manageable through electrical equipment selection, appropriate access arrangements, fuel load reduction programs, safety protocols during periods of high fire risk and the implementation of an Emergency Response Plan (ERP) as detailed below in Section 6.10.4.

Potential fire risk during decommissioning activities would be similar to those for construction.

Operation

In addition to the potential ignition sources identified above, the operational phase would include fire risks associated with damaged or faulty electrical equipment.

With appropriate mitigation strategies in place, as discussed below, bushfire and electrical fire risks during the operation of the solar farm are considered highly manageable.

6.10.4 Mitigation measures

The following mitigation measures are proposed in order to reduce and manage the risk of fire, and reduce the impact of any fires within or surrounding the Proposed Development.

Risk assessment

Undertake a Bushfire Risk Assessment and develop a Bushfire Management Plan prior to commencing construction activities to assess specific risks associated with the Site and identify a suite of strategies and mitigation measures to manage these risks.

Design

Electrical equipment selected for the 30 year life span of the Proposed Development would be designed to minimise the potential for ignition and certified to comply with relevant Australian Standards. All equipment installed would be earthed appropriately following comprehensive testing of soil conductivity to ensure lightning effects are not harmful to the operation of the Proposed Development.

Chemical storage will be in accordance with MSDS requirements and would consider potential fire hazards (e.g. the use of fire cupboards for the storage of chemicals).

There will also be a 20,000 litre water tank locating in the support building area for the sole use of fire protection in line with the RFS standards (RFS, 2006).

Access

Appropriate emergency vehicle access will be provided across the entire site, including access to inverters.

The Site access track network will be designed and constructed in compliance with RFS standards. As such, infrastructure setbacks from the boundary shall include a 5 m wide firebreak that will be adequate to allow emergency vehicles to access the entire permitter of the Site. The RFS recommends that firebreaks around valuable assets be mown, grazed or ploughed.

Fuel reduction

The fuel load across the Proposed Development will be monitored, and will be mechanically slashed, grazed or ploughed to reduce the risk of grass fires starting within the Site and ensuring that fires originating from outside the Site do not intensify as a consequence of entering the site. In addition, asset protection zones would also be designed and maintained around buildings and infrastructure to reduce the risk of fuel loads building up around sensitive assets. These management actions will be included in the CEMP, OEMP and DMP.

Emergency Response Plan

The OEMP will include an ERP and a copy will be provided to the RFS and Fire and Rescue NSW. This will allow the first responders to a fire to have ready access to information that details the effective control measures for a fire at the Proposed Development Site and for these to be implemented quickly. The ERP will include the controls required to mitigate the potential risks that could be experienced by fire fighters at the Proposed Development, including the methods required to safely shut down and isolate the necessary components of the solar farm.

Safety protocols

The CEMP, OEMP and DMP will provide safety protocols to ensure all staff and contractors are aware of the bushfire risk on site and the mitigation measures required to reduce this risk. Protocols, will include, but are not limited to:

- Basic training of all staff in the use of firefighting equipment on site;
- Firefighting equipment lists will be detailed in the Work Method Statements;
- Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and
- Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.

6.11 Electromagnetic Interference

6.11.1 Introduction

This section considers the potential for nuisance and health impacts from Electromagnetic Fields (EMFs) associated with the Proposed Development within the vicinity of the Site.

In accordance with relevant guidelines, consideration is given to human health and safety as well as potential interruption of existing services during the construction operational and decommissioning phases of the Proposed Development.

6.11.2 Existing environment

The existing environment exhibits variable topography, is sparsely populated and is likely to be characterised by relatively weak radio signal strengths (primarily due to distance from transmission stations). Existing potential sources of electromagnetic interference within the vicinity of the Site include three 132 kV transmission lines, one 66 KV and one 330 kV transmission line.

6.11.3 Potential impacts

EMFs consist of electric and magnetic fields. EMFs are produced by electrical equipment of all size and voltage, and also occur naturally. Electric fields are produced by voltage while magnetic fields are produced by current. EMFs exist close to wires and lines that carry electricity and electrical devices and appliances that are operating. The strength of both electric and magnetic fields reduce quickly with distance, and while electric fields are insulated to an extent by their surroundings (buildings or the earth in which cables may be buried), magnetic fields are not.

In Australia, transmission lines and other electrical devices and infrastructure operate at 50 Hz, and fall within the Extremely Low Frequency (ELF) range of 0 – 300 Hertz (Hz). Short-term exposure to very high levels of EMFs can be detrimental to human health, however exposure to EMFs generated within the Extremely Low Frequency range, at the low levels experienced by the general public, do not have substantive impacts to health. This is the case for the EMFs that would be produced by the Proposed Development (and the transmission lines that already exist on site).

There is uncertainty about the health impacts of longer term exposure to Extremely Low Frequency EMFs. Advice from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2015) indicates that scientific evidence of exposure to 50 Hz electromagnetic fields near transmission lines has not established a human health hazard. However, where any risk does exist, it would be small (ARPANSA, 2015).

In the absence of a standard for regulating exposure to extremely low frequency EMFs, the National Health and Medical Research Council's (NHMRC) *Interim guidelines on limits of exposure to 50/60 Hertz electric and magnetic fields* has been used to assess the impact of the existing and Proposed Development infrastructure to contractors and the general public's health (Table 6-35).

Table 6-35: Summary of NHMRC's Interim Guidelines on limits of exposure to 50/60 Hz electric and magnetic fields

Exposure characteristics	Electric field strength (volts per metre – V/m)	Magnetic flux density (microtesla - µT)
Occupational		
Whole working day	10,000	500
Short term (maximum exposure is 2 hours/work day)	30,000	5,000
General public		
Up to 24 hours/day	5,000	100
Few hours/day	10,000	1,000

Construction and decommissioning

The potential of EMF impacts during the construction and decommissioning phases is low. Exposure by construction staff would be limited to intermittent periods, during works at and around the existing 132 kV and the 330 kV transmission lines on Site. Furthermore, development of the solar array would not occur within the transmission line easements.

Operation

Potential EMF impacts would occur only during the operational phase, when the solar farm infrastructure is capable of generating EMFs. The EMFs generated would vary due to the type and size of electrical equipment on site, and whether potential sources of EMF are overhead or buried.

EMF generating components at the Proposed Development include:

- 132 kV connection line to the existing 132kV transmission line onsite; and
- The above or below ground 33 kV cables connecting the array area with the substation; and
- The PV array and its wiring system.

The 132 kV cable connecting the substation to the adjacent existing 132 kV transmission lines would be overhead, producing both electric and magnetic fields. The Magnetic field associated with the line would be approximately 1.7 µT directly below the line diminishing to 0.4 µT at a distance of 10m. The electrical field would be approximately 2.6 kV/m (2600 V/m) directly below the line, diminishing to 0.7 kV/m (700 V/m) within 10m (EMFs Info, 2017). These levels are below the requirements for contractors and public exposure levels as per NHMRC's Interim guidelines in Tabl 6-35. The cabling connecting the substation to the array area, and to the grid transmission lines, would produce significantly stronger EMFs than the substation itself. Any EMFs produced by the substation would comply with exposure limits (EMFs Info 2017) and is not considered further.

The 33 kV cables connecting the array area with the Substation would either be overhead or underground. Underground 33 kV cables would produce a magnetic field only, as the electrical field would be insulated by the earth, whereas overhead 33 kV lines would produce both electric and magnetic fields.

The typical magnetic field from the underground cables is 1 µT immediately above a 33 kV cable buried at 0.5 m (Figure 6-28). This is below the requirements for contractors and public exposure levels as per

NHMRC's Interim guidelines in Table 6-35. The maximum electric and magnetic fields for a 33 kV overhead powerline is shown respectively in Figure 6-29 and Figure 6-30. The maximum electric field produced by a 33 kV overhead powerline is less than 0.85 kV/m (850 V/m) at the source, while the maximum magnetic field produced is approximately 26 µT at the source. These are below the exposure limits for contractors and the general public as per the NHMRC's Interim Guidelines (Table6-35), and does not pose a health risk.

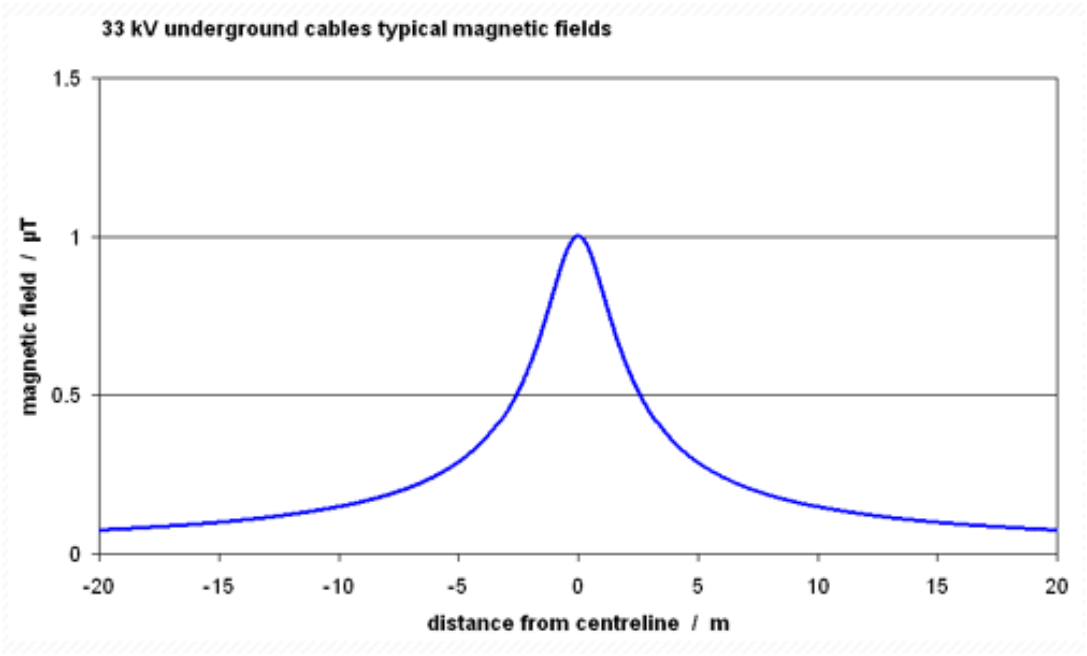

Figure 6-28: Typical magnetic field from a 33 kV underground cables (EMFs Info 2017)

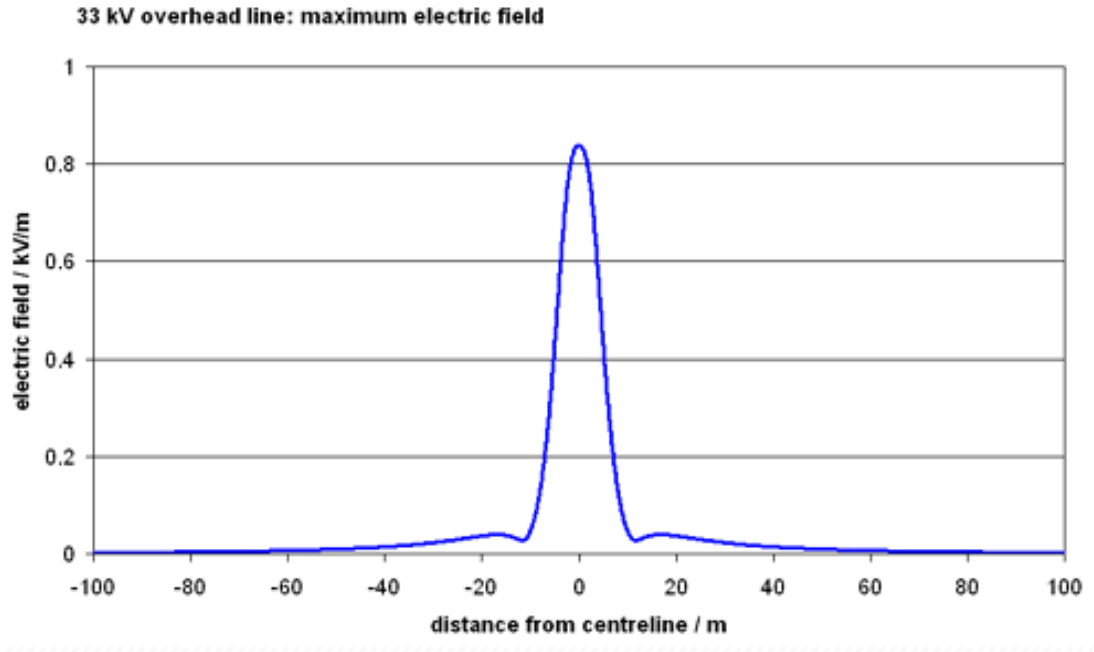

Figure 6-29: Maximum electric field from a 33 kV overhead powerline (EMFs Info, 2017)

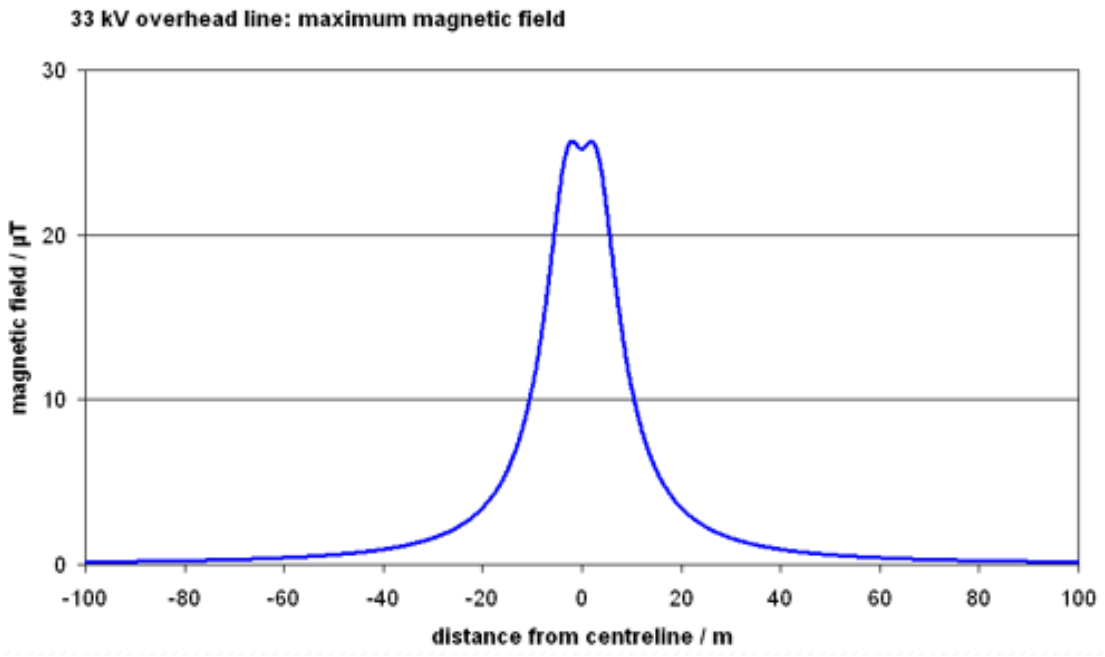

Figure 6-30: Maximum magnetic field from a 33 kV overhead powerline (EMFs Info, 2017)

Magnetic fields produced by the PV solar array would be significantly less than those produced for household applications and are indistinguishable from background levels at the Site boundary (Chang & Jennings, 1994). Therefore the health risk of EMFs from solar arrays would be insignificant.

There are two residences located within approximately 1 km of the boundary of the Development Footprint and approximately 3 km from the substation. Given the distance from the highest EMF emitter (the substation) and the low EMFs emitted from the PV solar arrays, and the existing 66 kV and two 132 kV transmission lines located near these residences, EMFs from the Proposed Development are likely to be indistinguishable from background levels at the boundary fence.

All AC electrical equipment that would be used as part of the Proposed Development operates at 50 Hz. Household appliances and devices, as well as telecommunication signals operate at much higher frequencies. For example, microwave ovens and Wi-Fi routers operate at 2.4 GHz, while mobile phones currently operate at 1.8 GHz. As these devices operate at higher frequencies which do not overlap with 50 Hz, and due to the rapid dissipation with distance from the source of EMFs, it is considered that they would not be impacted by EMFs from the Proposed Development.

6.11.4 Mitigation measures

Design principles and staff safety

In limiting exposure to EMFs, following advice from the International Commission on Non-Ionizing Radiation Protection, priority will be given to engineering and access controls that limit exposure (ICNIRP, 2010). This means that:

- The final design of the Proposed Development would be undertaken by qualified and competent persons;
- Design would meet relevant Australian standards, ensuring EMFs would be minimised as far as possible; and
- Access to electrical equipment would be limited to qualified personal only.

In addition to the design and access control measures outlined above, potential exposure levels on Site are predicted to be below the exposure limits for staff in line with the NHMRC's Interim Guidelines (Table 6-35), therefore further mitigation is not proposed.

Receptors – public safety

To reduce the potential for chronic or acute exposure to EMFs, no unsupervised public access to the Proposed Development would be permitted. As discussed above there is unlikely to be any negative impact to public health from EMFs outside of the Site.

The landholder or its employees may have limited access to the Site for grazing activities, however there will be no need to spend extended periods near electrical infrastructure. As such, the potential for impacts from EMFs is low.

The landholder or its employees would not have access to the substation or inverters.

Receptors - electrical devices

As noted, electrical equipment commissioned as part of the Proposed Development would be designed to reduce possible interference in line with Australian Standards. It would also operate at different frequencies to household electrical devices and telecommunication signals. In addition, due to potential receptors' location outside of the Site, there would be no impact on any electrical devices. Impact to household devices created by EMFs would require no additional mitigation measures.

6.12 Air Quality

6.12.1 Introduction

During the construction, operational and decommissioning phases, the Proposed Development has the potential to create air quality impacts, particularly dust from soil disturbance and emissions from vehicles and machinery. These impacts may cause nuisance to nearby residential receptors and the adjoining environment. At worst, they can impact on ecosystem function, pose a human health risk and contribute to anthropogenic climate change.

The statutory framework for managing air emissions in NSW is provided in the POEO Act. The POEO Act is supported by the *Protection of the Environmental Operations (Clean Air) Regulation 2010* (POEO Reg) which provides the regulatory measures required to control emissions. Relevantly, the POEO Act requires that vehicles shall not continuously emit smoky emissions for more than 10 seconds and limits dust deposition to 4 mg/m/m^2.

6.12.2 Existing environment

The current air quality within the Metz area is typical of a rural area with air quality considered to be moderate to good (Pacific Environment Ltd, 2015). Potential air pollution sources include, agricultural practices, nearby mining and road transport.

The annual average maximum and minimum temperatures recorded at the Armidale Airport station are 19.4°C and 7.4 °C respectively. On average, January is the hottest month, with an average maximum temperature of 25.9°C. July is the coldest month, with average minimum temperature of 1.2°C.

Rainfall data collected at the Armidale Station shows that November is the wettest month, with an average rainfall of 106.2 mm over an average of 13.1 rain days. The average annual rainfall is 788.4 mm with an average of 141 rain days per year.

Meteorology assessment and air quality modelling was undertaken by Pacific Environment Ltd (2015) as part of the assessment of the proposed Clarks Gully Mine. From this study, wind speed and direction data (wind roses) for the Hillgrove Mines meteorology site (4.5 km south east) and Armidale Regional Airport (26 km west), for the 12-month period January 2014 to December 2014 are presented in Figure 6-31 and Figure 6-32 respectively.

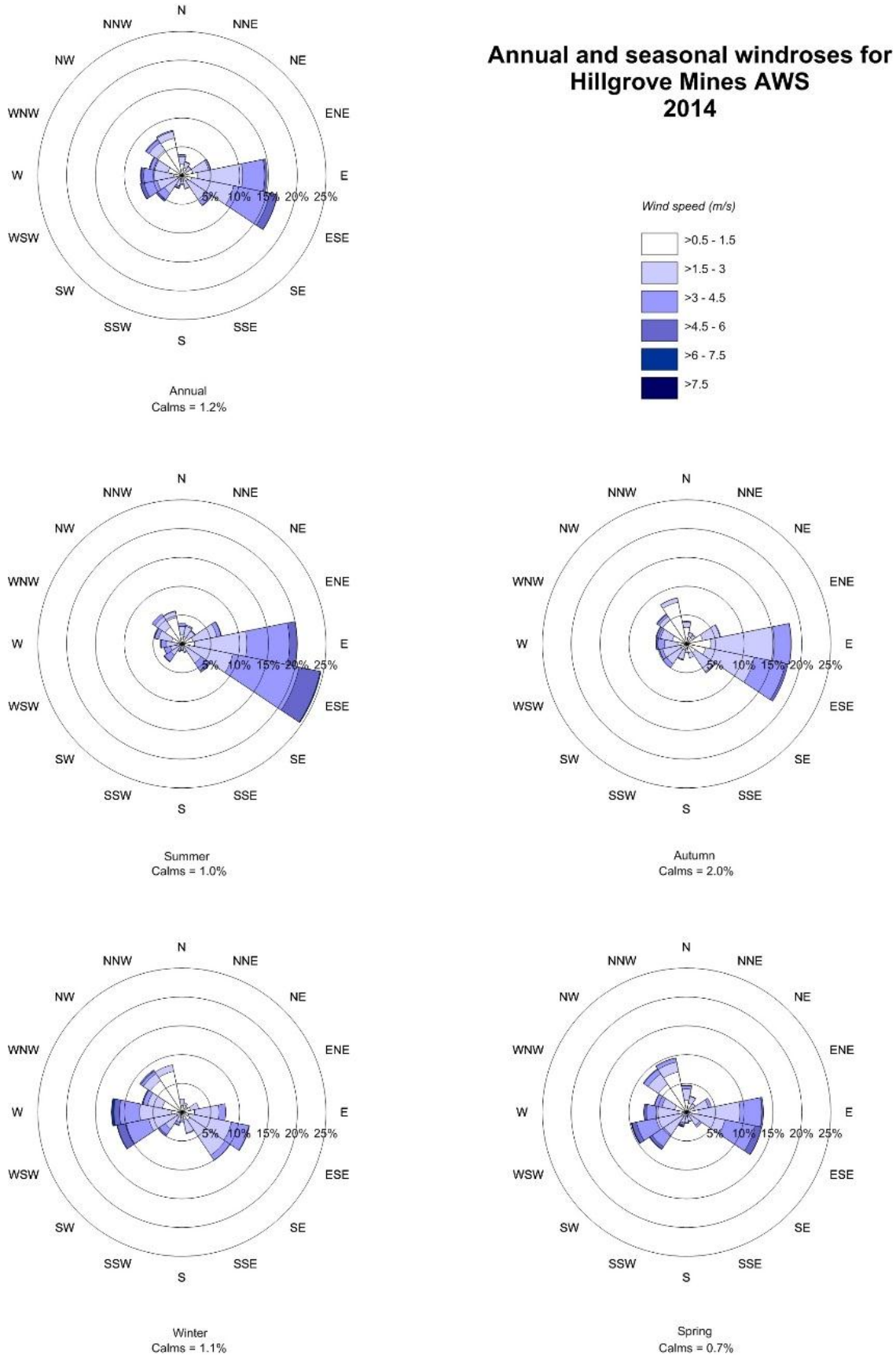

Figure 6-31: Wind roses for Hillgrove Mines AWS meteorological station - January 2014 - December 2014

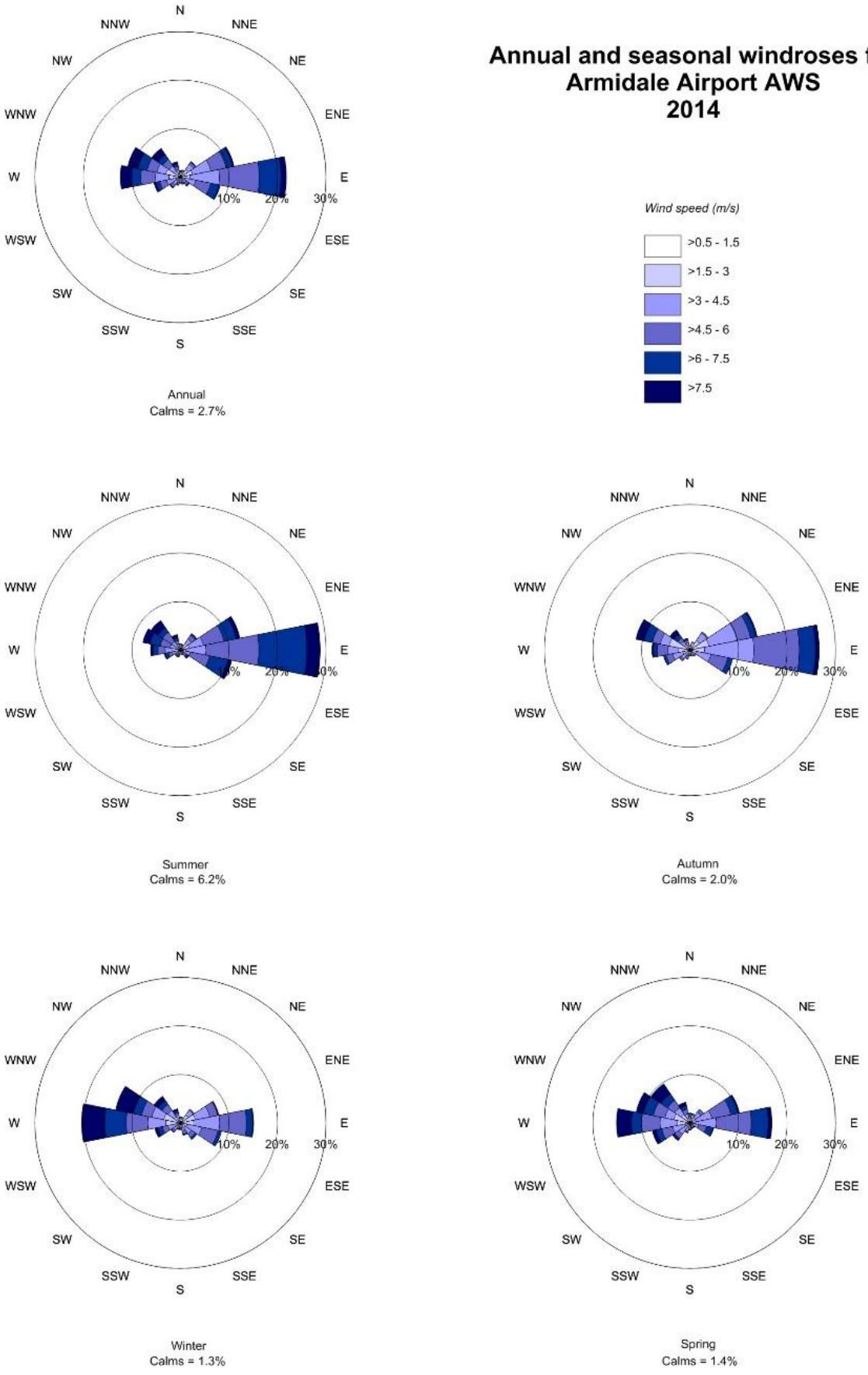

Figure 6-32: Wind roses for Armidale Regional Airport meteorological station - January 2014 - December 2014

Dust monitoring

Dust deposition has been monitored by Hillgrove Mines since 2007. The dust monitoring programme operated by Hillgrove Mines uses dust fall out gauges to collect deposited material on a monthly basis. These samples are analysed in accordance with Australian Standard AS3580 and the total insoluble component of the sample is used to represent deposited particulate matter.

Data provided in Table 6-36 shows that average monthly dust deposition levels at Clarks Gully (approximately 300 m south west of the Site) during 2014 were below the EPA criteria at all times.

Table 6-36: Dust deposition results 2014 (courtesy Hillgrove Mines)

Dust deposition gauge	Dust deposition rate (g/m^2/month)												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Average
HD14	0.1	1.1	0.3	0.4	0.6	0.2	0.3	0.5	0.4	0.6	0.9	1.2	0.6
EPA Criteria	**4.0**												

6.12.3 Potential impacts

Construction and decommissioning

Dust generation would accompany excavation and earthworks as well as the movement of trucks and other work vehicles along unsealed access roads during construction and decommissioning of the Proposed Development. Air emissions would also be produced from equipment and vehicle exhaust fumes.

Dust and exhaust emissions can be a nuisance, interfere with visibility and safety or lead to adverse health impacts where the effects are severe or prolonged. Exhaust emissions also contribute to CO_2 emissions and anthropogenic climate change.

Earthworks associated with construction would be relatively minor, these include:

- Excavation of footings for the substation, support buildings and invertors;
- Development of hardstands and access tracks; and
- Piling activities.

The construction phase is expected to last approximately 9 - 12 months. During this time, engine emissions would be generated from road transport, earth-moving equipment, diesel generators, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared transport, (up to 150 personnel during the peak period) and haulage traffic delivering construction components.

The closest residence will be more than 360 m to the south of any construction activities. While some level of dust generation is inevitable during construction, meteorological data suggests that dominant prevailing winds (from the east and from the west, see Figures 6-27 and 6-28) would not normally carry dust in a southerly direction. This, in combination with the low potential for dust generation through the main activity of pile driving means that impacts from construction works are considered to be minor, will be short-term in nature, and are unlikely to significantly affect nearby residential receptors. Any dust that is generated through the activities listed above can be effectively mitigated through the measures described below.

No air quality impacts in addition to those detailed for construction are anticipated during the decommissioning phase. Traffic generation would be similar in type but of shorter duration than that required to support the construction phase.

Potential cumulative impacts may occur should construction of the Proposed Development overlap with construction and/or the operation of the proposed Clark Gully Mine, however, due to the location of the nearby residences, it is considered unlikely that dust impacts would occur simultaneously at any residence. Nonetheless, it is recommended that a combined dust management agreement be developed in conjunction with Hillgrove Mines aimed to minimise and mitigate potential impacts should construction periods overlap.

Operation

The generation of solar energy during the operation of the Proposed Development would generate negligible air quality impacts and emissions. Indeed, during its operational lifetime, the Proposed Development would have a positive impact by displacing traditional carbon intensive electricity and as such reducing greenhouse gas emissions.

Maintenance activities during operation would result in some minor, localised vehicle and machinery emissions and potentially some dust generation from vehicles travelling on the unsealed access roads and tracks. However, impacts are likely to be less than those associated with current agricultural activities at the Site and, overall, would be very minor.

6.12.4 Mitigation measures

In order to meet Australian air quality standards, as well as the requirements under the POEO Act and POEO Regulation, the following mitigation measures would be followed during all phases of development:

- Develop protocols for inclusion in the CEMP, OEMP and the DMP to guide vehicle, plant and construction activities to minimise air quality impacts, for example:
  - Define designated access and travel routes;
  - Set onsite speed limits; and
  - Adopt trip management protocols to avoid unnecessary trips e.g.:
    - carpooling for construction staff;
    - coordinating delivery and removal of materials.
- Develop protocols for inclusion in the CEMP OEMP and DMP to identify, minimise and treat dust emissions, for example:
  - The use of a water truck during dust generating activities;
  - Limit the extent of clearing and excavation;
  - Stage clearing and excavation activities to minimise total areas of exposed soil;
  - Minimise the number and volume of stockpiles on-site and the number of work faces on stockpiles;
  - Modify activities if dust is observed leaving the Development Site towards nearby sensitive receptors; and
  - Develop and implement a dust management agreement in conjunction with Hillgrove Mines aimed to minimise and mitigate potential dust impacts should construction periods overlap.
- Develop protocols for inclusion in the CEMP, OEMP and DMP to reduce emissions, for example:

- Ensure all vehicles and machinery that enter the site meet relevant standards for emissions; and
- Maintain vehicles and plant in accordance with manufacturer's requirements to minimise emissions.

- Develop a complaints' procedure to promptly identify and respond to issues generating complaints.

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6.13 Waste and resource use

6.13.1 Introduction

The consumption of resources, and production and disposal of waste has potential to have negative impacts on the environment, and needs to be managed to ensure that:

- Resources are used efficiently;
- Waste production is minimised;
- Reuse of materials is maximised; and
- Contamination of land and water is avoided.

The developer's obligations in regard to waste management are guided by the following legislation:

- *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) – promotes waste avoidance and recovery;
- POEO Act – requires a licence to carry out certain scheduled waste activities and makes it an offence to pollute or potentially pollute land, air or water with waste; and
- *POEO (Waste) Regulation 2005* (POEO (Waste) Reg) – prescribes requirements for the tracking and management of certain wastes.

The WARR Act aims to encourage the most efficient use of resources and to reduce environmental harm. Waste management hierarchy principles are provided in the WARR Act and are considered in the following order:

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

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

6.13.2 Existing environment

The existing site is characterised by agricultural production and grazing activities. Responsibility for the management of waste generated by these activities lies with the landholder.

6.13.3 Potential impacts

Resource use

Construction

Key resources required for the Proposed Development include gravel, sand, metal, glass, silicon and water. The supply of these materials is not currently limited or restricted, and the likely quantities required by the Proposed Development are unlikely to place significant pressure on necessary resources.

Operation

The production of electricity using PV panels utilises an energy resource (sunlight) that is considered to be renewable, as such, there would be no impact on this resource as a consequence of the Proposed Development.

During operation the resources used would largely be associated with maintenance activities and the use of machinery and vehicles. While this would require the use of non-renewable resources such as hydrocarbon fuels to power machinery and vehicles, in the very limited volumes required, the Proposed Development is unlikely to place significant pressure on the availability of these resources. Furthermore their use during this period is considered reasonable in light of benefits of offsetting fossil fuel electricity generation.

Imported potable water may be required for cleaning panels intermittently during dry periods (Section 6.8 details cleaning requirements and 6.12 details the regional climate).

The consumption of resources during the operation of the Proposed Development would not place significant pressure on necessary resources.

Decommissioning

The main resources required to support the decommissioning phase of the Proposed Development would be the use of machinery and vehicles associated with the activities of removing all onsite infrastructure. While this would require the use of non-renewable resources such as, hydrocarbon fuels to power machinery and vehicles, in the volumes required, the Proposed Development is unlikely to place significant pressure on the availability of these resources. Accordingly, their use during this limited period is considered reasonable in light of benefits of the 30 year life of the Proposed Development.

Waste Generation

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction and decommissioning phases would be classified as building and demolition waste within the class general solid waste (non putrescibles).

Potential impacts associated with waste management on Site are:

- Potential contamination of land and water from inappropriately managed waste and waste storage areas;
- Human and animal health impacts; and
- Resource wastage through inefficient use or the recycling of over-ordered stock.

Construction

Solid wastes will be the main pollutant generated by construction activities. Solid wastes will include packaging, excavated material, metal and cable off-cuts, excess building materials, general refuse and other non-putrescible wastes. Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescibles) in accordance with the POEO Act.

Operation

Waste streams during the operation of the Proposed Development would be very low. No waste streams would be associated with the generation of electricity using PV panels. There would be solid waste streams associated with maintenance activities (non putrescibles) and the solid waste generated as a consequence of having employees and/or contractors on site (putrescibles). Some materials such as, fuels and lubricants, metals may require replacement over the operational life of the Proposed Development.

Decommissioning

The Proposed Development has a design life of at least 30 years. At the end of its useful life the Proposed Development will be decommissioned and the Site will be returned to agricultural use.

Decommissioning activities will involve the removal of all above ground infrastructure, including the PV modules, the racking system, the piles, and grid connection infrastructure. Note, underground cables (inert and stable) at a depth greater than 500 mm would be left in the ground to avoid unnecessary ground disturbance.

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

- Solar panels and mounting system; and
- Metals from posts, cabling, fencing.

Infrastructure and equipment that may be suitable for reuse include grid connection equipment, substation equipment and invertors. Support buildings will be removed from the Site for reuse if possible.

Solid wastes will be generated by decommissioning activities (non putrescibles, putrescibles), although to a lesser degree than during the construction phase. Solid wastes will include packaging, excess building materials, general refuse and other non-putrescible wastes.

Waste Classification

The classification and description of the potential waste types likely to be generated by each phase of the Proposed Development are summarised in Table 6-37 below.

Table 6-37: Potential waste description

Waste Type	Project phase*	Waste Classification	Details
Hydrocarbons	C,D	Liquid Waste	Used lubricants, etc.
Construction/ structural Waste	C,D	General Solid Waste (non-putrescible)	Waste from construction would include excess concrete, metal, timber, fittings and packaging.
Domestic/ office waste	C,O,D	General Solid Waste (non-putrescible and putrescible)	Waste would consist of everyday items such as paper, aluminium cans, plastics, packaging and other material generated by onsite contractors.
Green Waste	C	General Solid Waste (non-putrescible)	Cleared vegetation.
Liquid waste	C, D	Liquid waste	Oil, paint, lubricants, glue etc.
Sewage	C,O,D	Liquid Waste General Solid Waste (putrescible)	Effluent from ablutions and office buildings.

Waste Type	Project phase*	Waste Classification	Details
Chemical/ hydrocarbon containers	C,O,D	General Solid Waste (non-putrescible)	Fuel and lubricant storage. Herbicides and pesticide storage.

* C – construction; O – operation D – decommissioning

Managed effectively, in line with the mitigation measures described in the section below, the generation of waste as a consequence of the construction, operation and decommissioning of the Proposed Development would not result in significant impacts.

6.13.4 Mitigation measures

In order to encourage the efficient use of resources and reduce environmental impacts in line with the POEO Act, POEO (Waste) Reg, and the WARR Act, resources and waste will be managed according to the following hierarchy:

1. Reduce waste production;
2. Recover resources (including reuse, reprocessing, recycling and energy recovery); and
3. Dispose of waste appropriately.

Waste will be classified in accordance with the NSW EPA *Waste Classification Guidelines – Part 1: classifying waste* (EPA, 2014) and *addendum* (EPA, 2016). Waste that cannot recovered will be disposed of lawfully at a licensed waste facility. A Waste Management Plan will be prepared in order to meet the hierarchy set out above, and will form part of the CEMP, OEMP and DMP. The objectives, protocols and responsibilities within it will be communicated to all staff and contractors through a site induction process and ongoing training.

Specific measures to be incorporated into the Waste Management Plan would include, but not limited to the following:

- Protocols to identify opportunities to follow the waste hierarchy - to ensure that waste is minimised, recovered, and disposed of appropriately, and also to ensure a culture of responsible waste management is upheld by staff;
- Quantification, classification, and tracking of all waste streams - to encourage waste reduction and minimise inter-contamination of waste streams;
- Controls on the disposal methods of all waste streams;
- Provision of recycling facilities onsite to reduce waste streams;
- Provision of a dedicated waste management area onsite; and
- Protocols on the transportation of waste, for example covered loads.

6.14 Socioeconomic Factors

6.14.1 Introduction

In this section the potential socioeconomic impacts of the Proposed Development are considered within the Armidale Dumaresq LGA and the wider New England Tablelands. First the socioeconomic makeup of the area is summarised, including a review of the Council and the communities' longer term strategies for the region. Secondly, potential socioeconomic impacts throughout the Proposed Development's lifecycle are considered along with strategies to enhance positive effects and mitigate negative impacts.

6.14.2 Existing environment

The Armidale-Dumaresq LGA has a population of 24,105, of these 47.8% were male and 52.2% were female (ABS, 2011). Aboriginal and Torres Strait Islander people made up 6.3% of the population. Population growth rates for the Armidale Dumaresq LGA between the 2001, 2006 and 2011 census dates were, -0.31%, -0.16% and +3.1%, respectively. Under current NSW planning, the population of the greater New England North West region is expected to grow modestly over the next 20 years from 188,200 in 2016 to a predicted 202,000 in 2036 (DPE, 2016).

The median age of people in the LGA is 34 years, three years younger than the national median. Children aged between 0 and 14 years make up 18.8% of the population and people aged 65 years and over made up 14.5% of the population.

The New England North West regional economy has historically been based on agriculture, and it remains one of the most productive agricultural areas in Australia. The agricultural industry in the region is worth approximately $1.8 billion annually, employing 30,000 people directly or indirectly and equating to 42% of the region's employment (NSW DPI, 2012). The agricultural industry is complemented or supported by urban industries and services ranging from manufacturing to professional services.

In the Armidale-Dumaresq LGA the other main industries of employment are education and training, healthcare and social assistance and retail trade. The unemployment rate is 7.4%, greater than the national unemployment rate of 5.6% (ABS, 2011).

Armidale is a service area for the New England Tablelands and includes the University of New England, educational facilities, transport facilities, sporting and recreational facilities, hospitals and services for the tourism industry.

The region has been identified as one of the best locations in NSW for the generation of renewable energy from wind and solar power (Department of Planning & Infrastructure, 2012). Solar farms have been approved at Moree and White Rock (Inverell).

Armidale Dumaresq Community Strategic Plan 2013 – 2028

The Armidale Dumaresq Community Strategic Plan 2013 – 2028 was adopted by Armidale Dumaresq Council (ADC) in June 2013. The Community Strategic Plan establishes the community's goals and long-term aspirations. The Proposed Development finds support in a number of the community's main priorities and aspirations which are identified in the Community Strategic Plan and detailed below:

- **Increase the use of Renewable Energy:** The Proposed Development will provide renewable energy directly to the section of the grid that in turn supplies the Armidale Substation. A large proportion of this energy will be used by people living in the Armidale Dumaresq region directly.

- **Enhance employment opportunities:** The Proposed Development will provide up to 150 jobs during the construction phase, and 8 to 12 positions will be created during the operation phase.
- **Increase Industry in the area:** The Proposed Development will allow for the diversification of industry in Armidale, which is currently highly geared to the education and rural sectors, by directly providing construction jobs which in turn will benefit the services, hospitality and retails sectors.
- **Respond to Climate Change risk and opportunities:** The Proposed Development represents a proactive approach to climate change risks and opportunities by reducing greenhouse emissions, hence increasing the community's capacity to respond.

Community and national attitudes to Solar Farms

As detailed in Section 5, during the Information Sessions in Hillgrove and Armidale attendees expressed overwhelmingly positive attitudes towards the Proposed Development with few issues being raised. This response corresponds with wider national views on renewable energy, where in particular solar power is viewed as the single most preferred form of electricity generation. For example in a 2016 survey, 86% of respondents named solar power among their top three most preferred energy sources, up from 81% in the same survey in 2012 (The Climate Institute, 2016).

6.14.3 Potential impacts

General

The socioeconomic and environmental benefits of developing renewable energy sources, and transitioning to a low carbon future are large, providing potential benefits to entire communities and helping to maintain quality of life. Indeed, increased adoption of renewable energy sources will assist Australia to transition away from traditional carbon intensive energy production which is linked to atmospheric pollution and carbon emissions associated with climate change. Reduced carbon emissions have the potential to reverse or slow the effects of climate change, benefitting current and future generations.

Electricity produced from the Site provides a clean power source for local and regional consumers in a cost effective manner. Section 2.4 details that the Proposed Development would produce approximately 233GWh of clean renewable energy to the local electricity transmission network. This would provide enough energy to power up to 40,000 NSW homes each year, and in doing so would reduce approximately 225,000 tonnes of CO_2 per annum through the displacement of conventional electricity supply.

Construction

The Proposed Development would have an overall positive impact on the local and wider economy during the construction period. Construction will take between 9 to 12 months and up to 150 staff will be required. Local employment opportunities will be generated, while additional workers from outside the region would stimulate the local economy through demand for accommodation, hospitality and retail services. A temporary influx of staff may lead to a small increase in pressure on local services, including accommodation. However, Armidale, and the New England North West have occupancy rates of around 56% and 51% respectively (AEC Group, 2011), which suggests that the region would easily accommodate additional workers.

Construction noise and additional traffic on the Waterfall Way may be noticeable to local residents, with traffic representing a slight increase in risk (Section 6.6).

During the construction period there would be a large scale change to the character of the Site as viewed from Waterfall Way, however this would be temporary in nature, and would be lessened in magnitude by the changes in construction activities and their location across the Site. Furthermore, views of the Proposed Development from Waterfall Way would only extend over the southern part of the Site (see Section 6.7).

There would be a reduction in farming related income on those areas of the Proposal Site within the Development Footprint, although income generated from the lease arrangements during this time would offset these losses.

Operation and decommissioning

The Proposed Development would have an overall positive effect on the local and wider economy through the employment of 8 to 12 full time equivalent employees. Increased employment from the Proposed Development would provide an opportunity for the diversification of rural incomes and, therefore, would increase economic security for the local economy.

The Proposed Development would result in a diversification of farm income for the landowner.

The Proposed Development would not create major land disturbances or land use conflict (Section 6.2.2). Furthermore, the size of the Proposed Development (up to 507 ha) would not significantly diminish the availability of land for agricultural production purposes within the Armidale Regional LGA, (Section 6.2.2). The Proposed Development is fully reversible and would not result in any long-term impacts to the inherent soil fertility, allowing existing farming activities to recommence following decommissioning.

It is not anticipated that the Proposed Development would have any adverse impacts on tourism given its limited visibility and the general positive attitude of Australians towards renewable energy and solar developments in particular. Indeed, it may present an opportunity for tour operators to add an additional attraction to existing tours.

Noise and traffic impacts during this time are not predicted to be significant.

No negative socioeconomic impacts are expected as a result of the introduction of the Proposed Development during the operational period.

It is anticipated that decommissioning would be of a shorter duration than the construction period (up to 6 months). However, the same economic benefits and opportunities identified for the construction period would arise during this time. Further economic benefits may include local recycling of infrastructure.

6.14.4 Mitigation Measures

Construction

A Community Consultation Plan (CCP) will be prepared and implemented outlining the measures that will be taken during the construction phase to increase positive benefits to the Armidale community and to reduce any adverse impacts. It will note protocols to keep the community updated on project progress during the construction phase, how relevant stakeholders will be informed of potential impacts, and the resolution process, for any complaints received.

Infinergy and the appointed EPC Company will liaise with relevant local representatives to maximise the benefits to the local economy, by recruiting contractors from the local area and implementing an

informal ‘buy local’ practice where goods and services are purchased from local businesses, provided that they are competitive in terms of quality and price.

Mitigation measures, that would reduce risk associated with increased traffic volumes during construction to acceptable levels have been provided in Section 6.6.4.

Mitigation of noise impacts are addressed in Section 6.9.3. It is concluded that predicted noise levels for the Site will be acceptable with the implementation of standard construction noise mitigation measures. These procedures will also be included in the CEMP.

Operation and decommissioning

No additional mitigation measures are considered necessary for the operational period. Mitigation and enhancement strategies for the decommissioning period would be the same as those outlined for the operational period.

7 Environmental Management

7.1 Environmental Management Plans

Environmental management for the Proposed Development would be undertaken in accordance with Environmental Management Plans (EMPs), which would be prepared to provide an overall framework for the management of environmental impacts that could potentially arise as a consequence of the Proposed Development. All mitigation measures identified throughout this EIS would be incorporated into the EMPs, which would provide:

- An environmental operations manual for staff and contractors throughout the construction, operation and decommissioning of the Proposed Development;
- Identification of the potential impacts of the Proposed Development and the measures identified to mitigate these impacts as described in the preceding chapters of this EIS;
- Details of how environmental safeguards are to be implemented;
- Details of the timing of the implementation of the mitigation measures;
- Clearly defined allocations of environmental responsibilities for all staff members and contractors;
- Monitoring and reporting requirements to demonstrate compliance with licensing and approval requirements; and
- Procedures for review and updating of the EMPs.

Adherence to the EMP would enable environmental safeguards and mitigation measures to be effectively implemented and sustainable work practices adopted throughout the duration of the Proposed Development.

This would demonstrate Infinergy's intent to comply with conditions of consent, relevant environmental legislation, prevent environmental pollution and minimise the impact of the Proposed Development on the environment.

7.2 Statement of Commitments

A final design of the solar farm (Final Layout Plan) would be submitted to DPE for approval. Based on the final layout, environmental safeguards outlined in this document are to be incorporated into either the CEMP, the OEMP, and/or the DMP. Each plan will be prepared prior to each stage of development commencing and submitted to the DPE for approval. The safeguards will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Statement of commitments

Impact	Environmental safeguard	Commitment
Land Use and Soils	Construction and/or installation of erosion and sediment control structures shall be in accordance with the specifications provided in the Blue Book.	The CEMP , OEMP and DMP will incorporate Erosion and Sediment Control Management that will include provisions for the: • Installation and maintenance of erosion controls for the duration of the construction phase; • Requirements for regularly inspecting erosion and sediment controls, including maintaining a register; • Machinery to arrive and leave site in a clean condition, free of oil leaks to prevent contamination and sediment tracking on sealed roads; • Minimisation of areas to be cleared; • Separation of topsoil and subsoil for stockpiling and the correct placement during backfill; • Appropriately handling and stockpiling soil to minimise weed infestation and maintain soil structure and microbial activity; • Protocol to be followed for heavy rainfall event predictions; and The CEMP , OEMP and DMP will incorporate a Spill Response Plan (SRP) that will include: • Protocols for the storage of any potential contaminants on site; and • Processes to mitigate any soil contamination that occurs on site, including the emergency response and EPA notification procedures. Weed management strategies will be included in the OEMP and include strategies to prevent and minimise the spread of weeds, including:
	Regular inspection and programmed maintenance of erosion and sedimentation controls will be undertaken and documented in a register of inspections and actions.	
	Cable trenches will be constructed in accordance with relevant regulations and ground conditions. Trenches will be excavated and filled progressively to ensure they are left open for the shortest period possible. Surface conditions will be returned to pre-disturbance conditions and groundcover rehabilitated as soon as practicable to prevent the formation of preferential flow pathways.	
	Management of erosion generated by traffic shall include a driving code of practice, installation of appropriate drainage controls, inspection and maintenance of unsealed road surfaces and dust management strategies.	
	Appropriate stockpile management to ensure air and water erosion is minimised, soil health, organic matter and structure are retained and weed infestation minimised.	
	Account for climatic events during construction; • If heavy rainfall is predicted the site should be stabilised and works modified to prevent erosion for the duration of the wet period; and • Works methods shall be modified during high wind conditions if excess dust is generated.	
	To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc.) will be disposed of site in accordance with DECC guidelines.	
	Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area.	
	Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery	

Impact	Environmental safeguard	Commitment
	Potential soil contamination will be managed by the implementation of a Spill Response Plan (SRP).	• Management protocols for any declared noxious weeds according to the stipulations of the Noxious Weeds Act; and • Protocols for weed hygiene in relation to plant and machinery entering and leaving the Site, and the importation of fill.
	Maintaining access tracks in good condition and ensuring that associated drains and/or sedimentation traps are monitored and maintained will ensure that the potential erosion associated with the tracks is minimised.	
	Maintaining the vegetation cover below the panels will assist in reducing the potential for scouring and erosion.	
	To minimise the potential for erosion in the areas beneath the panels an inspection program following significant rainfall events would implemented and stabilisation works would be undertaken as required.	
	Weed management strategies will be implemented aim at preventing and minimising the spread of weeds to and from, and within the Site.	
Biodiversity	The Development Footprint is located so as to avoid all impacts upon EECs.	The CEMP, OEMP and DMP will incorporate a Biodiversity Management Plan that will specify controls to reduce impacts including:: • An induction and awareness program for construction workers; • Methodology for a two stage clearing process; • Develop a plan for replanting and vegetation management; • Develop a plan for on-going weed control; and • Monitoring program focusing on on-going impacts, including erosion. The CEMP, OEMP and DMP will incorporate a Erosion and Sediment Control Management that will include provisions for the: • Installation and maintenance of erosion controls for
	Vegetation that is to be removed nearby to retained vegetation will be removed using a chain-saw rather than heavy machinery to avoid any additional impacts on adjacent vegetation.	
	Clearing of vegetation will be undertaken via a two stage clearing process. Clearing will not be undertaken until a pre-clearance assessment is conducted by qualified ecologists. Ecologists will be present for all vegetation clearing. Stage 1 of the clearing process involved marking of habitat features, and removal of all vegetation except habitat features. Stage 2 involves removal of habitat features under the supervision of ecologists to relocate resident fauna. .All clearing staff will be briefed about the two stage clearing process, and their responsibilities to minimise impacts to biodiversity.	
	Other measures to minimise the impacts of the project on biodiversity will be detailed within the CEMP and DMP. These measures will include at a minimum: • Temporary fencing to delineate clearing boundaries;	

Impact	Environmental safeguard	Commitment
	• Marking of trees for retention within open areas; • Cleaning of mobile plant prior to works to prevent the spread of weeds and pathogens; • Sediment controls along Limerick Creek to prevent impacts downstream; and • Signage within the works area to advise contractors and responsibilities.	the duration of the construction phase; • Requirements for regularly inspecting erosion and sediment controls, including maintaining a register; • Machinery to arrive and leave site in a clean condition sediment tracking on sealed roads; • Minimisation of areas to be cleared; • Separation of topsoil and subsoil for stockpiling and the correct placement during backfill; • Appropriately handling and stockpiling soil to minimise weed infestation and maintain soil structure and microbial activity; and • Protocol to be followed for heavy rainfall event predictions. Weed management strategies will be included in the CEMP, OEMP and DMP and include strategies to prevent and minimise the spread of weeds, including: • Management protocols for any declared noxious weeds according to the stipulations of the Noxious Weeds Act; and • Protocols for weed hygiene in relation to plant and machinery entering and leaving the Site, and the importation of fill.
	Sediment and erosion control.	
	A weed management plan will be included within the BMP for the Site which will include cleaning and inspection of light vehicles and mobile plant.	
	A monitoring program will be drafted within the BMP to measure infrequent and cumulative impacts of the project. The monitoring program will include baseline data capture to measure any effects of the project over time. Given the low biodiversity values at the Site, the monitoring program should focus on likely ongoing impacts of the development such as erosion.	
	Fences will be placed around key biodiversity areas to prevent rubbish dumping by contractors. Appropriate security measures will also be in place to reduce illegal dumping.	
	Nest boxes can be installed to minimise impacts to arboreal mammals. It is recommended to replace all removed hollows with artificial nest boxes at a ratio of 1:1 (removed: replaced).	
Heritage	*Aboriginal Cultural Heritage*	
	No further archaeological investigation is required at the artefact locations (find spots) identified as falling within Bayley Park Study Areas 1 – 3.	A cultural Heritage Management Plan (CHMP) will be prepared and incorporated into the CEMP, OEMP and DMP following the detailed design of the Proposed Development (post consent)/ The CHMP will: • Indicate were avoidance is possible and where impacts are unavoidable
	No further archaeological investigation is required at the scarred tree locations that fall within the Development Footprint. Scarred trees, regardless of whether they are alive or dead shall be avoided; initial ground surface disturbance and project construction activity should be excluded from within 10 m of these trees.	

Impact	Environmental safeguard	Commitment
	No further archaeological investigation is required at the stone arrangement that falls within the Development Footprint. This site shall be avoided and a 10 m exclusion zone placed around it, into which no vehicles (including rubber-tyred light vehicles) must travel.	• Detail how heritage items and artefacts will be identified and protected during construction; • Include a cultural awareness program for all works developed in consultation with a selection of RAPs; • The few artefacts requiring AHIPs will be managed and re-patriated; • Show buffer and exclusion zones; • Detail procedure for dealing with un-expected archaeological finds; and • Detail the long-term management of protected heritage items.
	For the duration of construction, 10 m buffer zones be established around the two identified scar trees and stone arrangement using star pickets and high visibility barrier fencing. At completion of construction, and in consultation with the RAPs, the barrier fencing may be removed from around the scarred trees. At completion of the construction phase the high visibility barrier fencing be removed from around the stone arrangement and is replaced with a stock-proof fence.	
	Once detailed design has been established, any artefact concentration or isolated locations that may be impacted shall be marked with a star picket and appropriate flagging for the interim period between final design and the gaining of approval to mitigate potential impacts.	
	If, through future development planning, impacts are proposed for any land outside the Development Footprint, cultural heritage assessment of the area(s) proposed shall be undertaken.	
	In the event of an unanticipated find all works shall cease in the immediate area (10m buffer) and the find spot marked with high visibility barrier fencing. A qualified archaeologist and representatives from the Aboriginal community are to be contacted to verify the status of the find and to determine its significance. If verified, the Site is to be registered with OEH in the AHIMS database. Approval shall be required to impact the find prior to recommencement of works.	
	Appropriate communication protocols between the proponent (and/or their contractors) and Aboriginal stakeholders will agreed and set out in the CHMP. During initial ground surface disturbance it is recommended that the proponent (and/or their contractors) communicate the progress and/or any developments concerning Aboriginal cultural heritage.	
	Monitoring of tree removal will be carried out on a needs basis, the number of monitors	

Impact	Environmental safeguard	Commitment
	present equal to the number of machines engaged in tree removal.	
	The RAPs have requested and it is recommended here, that they be involved in monitoring vegetation removal in the pine plantation located along the western margin of Study Area 2.	
	Draft copies of the ACHA have been sent to each of the RAPs for review and feedback, and a digital copy of the final report shall submitted to the OEH for inclusion in the AHIMS database.	
	In the event of an unanticipated find all works shall cease in the immediate area (10m buffer) and the find spot marked with high visibility barrier fencing. A qualified archaeologist and representatives from the Aboriginal community are to be contacted to verify the status of the find and to determine its significance. If verified, the Site is to be registered with OEH in the AHIMS database. Approval shall be required to impact the find prior to recommencement of works.	
	Historic Heritage	
	In the event potential historic heritage items are found during construction activities, works in that area shall cease until an assessment is made by an appropriately qualified archaeologist and OEH has been consulted.	A cultural Heritage Management Plan (CHMP) will be prepared and incorporated into the CEMP, OEMP and DMP following the detailed design of the Proposed Development (post consent)/ The CHMP will: • Indicate were avoidance is possible and where impacts are unavoidable; and • Detail procedure for dealing with un-expected archaeological finds.
Traffic and Transport	The Road Safety Audit (Appendix F) suggests consideration be given to: • Advance truck warning signs to be installed on Waterfall Way; • Double white lines should be extended past the intersection of Waterfall Way and Bayley Park Road; • Guide posts with reflective markers should be installed at regular intervals (100 m	The CEMP will incorporate a Traffic Management Plan that will detail: • All site access for construction workers and delivery vehicles; • Any temporary road safety requirements during the

Impact	Environmental safeguard	Commitment
	spacing) and at specific roadside hazards such as on bends and culverts along Bayley Park Road; and • Upgrading Bayley Park Road with improvements to the unsealed gravel pavement in accordance with the ARRB Unsealed Roads Manual (2009).	construction; • All permanent road safety requirements; • Carpooling arrangements to minimise vehicle numbers during construction; • Procedures to monitor traffic impacts and adapt controls as required; • How inspections and regular safety checks will be completed; and • Include a code of conduct for transport drivers to and from site.
Visual amenity	Establish an infrastructure free Visual Buffer Zone that will, as far as practical, maximise infrastructure setbacks from public areas of high visual amenity impact along Waterfall Way (50 m minimum setback).	A Visual Buffer Landscaping Plan will be prepared and implemented as one of the first activities on the commencement of site preparation. This plan will include: • Preparation of the vegetation buffer; • Local endemic species selection; • Care and maintenance requirements over the lifetime of the Proposal; and • Procedures to follow if planting fails or does not achieve objectives, including alternative species.
	Minimum setback distances of 160 m proposed in the north east viewshed from Cubba Cubbah (towards the north east from the residence, no development to take place south of proposed screening buffer).	
	Establish a vegetation buffer within the Visual Buffer Zone where Waterfall Way borders the southern boundary of the Proposed Development.	
	Establish vegetation buffers within the Site boundary to help screen views from Kiama.	
	Ensure that establishment of the vegetation buffer is conducted as one of the first activities of site construction.	
	Promote management of road corridor vegetation to allow natural regeneration of native plant species in consultation with ARC and other relevant authorities.	
	Continue to consult with nearby impacted landholders to identify, where possible, the location of mutually agreeable vegetative screening both pre and post construction. Ensure that actual screening meets mitigation expectations and broaden planting if it does not.	

Impact	Environmental safeguard	Commitment
	Use muted, low contrast colours for all supporting infrastructure, so that they blend into the landscape as far as possible.	
	Locate substation, support buildings, construction site compound and lay down areas away from visual receptors and apply visual screening if necessary.	
	Minimise night lighting to the substation and support buildings area.	
	Minimise vegetation clearing and earthworks and rehabilitate progressively.	
Water Resources	As a result of a design philosophy that, in the first instance, seeks to avoid impacts, the following environmental protections apply: • Exclusion of 3rd order streams from the Development Footprint (except internal site access points); • Application of a 30 m buffer zone for 3rd order riparian zones; • Exclusion of all local GDEs associated with Limerick Creek; • Avoidance of footings and pilings within 1st and 2nd drainage lines; • Minimisation of creek crossings for within site access and electrical cabling; • Sourcing of non-potable, construction and operational water from rainwater tanks and existing farm dams; • Purchasing and transporting to site all potable water requirements; and • The use of portable chemical toilets.	The CEMP, OEMP and DMP will incorporate a Erosion and Sediment Control Management that will include provisions for the: • Installation and maintenance of erosion controls for the duration of the construction phase; • Requirements for regularly inspecting erosion and sediment controls, including maintaining a register; • Machinery to arrive and leave site in a clean condition, free of oil leaks to prevent contamination and sediment tracking on sealed roads; • Separation of topsoil and subsoil for stockpiling and the correct placement during backfill; • Appropriately handling and stockpiling soil to minimise weed infestation and maintain soil structure and microbial activity; • Minimisation of areas to be cleared; • Protocol to be followed for heavy rainfall event predictions; and The CEMP, OEMP and DMP will incorporate a Spill Response Plan that will include: • Protocols for the storage of any potential
	To avoid release to the environment, all hazardous materials (fuels, lubricants, herbicides, etc) will be disposed of offsite in accordance with DECC guidelines.	
	Onsite refuelling shall occur in an area that is located greater than 100 m from the nearest drainage line and within an impervious bunded area.	
	Machinery will be inspected daily to ensure no oil, fuel or lubricants are leaking from the machinery.	
	All hazardous materials will be classified and appropriately stored away from any flood prone areas and drainage lines	

Impact	Environmental safeguard	Commitment
	Activities with the potential for adverse water quality impacts would be managed through the development of site specific sediment control plans and spill controls.	contaminants on site; and • Processes to mitigate any soil contamination that occurs on site, including the emergency response and EPA notification procedures. The OEMP will assess and identify appropriate operational protocols to ensure the: • Protection of surface and groundwater quality; • Maintenance of water supplies and rights of access; and • Maintenance and protection of riparian, aquatic and groundwater dependent ecosystems.
	Culverts on Limerick Creek will be designed as per the *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI 2004) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).	
	Potable water will be sourced off-site, via registered water suppliers. Non-potable construction water requirements will be sourced either off-site or from existing farm dams within the lease area. Rainwater tanks installed to support buildings provide an additional source of non-potable construction water and a climate independent firefighting source.	
	Culverts on Limerick Creek will be designed as per the *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2004) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).	
	Installation of cables across Limerick Creek will follow relevant design considerations as per the NSW Office of Water's *Controlled Activities: Guidelines for laying pipes and cables in watercourses.*	
	Infrastructure shall be designed and located to avoid being impacted by impeding run off, streams or flood flows.	
	Protocols will include maintaining groundcover across the Proposed Development during operation to minimise the potential for erosion and sedimentation.	
Noise and Vibration	Use mobile noise barriers/enclosures during certain construction work, such as around stationary work activities and plant.	The CEMP and DMP will incorporate a Construction Noise and Vibration Management Plan (CNVMP) that will: • Define hours of work in accordance with construction noise guidelines; • Specify the requirement for noise management and selection of mobile plant;
	Informing and consulting residents and interested parties, as far as practicable, regarding impending or current events that may cause high levels of noise and how long they are expected to take. This may take the form of letter drops, or community notices.	
	Provide a complaints telephone number prominently displayed where the works are taking	

Impact	Environmental safeguard	Commitment
	place and on any letter drops or community notices.	• Include noise awareness training and induction for workers; • Consider adverse weather conditions; • Detail communication with the community as required; • Be used as a working document on-site by contractors and subcontractors to ensure everyone is aware of their responsibilities; and • Development of combined noise management agreement in conjunction with Hillgrove Mines should construction periods overlap.
	Respite hours agreed with residents when noisy works will not take place if necessary.	
	Investigate complaints when received to establish the cause, and where possible implement a corrective action such as, provide a respite period or other practical measure.	
	Minimising the operating noise of machinery brought on to the Site.	
	If there is excessive noise from any process, that process will be stopped and if possible that noise attenuated to acceptable levels. Where there is no alternative the process will be rescheduled to non-sensitive hours.	
	Ensuring that plant is not left idling when not in use.	
	Ensuring that plant is well maintained and in good working order and not causing unnecessary noise, such as damaged mufflers on plant, and ensuring plant is not left idling when not in use.	
	All access hatches for plant to be kept closed.	
	Provision of a toolbox talk to personnel on-site so that everyone understands the importance of controlling noise and vibration.	
	To provide a framework for construction noise management on-site, it is recommended that a CNVMP is produced by the contractor. This should include all pertinent information regarding the control and management of noise and vibration, and would be used as a working document on-site by contractors and sub-contractors so that everyone is aware of their responsibilities.	
Bushfire and Electrical Fire	Undertake a Bushfire Risk Assessment and develop a Bushfire Management Plan prior to commencing construction activities to assess site specific risks.	The Emergency Response Plan will: • Detail the mitigation of and response to electoral and bush fires; and • Be provided to NSW Rural Fire Service and NSW Fire and Rescue.
	Electrical equipment selected for the 30 year life span of the Proposed Development would be designed to minimise potential for ignition and certified to comply with relevant Australian Standards.	

Impact	Environmental safeguard	Commitment
	Chemical storage will be in accordance with MSDS requirements and consider potential fire hazards (the use of fire cupboards for storage of chemicals.	The CEMP, OEMP and DMP will provide safety protocols, including but not limited to: • Basic training of all staff in the use of firefighting equipment on site; • Firefighting equipment lists will be detailed in the Work Method Statements; • Management procedures for hot works, smoking, vehicle use off formal access tracks, and the use and storage of fuel and flammable chemicals; and • Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors.
	A 20,000 litre water tank will be provided in the support buildings area for the sole use of fire protection in line with the RFS standards.	
	Appropriate emergency vehicle access will be provided across the entire site, including access to inverters and between the rows of the solar array. This will be designed and constructed in compliance with RSF standards.	
	The fuel load across the Proposed Development will be monitored, and will be mechanically slashed, grazed or ploughed to reduce the risk of a grass fires starting within the Site and ensuring that fires originating from outside the Site do not intensify as a consequence of entering the site.	
	Asset protection zones would also be designed and maintained around buildings and infrastructure to reduce the risk of fuel loads building up around sensitive assets	
	An Emergency Response Plan will be prepared and provided to the RFS and Fire and Rescue NSW.	
Electromagnetic Interference	In limiting exposure to EMFs, following advice from the International Commission on Non-Ionizing Radiation Protection, priority will be given to engineering and access controls (ICNIRP, 2010). This means that: • The final design of the Proposed Development would be undertaken by qualified and competent persons; • Design would meet relevant Australian standards, ensuring EMFs would be minimised as far as possible; and • Access to electrical equipment would be limited to qualified personal only.	A Health and Safety Plan (HSP) will be developed in accordance with the *Work Health and Safety Act 2011* and incorporated into the CEMP, OEMP and DMP. The HSP will include details relating to exposure limits to EMFs for contractors and staff working on the substation, inverters and within vicinity of the overhead transmission lines.
	To reduce the potential for chronic or acute exposure to EMFs, no unsupervised public access to the Proposed Development would be permitted.	
	The landholder or its employees would not have access to the substation or inverters.	

Impact	Environmental safeguard	Commitment
	Electrical equipment commissioned as part of the Proposed Development would be designed to reduce possible interference in line with Australian Standards.	

Air Quality	Develop protocols to guide vehicle, plant and construction activities to minimise air quality impacts.	The CEMP, OEMP and DMP will incorporate an Air Quality Management Plan that will:
		• Define designated access and travel routes;
		• Set onsite speed limits; and
		• Adopt trip management protocols to avoid unnecessary trips e.g.:
		  ○ car-pooling for construction staff;
		  ○ coordinating delivery and removal of materials.
		• The use of a water truck during dust generating activities;
		• Limit the extent of clearing and excavation;
		• Stage clearing and excavation activities to minimise total areas of exposed soil;
		• Minimise the number and volume of stockpiles on-site and the number of work faces on stockpiles;
		• Modify activities if dust is observed leaving the Development Site towards nearby sensitive receptors;
		• Ensure all vehicles and machinery that enter the site meet relevant standards for emissions;
		• Maintain vehicles and plant in accordance with manufacturer's requirements to minimise emissions;
		• Provide a complaints' procedure to identify and respond to air quality issues generating complaints; and
		• Development of a combined dust management agreement with Hillgrove Mines should construction

	Develop protocols for inclusion in the CEMP OEMP and DMP to identify, minimise and treat dust emissions.	
	Develop protocols for inclusion in the CEMP, OEMP and DMP to reduce CO2 emissions.	
	Develop a complaints procedure to promptly identify and respond to issues generating complaints.	

Impact	Environmental safeguard	Commitment
		periods overlap.
Waste and resource use	To encourage the efficient use of resources, reduce costs and environmental impacts, waste will be managed according to the following hierarchy: 1. Reduce waste production; 2. Recover resources (including reuse, reprocessing, recycling and energy recovery); and 3. Dispose of waste appropriately.	A Waste Management Plan will be prepared and included in the CEMP, OEMP and DMP, and will provide: • Protocols to identify opportunities to follow the waste hierarchy - to ensure that waste is minimised, recovered, and disposed of appropriately, and also to ensure a culture of responsible waste management is upheld by staff; • Quantification, classification, and tracking of all waste streams - to encourage waste reduction and minimise inter-contamination of waste streams; • Controls on the disposal methods of all waste streams; • Provision of recycling facilities onsite to reduce waste streams; • Provision of a dedicated waste management area onsite; and • Protocols on the transportation of waste, for example covered loads.
	Wastes will be classified in accordance with the NSW Environment Protection Authority (EPA) *Waste Classification Guidelines – Part 1: classifying waste* (EPA 2014) and *addendum* (EPA 2016), and disposed of lawfully at a licensed waste facility.	
	Opportunities for recycling will be investigated during both the construction and decommissioning phases.	
Socio-economic	Continued consultation with the community and relevant stakeholders during the construction phase.	Prepare and implement a Community Consultation Plan (CCP) that will include the protocols to: • Update the community on project progress; • Update relevant stakeholders of the timing of any potentially adverse impacts; and • Resolved any complaints received. Require EPC company to ensure local contractors/suppliers/workers are provided with timely information regarding potential opportunities.
	Construction staff, where possible, are recruited from local areas.	
	An informal ‘buy local’ practice applies, where goods and services are purchased from local businesses provided that they are competitive in terms of quality and price.	
	Infinergy and the eventual EPC company will liaise with the local tourism industry to minimise any potential conflicts arising from demand for accommodation and related services.	

8 Project Justification

8.1 Introduction

As a conclusion to the environmental assessment, the construction, operation and decommissioning of the Proposed Development is evaluated and justified through the consideration of its potential impacts against triple-bottom-line considerations (environment/community/economics) and its potential benefits to the local, regional and NSW community.

8.2 Residual environmental risks and impacts

The *Australian New Zealand Risk Management Standard (AS/NZS ISO 31000:2009*) defines risk management as the "*coordinated activities to direct and control an organisation with regard to risk*" (Standards Australia 2009). Risk arises in all aspects of the project life cycle and offers both opportunity and threat, and must therefore be managed appropriately. Risk management involves establishing an appropriate risk management culture, and applying logical and systematic risk management processes to all stages in the life cycle of any activity, function or operation.

This EIS adopts an environmental impact assessment methodology aligned to the *AS/NZS ISO 31000:2009* standard:

- Potential risks (environmental impacts) have been identified through the Environmental Assessment (Section 6);
- Strategies and actions are identified to mitigate the impact of the risk (Section 7);
- An assessment is made of the likelihood of the risk occurring and the consequence if the risk were to occur:
  - the likelihood of the risk occurring is described as *very unlikely, unlikely*, *possible*, *likely*, or *almost certain* to occur; and
  - the consequences or potential impact if the risk event occurred are described as *minor*, *major, severe, critical* or *catastrophic*.

The risk matrix below (Table 8-1) determines a risk rating of low, medium, high or extreme.

Table 8-1: Residual environmental risk assessment

Risk Assessment Matrix		Consequence				
Likelihood		Minor	Major	Severe	Critical	Catastrophic
		A	B	C	D	E
Very Unlikely	1	Low	Low	Medium	Medium	Medium
Unlikely	2	Low	Low	Medium	Medium	High
Possible	3	Low	Medium	High	High	High
Likely	4	Medium	Medium	High	High	Extreme
Almost Certain	5	Medium	High	High	Extreme	Extreme

In each case the likelihood and consequence is independently assessed in order to assign a mitigate risk score (Table 8-2).

Table 8-2: Residual risks for all impacts identified in the environmental assessment

Factor	Receptor	Potential Impact	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk
Land resources	Development Footprint	Disturbance and erosion of soils and productive topsoil	2	A	Low
		Soil compaction leading to concentrated runoff and erosion	2	A	Low
	Nearby properties	Reduced agricultural viability	1	A	Low
Biodiversity	Plant communities	Disturbance/loss of habitat	5	A	Medium
	Flora and fauna	Injury and mortality	2	A	Low
	Terrestrial and aquatic	Introduction/spread of weeds	2	A	Low
		Introduction/spread of pests	2	A	Low
		Sedimentation and erosion	2	A	Low
		Soil and water pollution	2	A	Low
		Indirect impacts of proposal e.g. light, noise, dust	2	A	Low
Heritage	Aboriginal heritage	Impacts on known artefacts/values	1	B	Low
		Impacts on unknown artefacts/values	2	B	Low
	Historic heritage	Impacts on known artefacts/values	1	A	Low
		Impacts on unknown artefacts/values	2	A	Low

Factor	Receptor	Potential Impact	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk
Traffic and transport	Existing road network	Significant increase in traffic volumes	2	A	Low
		Increased traffic risks and/or reduced safety	1	D	Medium
Visual amenity	Landscape	Altered landscape character	2	B	Low
	Nearby residences	Reduction in visual amenity	4	B	Medium reducing to Low over time
	Adjoining landscape	Reduction in visual amenity	4	A	Medium reducing to Low over time
Water resources	Surface water	Degradation of water quality	2	A	Low
		Reduction in water quantity	1	A	Low
		Flooding	2	A	Low
		Littering	3	A	Low
	Groundwater	Degradation of water quality	1	A	Low
		Reduction in water quantity	1	A	Low
Noise	Nearby residences	Nuisance noise levels during construction	4	A	Medium
		Nuisance noise levels during operation	2	A	Low
	Adjoining environment	Disturbance	3	A	Low
Hazard and risks	Development Footprint	Bushfire Fire and Electrical Fire	1	A	Low
		Lightning strikes	2	A	Low
	Adjoining environment	Electromagnetic interference	1	A	Low

Factor	Receptor	Potential Impact	Mitigated Likelihood	Mitigated Consequence	Mitigated Risk
Air quality	Nearby residences	Dust deposition	2	A	Low
	Adjoining environment	Dust deposition	3	A	Low
		Significant greenhouse gas emissions	2	A	Low
Waste management	Development site and adjoining areas	Contamination of land and water	1	B	Low
		Resource wastage	2	A	Low
		Human and environmental health	2	B	Low
Social and economic	Nearby properties	Altered property values	3	A	Low
	Local community	Reduced economic activity	1	B	Low

Most residual risks are assessed as low (Table 8-2). Medium residual risks are discussed below.

- Biodiversity – Clearing of native vegetation will be offset in accordance with the strategies outlined within the BOS;
- Traffic – The Proposed Development is considered highly unlikely to increase the likelihood of vehicular accidents, however, the potential for fatalities remains;
- Visual amenity – Residual impacts are due to the scale of the Proposed Development rather than the consequence, which is generally considered to be low. Significant efforts have been made to minimise visual impacts are far as possible and it is anticipated that residual impacts will reduce as vegetation buffers are established and mature; and
- Construction noise – Residual impacts may exceed nuisance levels, however, these are in compliance with legislative requirements and can be managed through effective consultation and CVMPs.

Based on these findings, environmental impacts associated the construction, operation and decommissioning of the Proposed Development are compliant with the requirements for SSD under the *State Environmental Planning Policy (State and Regional Development) 2011* and Division 4.1 of the EP&A Act. Therefore, environmental impacts associated with the construction, operation and decommissioning of the Proposed Development, with the implementation of the mitigation strategies and management plans identified within this EIS, are deemed acceptable.

8.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) integrates social, economic and environmental considerations into the decision making process. The principles of ESD are defined within the NSW *Protection of the Environment Administration Act 1991* and have been incorporated into NSW legislation, including the EP&A Act and the EP&A Regulation.

The Commonwealth of Australia (1992) defines Ecologically Sustainable Development (ESD) as "*using, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased*".

The principle basis for ESD is that current and future generations should leave a natural environment that functions as well or better than the one inherited. Each of the principles of ESD with respect to the Proposed Development and its environmental impact assessment are considered in the following subsections.

Precautionary principle

The precautionary principle means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The environmental consequences of the Proposed Development have been assessed as accurately as possible, using appropriate specialists in relevant disciplines where required. The assessment process involved computer modelling, scientific research, analysis and interpretation of the potential environmental impacts associated with the proposed operations.

This process has enabled the impacts of the Proposed Development to be predicted with a reasonable degree of certainty. All predictions, however, contain a degree of variability and uncertainty, which reflects the nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the EIS process, a conservative approach was adopted to ensure the worst case scenario was predicted in the assessment of impacts.

The Proposed Development is consistent with the precautionary principle in that where there was uncertainty, conservative over estimates where used, examples include:

- Potential impacts were assessed assuming the use of the full Development Footprint, however, in practice a smaller subunit of this footprint will be developed;
- Where potential threats to the environment have been identified, mitigation measures have been developed to minimise such impacts; and
- Monitoring will be undertaken, if required, as a precautionary measure to reduce the effect of any uncertainty regarding the potential for environmental damage.

Social equity in inter-generational equity

Social equity involves value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the well-being and welfare of the community, population and society. Social equity includes inter-generational equity, which requires that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The Proposed Development is consistent with the principles of social equity and inter-generational equity through the efficient use of a renewable energy source that provides a number of benefits to society.

Increased adoption of renewable energy sources will assist Australia to transition away from traditional carbon intensive energy production which is linked to atmospheric pollution and carbon emissions associated with climate change. Reduced carbon emissions have the potential or slow the effects of climate change, benefitting current and future generations.

Electricity generated from the Proposed Development would provide a clean electricity source for local and regional consumers in a cost effective manner, providing improved opportunities and quality of life for all members of the regional community.

Conservation of biological diversity and maintenance of ecological integrity

Biological diversity refers to the diversity of genes, species, populations, communities and ecosystems, and the linkages between them. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

The Proposed Development would require the clearing of up to approximately 8.40 ha of native vegetation. This clearing has been extensively assessed in Section 6.3 and, given its environmental context, it is considered extremely unlikely that this would result in a significant impact on any threatened species, populations or ecological communities or their habitats.

Areas of higher conservation value have been avoided during the evolution of the project design where possible, and where identified impacts are unavoidable these will be managed by the implementation of mitigation measures and ecosystem credits. At the conclusion of the 30 year development approval, the Proposed Development shall be fully decommissioned and rehabilitated.

Therefore, it is concluded that the Proposed Development would not have a significant negative impact upon the biological diversity or the ongoing ecological integrity in the locality.

Improved valuation and pricing of environmental resources

The environment has conventionally been considered a free resource, with the true cost to the environment not factored into cost of production or use of the resource. This principle involves placing a monetary or social value on the environment that ultimately increases its value in order to decrease future exploitation.

The Proposed Development recognises and makes use of the inherent value in solar energy. This converts an abundant, renewable natural resource (sunlight) into a valuable and valued commodity (electricity).

The commitment to offset impacts to native vegetation and to fund future biological conservation activities through the BioBanking Offset Strategy recognises and places an appropriate monetary value on environmental protection and the maintenance of biodiversity.

8.4 Justification/need for the Proposal

8.4.1 Socio-economic

The construction and ongoing operation of the Proposed Development will have significant social and economic benefits to the local community and provide environmental benefits to the broader community.

The Proposed Development provides direct employment opportunities for approximately 150 personnel during the construction period, sourcing workers from a wide range of fields and expertise, including engineers, construction workers and labourers with further employment opportunities associated with supply chains and local goods and services.

The Proposed Development will provide income for the region through capital expenditure, the provision of wages and predicted flow-on benefits. This will include the provision of 8 to 12 fulltime equivalent positions for the duration of the operational phase of the project.

The environmental benefits of developing renewable energy sources and transitioning to a low carbon future are manifold, providing potential benefits to the entire community and helping to maintain quality of life.

The commitment to decommission the Proposed Development at the conclusion of its operational period and return of the Site to its current state protects the long term agricultural value of the region.

8.4.2 Demand for products

Access to electricity is essential for the maintenance and improvement of living standards. Demand for clean, renewable energy sources will continue to grow for the foreseeable future as governments and consumers respond to the threat of climate change and act to actively reduce carbon emissions.

Electricity supply from renewable sources currently provides 15% of the Australian electricity market (Department of Industry and Science, 2015), this is expected to grow to 23.5% by 2020 under the Australian Government's Renewable Energy Target scheme.

8.5 Project Alternatives

8.5.1 Alternative land use

The current proposal has been developed through a thorough concept development process aimed at maximising potential benefits while minimising environmental impacts. Examples of this approach include:

- Defining the Development Footprint in order to minimise impacts on biodiversity, native vegetation and the need for clearing; and
- Identifying environmental constraints associated with the Development Footprint and developing mitigation strategies to avoid impacts to:
    - Riparian areas;
    - Aboriginal cultural heritage; and
    - Adjoining landholders.

Alternative land uses would potentially forego this environmentally responsible approach to project development and impact minimisation.

8.5.2 Development of an alternative site

The site selection process and footprint optimisation process has been fully documented and the outcomes of the environmental assessment indicate the suitability of the Site for the Proposed Development.

Developing an alternative site would have similar or greater environmental impacts than the current proposal and would forgo connection to the existing capacity within the local electricity network.

8.5.3 Do Nothing

The “do nothing” option would negate all potential environmental impacts associated with the Proposed Development, but would forgo all environmental benefits associated with the project, such as:

- Access to renewable energy sources;
- Progress towards Renewable Energy Targets and national and international carbon reduction commitments;
- Economic and social benefits to the community; and
- Biodiversity offsets protected in perpetuity.

9 Conclusion

The proposed utility-scale photovoltaic solar farm at Metz, is located approximately 18 km east of Armidale, NSW. The Proposed Development would have an electricity generation capacity of approximately 100 Megawatts, and would produce enough energy to power the equivalent of 40,000 average NSW households each year.

The Proposed Development is recognised as State Significant Development and is subject to assessment under Division 4.1 of the EP&A Act. This EIS has examined and taken into account all matters affecting or likely to impact the environment by reason of the Proposed Development.

Information about the Proposed Development has been extensively shared with local communities through a variety of consultation approaches including Information Sessions in Hillgrove and Armidale. Issues raised during the community consultation process have been addressed in this EIS and through the evolution of the design. The Proposed Development has received positive feedback from the general community with a limited number of concerns being raised. Where concerns were raised, relating to visual amenity along Waterfall Way, and certainty of local jobs being created, these have been addressed within this EIS.

Potential environmental impacts associated with the Proposed Development have been first avoided, and then reduced during the concept development process. In the absence of mitigation the Proposed Development would result in some impacts on biodiversity via vegetation clearing, soil and water via erosion, noise, visual amenity, dust and traffic via increased vehicle movements. These impacts have been mitigated by the following measures:

- Soil and water impacts – soil and sedimentation impacts would be managed under an erosion and sedimentation plan to be incorporated in the CEMP, OEMP and DMP;
- Biodiversity impacts – Development Footprint design has avoided EEC, and native vegetation that is cleared would require offsetting under the NSW Biodiversity Banking and Offsets Scheme;
- Visual Impact – onsite screening will minimise the viewshed and overtime the visual impact will be reduced to low;
- Noise impacts – adverse noise during construction will be managed under a Construction Noise and Vibration Management Plan, and no exceedances of noise levels are predicted during the operation phase;
- Dust impacts – impacts to nearby residents will be managed under an Air Quality Management Plan; and
- Traffic impacts – Increased traffic will be managed via upgrades to Bayley Park Road and, with appropriate signage during construction, Waterfall Way has adequate capacity for the temporary increase in traffic volumes.

Mitigation measures as detailed in this EIS would ameliorate or minimise these expected impacts to acceptable levels. The Proposed Development would also provide a number of employment opportunities and benefits to the local economy, while reducing carbon emissions and providing progress towards national and international environmental commitments.

On the basis of the information provided in this EIS, it is concluded that the proposal presents relatively minor and manageable environmental impacts, which can be effectively mitigated using best practice strategies and methodologies. Potential benefits associated with the Proposed Development are a reduction in greenhouse gas emissions, reduced reliance on non-renewable energy sources and positive outcomes for the local community. On this basis the Proposed Development is strongly justified.

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Appendices