ENVIRONMENTAL IMPACT STATEMENT

Tilbuster Solar Farm

October 2020

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W. www.nghconsulting.com.au

E. ngh@nghconsulting.com.au

BEGA - ACT & SOUTH EAST NSW
Suite 11, 89-91 Auckland Street (PO Box 470) Bega NSW 2550 **T.** (02) 6492 8333

BRISBANE
Suite 4, Level 5, 87 Wickham Terrace
Spring Hill QLD 4000 **T.** (07) 3129 7633

CANBERRA - NSW SE & ACT
8/27 Yallourn Street (PO Box 62)
Fyshwick ACT 2609 **T.** (02) 6280 5053

GOLD COAST
PO Box 466
Tugun QLD 4224 **T.** (07) 3129 7633

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Surry Hills NSW 2010 **T.** (02) 8202 8333

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TABLE OF CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AC	alternating current
ACHA	Aboriginal Cultural Heritage Assessment
ACHCRP	Aboriginal cultural heritage consultation requirements for proponents
AEMO	Australian Energy Market Operator
AEMC	Australian Energy Market Commission
AEP	Annual Exceedance Probability
AER	Australian Energy Regulator
AS	Artefact scatter
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARI	Average Recurrent Interval
APZ	Asset Protection Zone
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASC	Australian Soil Classification
ASL	Above sea level

ASRIS	Australian Soil Resource Information System
AV	Articulated Vehicle
BAL	Basic Left Turn
BAM	Biodiversity Assessment Methodology
BAR	Basic Right Turn
BC Act	*Biodiversity Conservation Act 2016*
BCD	Biodiversity Conservation Division (formally within Office of Environment and Heritage (OEH))
BDAR	Biodiversity Development Assessment Report
BFMC	Bush Fire Management Committee
BOM	(Australian) Bureau of Meteorology
BOS	Balance of System
BSAL	Biophysical strategic agricultural land
CCS	Community Consultation Strategy
CCTV	Closed-circuit television
CEC	Clean Energy Council
CEEC	Critically Endangered Ecological Community
CEMP	Construction environmental management plan
CER	Clean Energy Regulator
CHMP	Cultural Heritage Management Plan
CSG	coal seam gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CT	Cultural Tree
DA	Development Application
dB(A)	Decibels, a measure of A-weighted *(c.f.)* sound levels.
DC	direct current
DECC	Department of Climate Change (now DPIE)
DECCW	Department of Climate Change and Water (now DPIE)
DEM	Digital Elevation Model

DEMP	Decommissioning Environmental Management Plan
DP	deposited plan
DPIE	Department of Planning, Industry and Environment (formally Department of Planning and Environment (DPE))
DPI	Department of Primary Industries
DAWE	(Commonwealth) Department of Agriculture, Water and the Environment (Formally Department of Energy and Environment (DoEE))
EEC	Endangered Ecological Community
EES	(NSW) Environment Energy and Science
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electric and magnetic fields
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPA	(NSW) Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPC	Engineering Procurement and Construction
EPI	environmental planning instruments
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
ERP	Emergency Response Plan
ESD	Ecologically sustainable development
FAA	(U.S) Federal Aviation Administration
FM Act	*Fisheries Management Act 1994*
FPL	Flood Planning Level
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gas
GWh	Gigawatt hours

ha	hectares
HBT	Hollow Bearing Tree
HRV	Heavy Rigid Vehicle
HV	High Voltage
Hz	Hertz
IBRA	International Bioregions of Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IF	Isolated find
IPC	Independent Planning Commission (formerly Planning Assessment Commission; PAC)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
kl	kilolitres
km	kilometres
kV	kilovolts
kW	kilowatts
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LCU	Land Category Unit
LEMC	local emergency management committee
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LMZ	Land Management Zone
LRET	Large-scale Renewable Energy Target
LSC	Land and Soil Capability
LUCRA	land use conflict risk assessment
m	metres
mm	millimetres

ML	Megalitres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRV	Medium Rigid Vehicle
MW	Megawatt
MWh	Megawatt hours
NEM	National Electricity Market
NML	Noise Management Level
NPfI	NSW Policy for Industry
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
O&M	Office and Maintenance
OEH	(NSW) Office of Environment and Heritage (now Environment, Energy and Science)
OEMP	Operation Environmental Management Plan
PBP	Planning for Bushfire Protection
PCT	Plant Community Type
PCU	Power Conversion Unit
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PV	Photovoltaic
RAPs	Registered Aboriginal Parties
RBL	Rating Background Level - the level of background noise
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
RET	Renewable Energy Target
REZ	Renewable Energy Zone
RFS	(NSW) Rural Fire Service
RNP	*Road Noise Policy*
Roads Act	(NSW) *Roads Act 1993*
SAII	Serious and Irreversible Impacts

SEARs	Secretary's Environmental Assessment Requirements
SEIFA	Socio Economic Indexes for Areas
SEPP	State Environmental Planning Policy (NSW)
SHI	State Heritage Inventory
SOE	State of the Environment
sp/spp	Species/multiple species
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State Significant Development
ST	Scarred Tree
SWMP	Soil and Water Management Plan
TEC	Threatened Environmental Communities
TfNSW	Transport for New South Wales (formally Roads and Maritime Services (RMS))
TIA	Traffic Impact Assessment
TMP	Traffic Management Plan
UNE	University of New England
μT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
WAD	Works Authorisation Deed
WAL	Water Allocation License
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WHO	World Health Organisation
WMP	Waste Management Plan

TABLE OF DEFINITIONS

Tilbuster 150 MW AC Photovoltaic	**The construction, operation and decommissioning of an approximately 150 MW AC (approximately 176 MW DC) solar farm generally comprising a solar array,**

Plant (solar farm)	**access roads, underground and above ground cables, on-site substation and associated operational facilities, as set out in this EIS.**
Proposal	The Tilbuster approximately 150 MW AC solar farm.
Proponent	Enerparc Australia Pty Ltd.
Landowner(s)	Enerparc is leasing the Proposal Site from the landowner.
Proposal Site (referred to as Development Site within BDAR)	The Deposited Plan Lots that are involved in the Proposal comprise part of the following lots: Lot 1 DP 225170, Lot 1 DP 585523 and Lot 3 DP 800611. In addition to freehold land, the Proposal Site incorporates several Crown roads that would be formalised and used as site access.
Development Footprint	The land that would be used for the construction and operation of the Proposal , being the land set out in the map provided herein this EIS, comprising parts of the following lots: Lot 1 DP 225170, Lot 1 DP 585523 and Lot 3 DP 800611. This comprises the land required to construct the substation, the solar array, the proposed internal access tracks, and the connection to the existing 330 kV transmission line. The Biodiversity Assessment, comprises of an in-depth field survey of the Proposal Site.
Contractor	Responsible for the construction of the solar farm and would implement the requirements of the development consent, EIS, CEMP and associated management plans.
Operator	Responsible for the operation and management of the solar farm and would implement the requirements of the development consent, EIS and OEMP and associated management plans.
Sub-contractor	Construction and operation subcontractors are contractually bound to implement the development consent, EIS, CEMP, OEMP, and associated management plans provided by the Contractor and/or Operator.
Intersection upgrade at New England Highway	Based on swept path analysis for AV design vehicles, the intersection of New England Highway and the unnamed site access road would require shoulder widening on the western and eastern sides of New England Highway to facilitate right and left turn movements to and from the Proposal . The work would occur within the road corridor.
Substation	A new substation would be constructed to accommodate the 330 kV transmission line. The substation would be built on Lot 1 of DP 585523, as identified in Figure 1-4.

Certification

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*.

EIS prepared by: NGH, Suite 11 89-91 Auckland Street, Bega NSW 2550.

Applicant: Enerparc Australia Pty Ltd

Proposal :

The Tilbuster Solar Farm Proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce 150 megawatts (MW) of electricity. Associated infrastructure would include a substation, energy storage, access tracks and operations and maintenance buildings.

Land to be developed:

The Tilbuster Solar Farm Proposal would be located on approximately 310 hectares comprising of Lot 3 DP 800611, Lot 1 DP 585523 and Lot 1 DP 225170 and Crown land roads within the Proposal Site.

Certification

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

Name:	Louiza Romane
Qualification	B.Sc. (Honours)
Signature:	
Date:	21/09/2020

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental and planning issues associated with the construction, operation and decommissioning of the approximately 150 Megawatt Alternating Current (MW AC) Tilbuster Solar Farm. NGH has prepared the EIS on behalf of the proponent, Enerparc Australia Pty Ltd.

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

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and in consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and has resulted in a Proposal that responds appropriately to the sites constraints.

A Preliminary Environmental Assessment (PEA) was prepared in the early planning stages to determine environmental constraints associated with the site. The constraints were used to assist with designing the solar farm layout and planning the detailed methodologies for this EIS. Detailed investigations continued to inform the development throughout the assessment process. With reference to the site's key constraints, the Proposal assessed in this EIS has:

Biodiversity	• Avoided key areas of habitat connectivity and larger, more intact areas of wooded vegetation. • Located ancillary facilities in areas with no or poor condition native vegetation. • Committed to management measures to manage the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site. • Committed to offset impacts that cannot be avoided, in accordance with the Biodiversity Conservation and Environment Protection and Biodiversity Conservation Acts.
Heritage	• Three 'no impact zones' have been established in order to avoid impact on 14 isolated finds, four artefact scatters, two cultural trees and three scarred trees.
Watercourses	• Buffered waterways in accordance with their classification and the "Guidelines for Riparian Corridors on Waterfront Land", for 2nd order and above streams, to minimise impacts on hydrology and water quality.

PROPOSAL OBJECTIVES, NEEDS AND BENEFITS

The Tilbuster Solar Farm has been designed with the following objectives:

- Developing a utility scale solar electricity generation site with the capability for on-site energy storage to support the high voltage transmission network
- To develop a profitable solar farm with minimal environmental and social impact on the community
- Work collaboratively with key stakeholders to ensure all relevant requirements are considered in the location, design, construction and operation of the facility.
- Provide local and regional employment opportunities and other social benefits during the construction and operation of the facility.
- To obtain a social license to operate by acting as a responsible member of the local community.

The renewable energy generated by the Tilbuster Solar Farm also supports efforts to mitigate the effect of climate change by:

- Assisting the NSW and Commonwealth Governments to meet Australia's renewable energy targets
- Providing a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions
- Generation of enough clean, renewable energy for about 48,000 average NSW homes
- Displacement of approximately 250,000 metric tonnes of carbon dioxide, currently generated by non-renewable sources.

PROPOSAL DESCRIPTION

The proposed Tilbuster Solar Farm would be located 17 km north of Armidale, NSW and accessed via the New England Highway. The Proposal would connect to the existing TransGrid 330kV transmission line connecting Dumaresq substation to the Armidale substation located south - west of the Proposal Site.

The Tilbuster Solar Farm Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar farm which would generate approximately 150MW (AC) to be supplied directly to the national electricity grid. Development of the solar farm would make use of existing electricity infrastructure and contribute to Australia's transition to a low emission energy generation economy. The Tilbuster Solar Farm Proposal Site is outlined in the table below.

Table 1-1 Lots within the Development Footprint of the proposed Tilbuster Solar Farm

Development footprint	Owner 1	Crown Land	Existing use	Ownership arrangements
All proposed solar farm infrastructure including solar arrays, connection infrastructure, internal roads and ancillary infrastructure.	Lot 3 DP800611 Lot 1 DP225170 Lot 1 DP585523	Paper roads	Agriculture	Enerparc would lease this land.

The Proposal Site is approximately 310 ha in area. Of this, approximately 178 ha would be developed for the solar farm and associated infrastructure. Two existing TransGrid transmission lines transect the site; a 132 kV eastern line and a 330 kV central line. The 330 kV transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during the construction and operational phases for light and heavy vehicles would be off New England Highway, east of the site. The proposed infrastructure map (Figure 1-4) illustrates the indicative layout, including a concept development footprint for the solar arrays, laydown, energy storage, substation and internal access track network.

The site layout as presented in this EIS assumes the maximum development impact and includes the following key infrastructure:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MWh or less, battery technology is yet to be determined and subject to change based on detailed design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary site access on New England Highway – up to 6.8km in length
- Perimeter security fencing and tracks
- Security camera poles
- Construction of 11 watercourse crossings
- Native vegetative screening, as required.

In total, the construction phase of the Proposal is expected to take 12 months and the facility would be expected to operate for around 30 years, before either decommissioning or recommissioning the facility under the approval. The project would generate around 125 construction jobs during the peak construction phase. Once the project is operational, up to 5 equivalent full time staff would be employed. Upon decommissioning, all below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability, in consultation with the landowner.

The Proposal would require subdivision of Deposited Plan Lots within the Proposal Site for lease and purchase agreement purposes with the associated landowner.

COMMUNITY AND STAKEHOLDER CONSULTATION

Enerparc has undertaken comprehensive consultation with affected landowners, the local community and other relevant stakeholders in developing the proposal. A Community Consultation Strategy (CCS) is in place for the Tilbuster Solar Farm. Enerparc CCS considers stakeholders' views and provides timely feedback on any matters raised.

Enerparc has informed and engaged with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners on the proposal.

The development of the Tilbuster Solar Farm was made known to the public early in its development with a fact sheet distributed to the residents within 4km of the Proposal Site and the development of a project website. While much of the consultation process focused on informing the community about issues relating to the proposal, activities to engage the community in two-way dialogue were also undertaken.

As well as one -on -one meetings, to date, Enerparc has provided a variety of opportunities for the community members to find out more about the Proposal. Key stakeholders included:

- Associated and adjacent non-associated landowners
- The broader community
- Small local businesses
- The University of New England
- TransGrid
- Armidale Regional Council

KEY ENVIRONMENTAL ISSUES

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

- Biodiversity
- Aboriginal heritage
- Agriculture and land use
- Hydrology and flooding
- Visual amenity and landscape character.

Biodiversity

A specialist Biodiversity Development Assessment Report (BDAR) was undertaken by NGH to provide an assessment of the biodiversity values associated with the Tilbuster Solar Farm Proposal site and determine appropriate avoid, minimisation and offsetting commitments. The BDAR addresses the requirements of the *Biodiversity Conservation Act 2016* (BC Act). The Biodiversity Assessment Methodology (BAM) is the required assessment methodology. Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM.

The majority of the development site has been cleared of native vegetation, and purposed for stock grazing, which is the dominant land use in the area. Around 241.3 ha of native vegetation occurs in the development site as cleared, under scrubbed and thinned treed areas comprised of the following Plan Community Types (PCTs):

- PCT 567 Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion
- PCT 575 Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion
- PCT 704 Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion

All areas of PCTs 567 and 704 are considered to constitute the BC Act listed community *White box Yellow box Blakely's red gum woodland*. Some areas are considered to constitute the federally listed counterpart *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*. PCT 575 does not constitute a state or federally listed community.

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

- 78 ha of PCT 567, generating 422 ecosystem credits

- 0.9 ha of PCT 575, generating 14 ecosystem credits
- 48.5 ha of PCT 704, generating 185 ecosystem credits

Regarding species credits, the proposal generates:

- 564 species credits for Bluegrass for the proposed removal of 120.1 ha of assumed habitat
- 185 species credits for Pale-headed Snake for the proposed removal of 12.6 ha of assumed habitat
- 185 species credits for Koala for the proposed removal of 12.6 ha of breeding habitat
- 228 species credits for Southern Myotis for the proposed removal of 57.2 ha of habitat

An additional assessment of impacts on entities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was completed. A referral to the Federal Department of Agriculture, Water and the Environment (DAWE) commenced in August 2020. On 1st September 2020, the proposed Tilbuster Solar Farm was determined to be a controlled action for impacts on MNES (Bluegrass, Koala, Greater Glider and Box – Gum Woodland) and supplementary SEARs were issued for the proposal and have been addressed in the BDAR.

Biodiversity impacts have been assessed at a worst-case scenario, based on detailed plans that have been revised and altered with a reduction in impacts to higher quality vegetation. As well as the offset obligation, management measures would be put in place to adequately address impacts associated with the proposal, both direct and indirect. These centre on confining the works footprint, protecting retained vegetation, protocols to manage the adverse impacts of weeds, light spill, noise, traffic and shading.

Aboriginal heritage

A specialist Aboriginal Cultural Heritage Assessment (ACHA) report was undertaken by NGH to provide an assessment of the Aboriginal cultural values associated with the Tilbuster Solar Farm Proposal and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded.

The Aboriginal heritage investigations included consultation, background research, a field survey and significance assessment. The consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* (NSW). The assessment was guided by the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010a).

The survey strategy was to cover as much ground surface as possible within the development footprint within the Proposal Site. The survey resulted in 49 isolated finds, 28 artefact scatters, six scarred trees and three cultural trees being identified and recorded. An assessment of the proposed development footprint identified that of the total number of sites, 45 are within the proposed impact zones of the array and site facilities, including 23 isolated finds, 18 artefact scatters and three scarred trees and one cultural tree.

The proposed construction methodology for the project would result in only small areas of disturbance. The construction of access and maintenance tracks may involve some grading but given the nature of the majority of the terrain, this is likely to be minimal. The installation of the solar arrays involves drilling or screwing the piles into the ground and no widespread ground disturbance work such as grading required to accomplish this. Localised areas of earth works (cut and fill, grading and compacting) may be required in areas where there is sudden, significant changes in ground slope. The major ground disturbance will be the trenching for cables and vehicle movement during construction

Three ‘no impact zones’ have been established in order to avoid impact on Tilbuster Solar Farm ST1, ST 2, and ST3, Tilbuster Solar Farm CT1 and CT3, Tilbuster Solar Farm IF8, IF9, IF12, IF13, IF18, IF21, IF22, IF30, IF31, IF33, IF39, IF51, IF52, IF53, Tilbuster Solar Farm AS13, part of AS16, AS18, AS19.

While the site integrity of the majority of artefact sites has been significantly compromised by historic land use, compounded by the drought conditions, the quantity of artefacts present within this landscape have significantly increased the recorded data for the Armidale region and provided further insight into use of raw materials and occupation patterns during the mid- to late Holocene.

Safeguards and Management measures would be put in place to adequately address both direct and indirect impacts associated with the proposal. These include protection and management of isolated finds, artefact scatters, scarred trees and cultural trees within the Proposal Site.

Agriculture and land use

The Proposal Site is zoned as RU1 Primary Production and the land surrounding is RU1 Primary Production (grazing) and E3 Environmental Management and E1 National Parks and Nature reserves. The Proposal Site occurs in a rural landscape with agriculture as the current dominant land use. The Proposal Site is predominantly mapped as Land and Soil Capability Class 4 (Moderate capability land) as well as Class 5 (moderate – low capability land), Class 6 (Low capability land) and a small area of Class 3 (high capability land).

The temporary loss of 178 ha of agricultural land within the Armidale Regional LGA represents a small fraction (0.005%) of the agricultural holdings within the New England and North West region of NSW and would result in a negligible decrease in the overall productivity of the region.

No land use conflicts are anticipated for existing adjacent agricultural land uses or future agricultural land uses on the Proposal Site or adjacent lands during construction. A land use conflict risk assessment (LUCRA) was carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). Land use conflicts identified included conflicts with agriculture, crown land, traffic flow and amenity during all phases of the proposal.

All conflicts identified during construction, operation and decommissioning are expected to be manageable with measures presented within this EIS. Ongoing consultation would be undertaken where required, with affected stakeholders including TransGrid, Crown Lands, adjacent landholders and representatives from nearby major projects.

Hydrology and flooding

A Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd to assess the impact of the proposed permanent infrastructure on hydrology and flooding.

The Proposal Site is located in the Northern Tablelands Local Land Services region within the 50,000 km^2 Northern Rivers Catchment of which the major rivers are the Tweed, Brunswick, Richmond, Clarence, Bellinger, Nambucca, Macleay and Hastings. The dominant surface water feature within the locality is the Macleay River, located approximately 42 km south east of the Proposal Site.

The Proposal Site is traversed by one named watercourse (Duval Creek) which is categorised as 5th order stream. There are approximately 18 unnamed 1st, 2nd and 3rd order streams that are tributaries of Duval Creek and Sams Gully (a tributary of Duval Creek located north of the Proposal Site) which also traverse the site. All watercourses are described as ephemeral and would only contain flowing water during and shortly after rainfall events.

There is not predicted to be a significant impact on flood behaviour within the floodplain as a result of the proposed solar farm, with flood levels, depths, velocities and hazards remaining relatively unchanged. Importantly the modelling undertaken specific to this proposal demonstrates that changes in peak flood levels are limited to within the Proposal Site and are therefore not anticipated to adversely affect adjoining properties.

The mitigation measures presented within this EIS are considered sufficient in managing any potential impacts posed by the solar farm on hydrology and flooding. Key strategies include the designing the project to avoid the 1% AEP flood level, construction of watercourse crossings in accordance with the Guidelines for Watercourse Crossings on Waterfront Land and construction of access roads as close to natural ground levels as possible within the floodplain.

Visual amenity and landscape character

Visual impact assessments are used to identify and determine the value, significance and sensitivity of a landscape to change. NGH completed a Visual Impact Assessment (VIA) of the proposal in the following stages:

1. Background investigations, including Zone of Visual Influence (ZVI) modelling, identification of Landscape Character Units (LCU's) and identification of key viewpoints.
2. Field survey including reconnaissance, ground truthing and photography of key viewpoints.
3. Community consultation including understanding community values and documenting community perception.
4. Impact assessment of the potential visual impact during construction and operation of the proposal.
5. Development of a visual impact mitigation strategy, in consultation with near neighbours where a view would be visible from their residence.

Seven representative viewpoints were assessed, taken from publicly accessible roads surrounding the site to represent residents of Black Mountain, and the New England Highway in addition to directly adjacent neighbours. The viewpoints which have been included represent the areas from where the development would appear most prominent, either based on the degree of exposure or the number of people likely to be affected. The viewpoints were evaluated based on their land use, effect of the development on the viewpoint and overall visual impact.

Overall, the Proposal would result in low impacts on the existing landscape and scenic values. The proposed solar farm would be visible from one viewpoint resulting in a low unmitigated impact (R2). Some vegetation screening exists in the form of boundary plantings, which provides some screening of the Proposal Site at the affected residence. The Proposal would not be visible to residences located along the New England Highway or Black Mountain.

Based on the consultation with the specific landowner to date, and the findings of the visual impact assessment, visual screening and the development of a draft Landscaping Plan are not considered to be required.

Cumulative impacts

Cumulative impacts relate to the combined effect of impacts from several activities on a particular value or receiver. They may occur concurrently or sequentially. Considering the Tilbuster Solar Farm proposal, the relevant cumulative impacts are those associated with other known or foreseeable developments occurring in proximity to the Proposal.

Proposed developments within the locality or region which may contribute to cumulative impacts of the Proposal include:

- New England Solar Farm, proposed by UPC Renewables would be located approximately 26 km south of the Proposal Site. Development Consent has been granted and construction is anticipated to commence in Q3 2020.
- Oxley Solar Farm, proposed by Oxley Solar Development would be located approximately 20 km south-south-east of the Proposal Site. The EIS and DA are currently being prepared.

- Salisbury Solar Farm, proposed by MirrusWind and Energy would be located approximately 41 km south of the Proposal Site. SEARS have been issued by DPIE. Construction of Salisbury West is anticipated to commence by Q2 2021. Construction of Salisbury East is anticipated to commence by Q2 2022.
- Tamworth Solar Farm, proposed by Oriens Energy, would be located 120km south-west of the proposal site. The proposal is currently being assessed by DPIE. Construction of the Tamworth Solar Farm is anticipated to commence in late 2020.

During construction and decommissioning, the greatest potential for cumulative impacts relate to biodiversity, land compatibility and socio-economic impacts. The cumulative impacts identified for the Proposal are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

Other environmental issues

Ten lower risk issues were investigated, primarily by desktop assessment:

- Noise and vibration
- Water use and water quality
- Historic heritage
- Social and economic impacts
- Traffic, transport and safety
- Bush fire
- Electric and magnetic fields
- Air quality and climate
- Resource and waste generation
- Hazardous materials and development

Management measures have been developed to ensure that impacts are minimised and justifiable.

ENVIRONMENTAL MANAGEMENT FRAMEWORK

As above, specific impact avoidance and minimisation measures have been incorporated into the design of the proposal and form commitments of this EIS. These measures are considered practical and achievable by the proponent. They are set out for each area of investigation in Sections 7 and 8 and summarised in Section 9.2 of this EIS.

All commitments and environmental safeguards would be managed through the implementation of an Environmental Management Strategy, consisting of a Construction Environmental Management Plan, an Operation Environmental Management Plan and a Decommissioning Environmental Management Plan. These plans (and supporting subplans) would be prepared sequentially and submitted to the Department of Planning, Industry and Environment (DPIE), prior to each stage of works. These mechanisms ensure that the commitments of the EIS are carried through to on ground activities to ensure effective onsite mitigation of impacts for all project stages.

CONCLUSION

The Tilbuster Solar Farm would result in numerous benefits, local and regional, and has been developed to ensure the benefits are spread into the longer term, reflecting community expectations specific to this proposal.

The environmental impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Mitigation strategies have been developed with the community and other relevant agencies stakeholders in many cases. On balance, the Proposal is considered appropriate to the site’s constraints and is therefore, justifiable and acceptable.

1. INTRODUCTION

1.1. PURPOSE OF THIS REPORT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental and planning issues associated with the construction, operation and decommissioning of the proposed 150 Megawatt Alternating Current (MW AC) Tilbuster Solar Farm. NGH has prepared the EIS on behalf of the proponent, Enerparc Australia Pty Ltd.

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

The objective of this EIS is to fulfil the requirements of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and Section 4.15 of the EP&A Act. The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), provided by DPIE on 12 October 2018 (refer to Section 6.1.1).

1.2. PROPOSAL OVERVIEW

Enerparc proposes to construct, operate and decommission a photovoltaic (PV) solar farm with an estimated capacity of 152 MW. The Tilbuster Solar Farm (herein referred to as the Proposal) would be located on a rural property, approximately 17 km north of Armidale. The solar array and most infrastructure would be located on 310 ha of agricultural land (Proposal Site), owned by one landowner. Approximately 13 residences are located within 2 km of the Proposal Site, including three residences that are owned by the Proposal Site landowner.

1.2.1. Proposed locality

The Proposal Site is located on the western side of New England Highway, within the locality of Tilbuster (Figure 1-1). Tilbuster has a population of 62 people and a workforce of 29 people. It is comprised of large agricultural land holdings, including sparsely distributed dwellings. Agriculture and education are the primary employment industries in the locality (ABS, 2016).

The Proposal is situated in the Armidale Regional Council Local Government Area (LGA) in northern New South Wales at an altitude of > 1000 m. The region brings approximately 750,000 visitors annually to experience various events and natural attractions; areas of wilderness and wild rivers, granite boulder formations and waterfalls within world heritage listed national parks. The area holds significant Aboriginal heritage, including rock art sites.

Armidale is approximately 17 km to the south of the Proposal Site and is the closest regional centre. The primary employment industries in Armidale are education and healthcare. The surrounding land is primarily used for large lot agricultural enterprises (ABS, 2016).

Notable features within the region include:

- Duval Nature Reserve; located approximately 1.4 km south of the Proposal Site. Duval Nature Reserve covers about 243 ha and contains many rare species of orchids as well as providing habitat for a diverse range of native fauna. Recreation within the reserve is limited as access is across private lands. Although little is known about past Aboriginal association with the reserve, there is substantial evidence of Aboriginal occupation in proximity to the reserve.
- Booroolong Nature Reserve, which is about 4.4 km north west of the Proposal Site. This National Park covers approximately 865 ha and is significant for the refuge it provides for the endangered

Booroolong Frog and the endangered Bush Stone-curlew. Aboriginal sites have been identified within the reserve, including stone flakes and a core stone. There has been no study or research to determine the Aboriginal heritage values of the reserve. There are no visitor facilities in the reserve and no known use of the reserve by members of the public, due to access being restricted through private land.

- Newholme field laboratory, a research and extension facility of the University of New England (UNE). Since 1988 most of the Newholme land adjacent to Duval Reserve has been managed by the UNE for native vegetation regeneration, wildlife conservation and study purposes.

Other renewable energy projects are emerging in the region. A search for State Significant Development (SSD) on the Major Projects website (accessed 1 April 2020) of Armidale Regional Council LGA indicated the following major developments:

- Metz Solar Farm, proposed by Infinergy (and recently acquired by Clenergy) would be located approximately 20 km south-east of the Proposal Site. Development Consent has been granted and construction is anticipated to begin in Q2 2020.
- Oxley Solar Farm, proposed by Oxley Solar Development would be located approximately 20 km south-south-east of the Proposal Site. The EIS and DA are currently being prepared.
- New England Solar Farm, proposed by UPC Renewables would be located approximately 26 km south of the Proposal Site. Development Consent has been granted and construction is anticipated to commence in Q3 2020.
- Salisbury Solar Farm, proposed by MirrusWind and Energy would be located approximately 41 km south of the Proposal Site. SEARS have been issued by DPIE.
- Tamworth Solar Farm, proposed by Oriens Energy, would be located 120km south-west of the proposal site. The proposal is currently being assessed by DPIE. Construction of the Tamworth Solar Farm is anticipated to commence in late 2020.

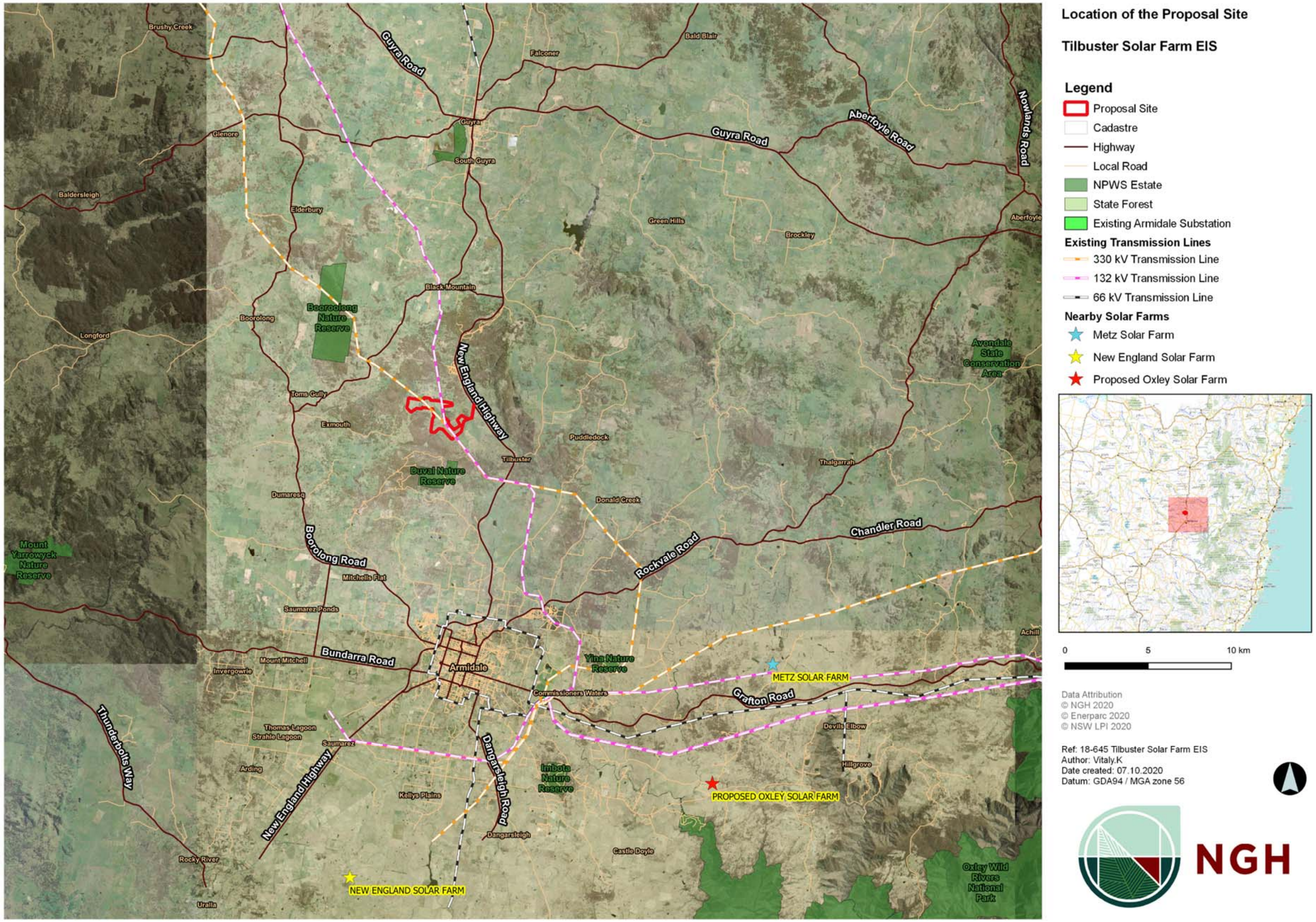

Figure 1-1 Location of the Proposal Site

1.2.2. The Proposal Site

The solar array and associated infrastructure would be located on 310 ha of agricultural land (Proposal Site), owned by one landowner and zoned RU1 Primary Production under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Regional LEP). Pending project approval, the Proposal Site is intended to be leased by Enerparc.

The Development Footprint, is the land that would be directly impacted for the construction and / or operation of the solar farm and, addition to the Proposal Site, includes land required to access the site, which includes several Crown (paper) roads. An existing TransGrid 330 kV transmission line transects the central portion of the Proposal Site, hence connection would be within the Proposal Site.

Table 1-1 Lots within the Development Footprint of the proposed Tilbuster Solar Farm

Development footprint	Owner 1	Crown Land	Existing use	Ownership arrangements
All proposed solar farm infrastructure including solar arrays, connection infrastructure, internal roads and ancillary infrastructure.	Lot 3 DP800611 Lot 1 DP225170 Lot 1 DP585523	N/A	Agriculture	Enerparc would lease or purchase this land.

Figure 1-2 shows the locations of the lots and DPs.

The topography of the Proposal Site is generally undulating with steep forested hills to the east and west of the site. The Proposal Site is accessed from a single access point on the New England Highway. Eleven dams occur within the Proposal Site; four within the south eastern portion, three within the central portion and four within the north western portion. Figure 1-3 shows the outline of the Development Footprint, which is responsive to site constraints including forested areas and water courses.

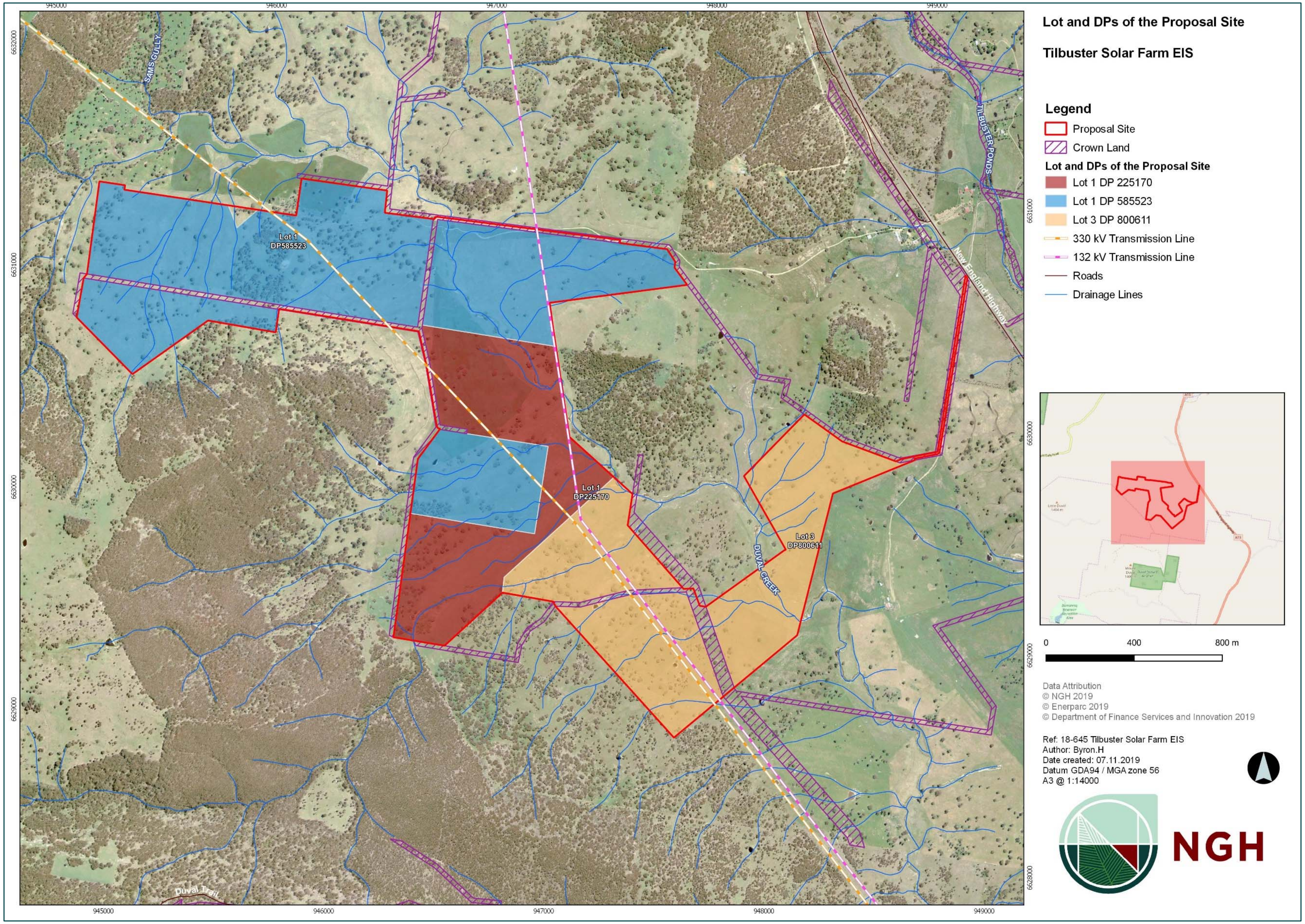

Figure 1-2 Lot and DPs of the Proposal Site

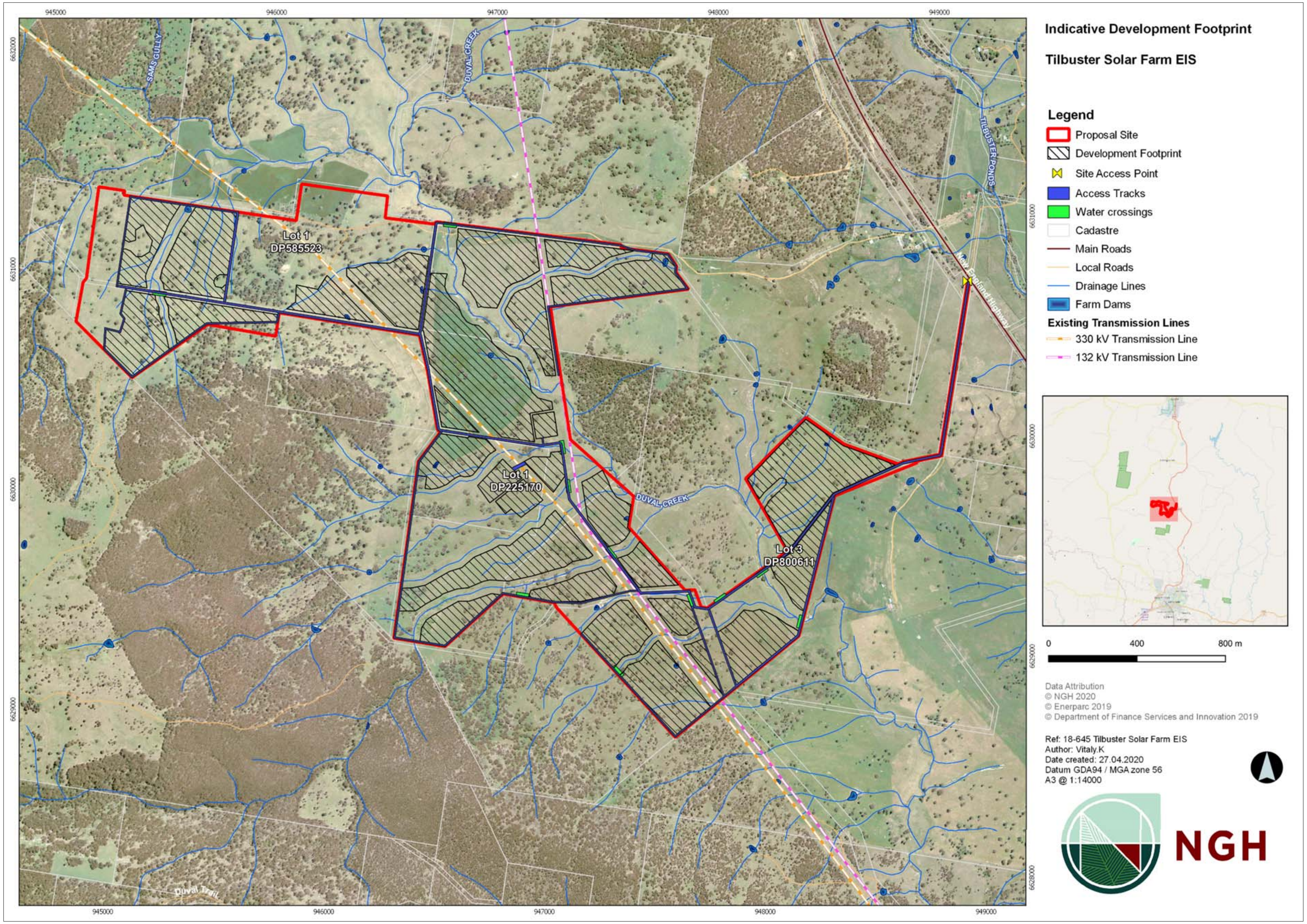

Figure 1-3 Indicative Development Footprint

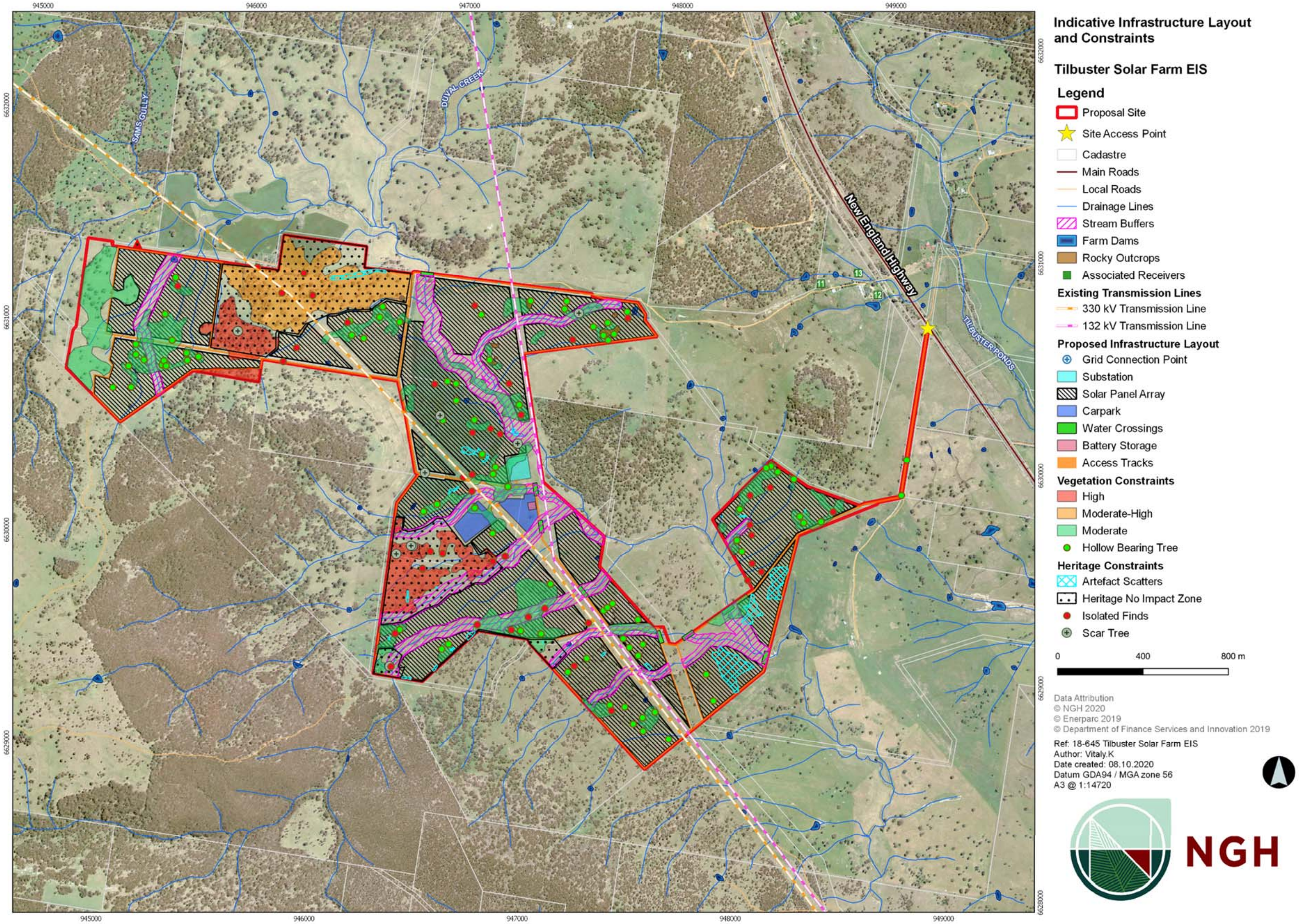

Figure 1-4 Indicative infrastructure layout in context of site constraints.

1.2.3. Key components of the proposal

The Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 150 MW (AC) to be supplied directly to the national electricity grid. The Proposal would provide enough clean, renewable energy for about 48,000 average NSW homes while displacing approximately 250,000 metric tons of carbon dioxide annually. The Proposal Site is approximately 310 ha of which approximately 178 ha would be developed for the solar farm and associated infrastructure (Development Footprint). Two existing TransGrid transmission lines transect the site, a 132 kV eastern line and a 330 kV central line. The 330 kV transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during construction and operation for light and heavy vehicles would be off New England Highway, east of the site. The proposed infrastructure map (Figure 1-4) illustrates the indicative layout, including a concept development footprint for the solar arrays, laydown, energy storage, substation and internal access track network.

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and results in a Proposal that responds appropriately to the site constraints for the Tilbuster Solar Farm.

Key infrastructure:

The final location of infrastructure components will depend upon a commercial tendering process during detailed design. A Request for Tender will be issued with the final project design, as such, flexibility is allowed for as part of the EIS proposal. The site layout as presented in this EIS assumes the maximum development impact and includes the following key infrastructure:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access roads and upgrades including primary site access on New England Highway – approximately 18.8km in length
- Perimeter security fencing and tracks
- Security camera poles
- Construction of 11 watercourse crossings.

In total, the construction phase of the Proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. Up to five fulltime equivalent operations and maintenance staff and service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability.

The Proposal would require subdivision of Deposited Plan Lots within the Proposal Site for lease and purchase agreement purposes with the associated landowner.

Further details on the Proposal design, infrastructure and works activities are provided in Section 4.

1.2.4. The proponent

Enerparc was founded in 2008 in Germany to design, build, and operate large PV systems in Europe. Since then, Enerparc has become one of the top global solar developers and has installed more than 2,200 MW of solar power in 20 countries. At the end of 2017, Enerparc Australia Pty Ltd was founded with an office in Sydney.

Enerparc's primary focus is on distributed utility-scale projects from 5 to 300 MW within part contracted offtake. They are actively exploring energy storage and other technological innovations to further lower the costs of solar energy while increasing its capacity factor and ability to provide ancillary grid services.

1.2.5. Capital investment

The Proposal would have an estimated capital investment of around $1 million (excl GST)

2. OBJECTIVES, PROJECT NEEDS AND BENEFITS

2.1. PROPOSAL OBJECTIVES

The Tilbuster Solar Farm has been designed with the following objectives:

- Developing a utility scale solar electricity generation site with the capability for on-site energy storage to support the high voltage transmission network
- To develop a profitable solar farm with minimal environmental and social impact on the community
- Work collaboratively with key stakeholders to ensure all relevant requirements are considered in the location, design, construction and operation of the facility.
- Provide local and regional employment opportunities and other social benefits during the construction and operation of the facility.
- To obtain a social license to operate by acting as a responsible member of the local community.

The renewable energy generated by the Tilbuster Solar Farm also supports efforts to mitigate the effect of climate change by:

- Assisting the NSW and Commonwealth Governments to meet Australia's renewable energy targets
- Providing a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions
- Generation of enough clean, renewable energy for about 48,000 average NSW homes
- Displacement of approximately 250,000 metric tonnes of carbon dioxide, currently generated by non-renewable sources.

2.2. PROJECT NEEDS AND BENEFITS

2.2.1. Climate change

The proposed Tilbuster Solar Farm supports Commonwealth and NSW climate change commitments including:

- United Nations Paris Climate Change Agreements.
- Renewable Energy Target (RET) Scheme.
- National Energy Guarantee.
- NSW Net Zero Plan Stage 1: 2020 - 2030
- NSW Climate change Policy Framework.
- NSW Renewable Energy Target.
- NSW 2021: A Plan to Make NSW Number One.
- New England North West Regional Plan.

Paris Agreement

In December 2015, the Australian Commonwealth Government ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, reinforcing its commitment to action on climate change. Australia has committed to the following greenhouse gas emission reduction targets:

- 5% below 2000 levels by 2020
- 26 to 28% below 2005 levels by 2030

- Net zero emissions in the second half of the century.

Electricity generation is the largest single emitter of greenhouse gas in Australia contributing 35% of total greenhouse emissions. It is to be expected that significant effort will be applied to transition to renewable energy sources of electricity generation.

Solar photovoltaic projects have the capacity to make a significant contribution towards these goals because of the relatively shorter times required to construct and commission.

Renewable Energy Target (RET) Scheme

The Renewable Energy Target Scheme (RET) was established under the *Renewable Energy (Electricity) Act 2000*. The RET scheme creates a market for renewable energy with the goal of ensuring that by 2020, around 23.5% of electricity will be generated from renewable sources. The RET scheme provides a mechanism to ensure that some portion of the electricity that is sold by electricity retailers is sourced from renewable sources.

The legislated objectives of the Commonwealth Renewable Energy Target (RET) Scheme are:

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

The RET scheme includes a Large-scale Renewable Energy Target (LRET) component which met its 33,000 GWh target in September 2019. Although the RET has been reached, it continues to provide a framework for investment in renewable energy.

The proposed Tilbuster Solar Farm would contribute directly to the RET scheme objectives by generating approximately 150 MW.

Renewable Energy Zones (REZ's)

The Australian Energy Market Operator (AEMO) has assessed 34 candidate REZ's across the National Energy Market (NEM) through consideration of a mix of resource, technical and other engineering considerations. The assessment identifies which REZ's are most optimal at present from a range of consideration, in particular the requirements for least-cost integration of REZ's into the transmission system.

AEMO has identified New England as the Immediately Optimal REZ Development Area, being supported by existing transmission strength and capacity. The Proposal Site for the Tilbuster Solar Farm is therefore well placed within this REZ.

NSW goals and policies

The NSW Climate Change Policy Framework (2016) sets out the log-term objectives of the NSW Government. The framework:

- Defines the NSW Government's role in reducing carbon emissions and adapting to the impacts of climate change.
- Sets policy directions to guide implementation of the framework.
- Commits NSW to achieving aspirational long-term objectives of net-zero emissions by 2050 and to help NSW become more resilient to a changing climate
- Sets out next steps for implementation.

The NSW Government has introduced a mandatory NSW Renewable Energy Target (NRET) relating to all electricity consumed in NSW. The scheme sets a target for the proportion of electricity sold by electricity retailers to be generated from renewable sources and imposes penalties where the retailer fails to meet these targets.

The Tilbuster Solar Farm Proposal is consistent with current goals and targets for renewable energy generation in NSW. These include Goal 22 of the NSW 2021: A plan to Make NSW Number One (NSW Government 2011):

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

The Tilbuster Solar Farm is consistent with the vision and goals of New England North West Regional Plan (DPIE, 2017). Achieving the vision of *'Nationally valued landscapes and strong, successful communities from the Great Dividing Range to the rich black soil plains'* would be supported by contributing to the following goals:

- A strong and dynamic regional economy:
  - New England North West as the renewable energy hub of NSW.
- A healthy environment with pristine waterways:
  - Adapt to natural hazards and climate change.

The New England North West is the second highest solar penetration region in NSW, presenting vast opportunities for the region to be a leader in renewable energy within the State (DPIE, 2017).

The Large-Scale Solar Energy Guideline was released by the NSW Government in December 2018. The guideline identifies the key planning and strategic considerations relevant to solar energy State Significant Development (SSD) in NSW. It aims to assist in the site selection and design of proposals, and it would be used by DPIE to assist in the assessment of relevant DAs. The Proposal has referenced this guideline throughout the impact assessment process.

The Net Zero Plan Stage 1: 2020 – 2030 (the Plan) sets out how the NSW Government will achieve its objective of net zero emissions by 2050 over the next decade. The Plan is financially supported by a Bilateral Memorandum of Understanding on Energy and Emissions Reduction Policy between the Commonwealth and NSW Governments (DPIE, 2020).

It is expected that by delivering the Plan, almost 2400 jobs will be supported over the next 10 years. Of the estimated $11.6 billion of investment expected over the next 10 years, around two-thirds will go to regional and rural NSW. In addition, delivery of the plan is expected to save household $40 per year on electricity bills.

Development of solar photovoltaic projects, such as the proposed Tilbuster Solar Farm, will assist in delivery of the Plan by providing emissions reduction technologies in the form of renewable energy generating infrastructure.

2.2.2. Electricity reliability and security benefits

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life (DIS, 2015). Nine coal-fired power stations have closed since 2011-2012, representing around 3,600 MW of installed capacity (AER, 2015 in Commonwealth of Australia, 2016). The reduction in energy supply from coal-fired power stations requires the development of reliable and sustainable energy supply.

The renewable energy sector in Australia contributes 14.3% of the country's overall electricity. Large scale solar farm projects such as the proposed Tilbuster Solar Farm support long-term and stable policies such as the Renewable Energy Target (RET) and have the potential to benefit average household electricity bills substantially and reduce power disruptions providing alternative generation sources for the energy sector.

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

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

The high average daily solar exposure of 19-20 MJ/m^2 (BOM, 2020) characterises an ideal location for a solar farm. In this way the solar farm would enhance the reliability, security and affordability of the NSW electricity supply.

2.2.3. Socio-economic benefits

Employment and local economic benefits

The project would generate around 125 construction jobs during the peak construction phase. Once the project is operational, up to 5 equivalent full time staff would be employed.

Employment opportunities would extend through the local supply chain to fuel supply, vehicle servicing, hotels/motels, cafes, hotels catering and cleaning companies, tradespeople, tool and equipment suppliers and many other businesses.

In summary, the project would provide significant local economic benefits including:

- Direct and indirect employment opportunities during the construction and operating phases of the project.
- Injection of expenditure in the local area.
- Development of a new land use thereby diversifying the local land use within the region.
- An alternative drought-proof income stream for host landowners.

These benefits would mostly be during construction. A smaller proportion would occur during operation mainly in relation to the maintenance and upgrade of infrastructure over the lifetime of the solar farms.

Electricity prices

The Australian Electricity Market Commission (AEMC) predicts residential electricity prices will fall 7.1% on average between 2019 and 2022, a reduction primarily driven by an 11.6% reduction in wholesale prices as 8,594 MW of new, mostly renewable energy, comes online (CEC, 2020). The commissioning of new renewable energy facilities will increase competition in wholesale energy marked and, as with any market, increased competition will tend to reduce prices. Photovoltaic solar farms operate with no fuel costs and can, with the correct policy framework, be used to reduce the overall wholesale prices of electricity. Both the Commonwealth and State Governments have established frameworks to support this objective.

3. SELECTION OF THE PREFERRED OPTION

3.1. THE 'DO NOTHING' OPTION

The 'do nothing' option must always be considered in any evaluation of options. It represents the status quo situation; avoiding all development impacts but similarly not realising a proposal's potential benefits.

The direct consequence of not proceeding with the Proposal would be to forgo the benefits outlined in Section 2.2 . This would include no contribution to:

- Climate change mitigation.
- Electricity reliability and security benefits.
- Direct or indirect socio-economic benefits.
- Providing additional generation in close proximity to high voltage networks.

The environmental impacts associated with the development and operation of the proposed solar farm would be avoided if the 'do nothing' option was selected. Such environmental impacts would include construction noise, traffic and dust and impacts to biodiversity, Aboriginal heritage. The land would remain as agricultural land with grazing and intermittent cropping. These impacts are discussed in Sections 7 and 8 of this EIS and are considered to be manageable. It is unlikely these impacts would result in medium to long term negative impacts to the environment and community.

The potential benefits and contributions of the proposed solar farm are considered to outweigh those of the 'do nothing' option. As such, the 'do nothing' option is not preferred.

3.2. ALTERNATIVE SITE LOCATIONS

The site selection for a large-scale project is an iterative process. Sites are initially identified using a Geographical Information System (GIS) model before being reviewed for suitability of grid connection and development constraints. Key considerations during the initial site investigations include:

- Availability of suitable land
- Access to grid connection
- Existing land use quality
- Site vegetation
- Locality of nearby sensitive receivers
- Flood risk management
- Location of renewable energy zones.

Enerparc reviewed a large number of sites on which to develop a solar farm before selecting the Tilbuster Solar Farm Proposal Site. Numerous sites surrounding the New England region were considered including sites in Wee Waa, Narrabri and Moree which were investigated as alternatives. These sites were assessed based on the objective of developing a profitable project with minimal development impacts before selection of the Tilbuster Solar Farm as the preferred site location.

3.3. ALTERNATIVE TECHNOLOGIES

The critical components of a solar farm include:

- Solar panels to generate DC electricity from sunlight
- Inverters to convert the DC electricity into AC electricity

In both cases, over recent years, the underlying technology has been developing at an increasingly rapid rate. Pending a commercial tendering process, Enerparc would likely utilise the latest equipment which best meets the requirements of the proposal.

3.4. SCALE OF THE PROPOSAL

The scale of the Proposal has been determined in response to the following factors:

- A desire to make a worthwhile contribution to the electricity market using renewable energy sources
- A need to ensure that the Proposal was commercially viable
- The capacity of the electricity grid to absorb the energy generated by the proposal
- The desire to make maximum use of the land within the Proposal Site
- The opinions expressed by landowners and the local community
- The constraints identified during the preparation of this EIS

The ability to connect to the high voltage network via TransGrid's 330 kV transmission line which traverses the site brings significant benefits as the network has the capacity to absorb the total output of the solar farm and deliver it anywhere in the network. Additionally, it would not be necessary to construct a new transmission line in order to make the connection.

On balance, it is considered appropriate to develop the solar farm with a capacity of approximately 150 MW which is expected to generate around 263,171 MWh of energy each year.

3.5. CONSIDERATION ADJACENT LANDS USES

The Proposal is located in a sparsely populated rural area where the dominant land use is broad scale agriculture. The solar farm is not likely to restrict or negatively impact any surrounding land uses.

The Proposal Site is located on rural land which has been under agricultural cultivation since the early 1900s and is predominately cleared of overstorey vegetation. The Proposal Site is currently grazed by sheep. Stock feed is occasionally cropped onsite, although the recent drought has impacted the capability of the land to produce crops.

The land immediately surrounding the Proposal Site includes grazed and cropped land and nature reserves. The grazing patterns and crops grown at the Proposal Site are characteristic of agriculture in the Armidale Regional Council LGA. In real terms, the Proposal would affect a very small proportion of the land used for agricultural production in the LGA. The reduction in production would be offset by increased productivity on other properties held by the landowner (refer section 7.3.1). The Proposal would not impose requirements for additional Council or State Government services or facilities.

Higher education is the main local industry for employment in the Armidale Regional LGA followed by beef cattle farming and healthcare. The University of New England (UNE) is approximately 12 km south of the Proposal Site.

It is noted that the Proposal involves minimal earthworks, and as such when the solar farm reaches end of life, it would be relatively easy to remediate the land to its existing condition so that grazing and occasional cropping can be resumed.

3.6. PREFERRED OPTION

While it would have been possible to construct and operate the solar farm at some of the alternative sites investigated and with different technology, Enerparc considers the Tilbuster Proposal Site to be the most suitable for the construction of a solar farm due to the following factors:

- Connection and capacity:
  - The site is located approximately 17 km from the Armidale 330 kV substation (Figure 1-1) and as such, a suitable location for connecting new energy generation.
  - An existing 330 kV transmission line traverses the site which means the that the connection to the high voltage network can be made without the need to construct any transmission lines.
  - Located within the New England Renewable Energy Zone.
- Solar exposure:
  - The site has high solar exposure measuring 19 MJ/m^2 (BOM, 2020)
  - There will be a meteorological station onsite throughout the operation of the plant
- Stakeholder interest:
  - Very few non-associated dwellings would be impacted by the development.
- Land suitability:
  - The site has already been cleared and heavily disturbed by cultivation and grazing.
  - The terrain of the development footprint is relatively flat.

The site has been evaluated in terms of the Large Scale Solar Energy Guideline for State Significant Development (SSD) 2018 which provides recommendations regarding selection of suitable Proposal Sites and areas of constraint that should be identified. This assessment is described in Table 3-1 below.

Table 3-1 Evaluation of preferable conditions associated with the Proposal Site

Preferable Site Condition	Observation
Optimal solar resources	Good solar irradiance observed.
Suitable land	Low relief land, close to major transport corridor and grid connection. Far from existing developments. Small area of proposal site (0.64 ha) mapped as Biophysical Strategic Agricultural Land (BSAL). The nearest residential receiver is 305 m from the site and does not have a view of the proposal. The closest receiver with a view to the solar farm is located 1880 m south east of the proposal site.
Capacity to rehabilitate	Proposal would involve minimal site disturbance and has potential to improve land by reducing grazing intensity.
Community support	The locality has a low density population and there are limited close neighbouring properties to the proposal.
Proximity to electrical network	Two existing TransGrid transmission lines transect the Proposal area, minimising additional connection impacts.
Connection capacity	Connection to the 330 kV transmission line traversing the site is an ideal point of connection to the high voltage network. Upgrade of the local network via

Preferable Site Condition	Observation
	Queensland NSW Interconnector (QNI) Minor by TransGrid, improves site selection value.

Considering all of the factors involved, the Proposal described in Section 4 is the preferred option.

The preferred option is commercially viable and feasible in terms of technological requirements. The Proposal would have a low environmental impact and take advantage of the land and solar exposure represented by the Proposal Site.

3.7. STRATEGIC JUSTIFICATION

The growing recognition for the need to mitigate the adverse environmental effects associated with traditional methods of energy generation has supported the development of clean and sustainable energy projects globally.

The proposed Tilbuster Solar Farm would add to secure, affordable and clean energy generation for the state of NSW whilst also contributing to the national Renewable Energy Target (RET) of 33,000 gigawatt hours by 2020 and the NSW Net Zero Plan Stage 1: 2020 – 2030. The New England region is considered an excellent province for solar energy generation due to its solar irradiance capabilities. Furthermore, the Australian Renewable Energy Agency (ARENA) and NSW Government have recently appointed funding to TransGrid - the proprietors of the high voltage electricity transmission network in NSW - in order to explore the possibility of developing a Renewable Energy Hub in the New England region to optimise the transmission network for renewable energy sources.

To this end, TransGrid is progressing work associated with “QNI Minor” to expand the transfer capacity between New South Wales and Queensland (TransGrid, 2020).

Large-scale renewable energy benefits

In 2017, about 700 MW of renewable energy made up of 16 projects were constructed and began generating electricity (CEC, 2018). Total large-scale solar capacity reached 450 MW at the end of 2017 after four new large-scale projects were completed. The equivalent number of households powered annually through large-scale solar in Australia is 151,243, and through all renewable energy generation sources totals 8,297,986 households. The beginning of 2018 saw an additional 21 large-scale solar projects under construction, contributing to the 6,080 jobs created by renewable projects as a whole as of April 2018.

By the end of 2018, 14.5 GW of new renewable electricity generation was under construction or financially committed. Electricity generated by renewables increased to 21% of total power generation, and investment in large-scale clean energy projects doubled to over $20 billion, with 38 projects completed, in 2018. In the beginning of 2019, 87 large-scale renewable energy projects were under constructed or financially committed (CEC, 2019)

In 2019, there were 34 large – scale projects completed, increasing Australia’s large – scale renewable energy capacity by 2.2 GW and generating $4.3 billion in investment and more than 4000 new jobs (CEC, 2020). The large – scale solar sector saw 1416 MW of new capacity added in 2019 across 27 solar farms. As of March 2019, 14,841 MW of renewable energy projects were under construction or financially committed, provided 13,233 jobs and $24.5 billion of investment in Australia.

Renewable energy currently contributes to 24% of total electricity generation in Australia, an increase of 2.7 percentage points in 2018. 2.2% of which of total electricity generation was through large-scale solar farms, and represents the lowest-cost type of new energy generation that can be constructed (CEC, 2020).

The successful introduction of energy storage into renewable energy projects was highlight in 2017. The Hornsdale Wind Farm installed the world's largest lithium-ion battery which supplies energy back into the grid. This proved valuable during a large power disruption in January 2018 when the battery delivered 100 MW into the national electricity grid in 140 milliseconds (CEC, 2018). The effectiveness of solar power was also further realised in the February 2018 Queensland heatwave during which power generated by rooftop solar contributed between 400 MW to 585 MW each day to assist in meeting electricity needs across the state.

An analysis of electricity price increases between 2006 and 2016 was undertaken by the Australian National University (ANU). The ANU reported that those states with relatively low levels renewable energy experienced higher electricity prices (NSW, QLD and VIC). States with higher levels of renewable energy, in particular South Australia which generated almost half of its energy from renewables, had a far lower electricity price.

In their Annual Report 2018 – 2019 the Australian Electricity Market Commission noted that residential electricity prices for the next two years (AEMC, 2019) Demand is relatively flat and a pipeline of new renewables supply is taking pressure off prices. All states in the national electricity market - SA, VIC, TAS, NSW and south east Queensland - are expected to see lower prices ((AEMO, 2019)

The NSW governments long term goal to reach zero-net emissions by 2050 is supported by the Climate Change Fund Strategic Plan that aims to double renewable energy capacity in NSW to more 10,000 MW by 2021. Reaching this goal would contribute to higher levels of renewable energy and consequently lower electricity prices as experienced by households and businesses in SA.

4. THE PROPOSAL

4.1. PROPOSAL SUMMARY

The key features of the Proposal are summarised in Table 4-1 below. The component specifications are subject to change. Where required, upper limit quantities and power level estimates are provided to ensure the assessment and any subsequent approval maintains the flexibility required in the detailed design in the Engineering Procurement and Construction (EPC) stage.

Table 4-1 Summary of key features of the proposal

Proposal element	Description
Proposal	Tilbuster Solar Farm
Proponent	Enerparc Australia Pty Ltd
Capacity	Approximately 150 MW (AC)
Proposal Site area	Approximately 310 ha
Development footprint area	Approximately 178 ha
Site description	Proposal Site: Lot 3 DP 800611, Lot 1 DP 585523 and Lot 1 DP 225170 Tilbuster substation: Lot 1 DP 225170 All land zoned as RU1 Primary Production under *Armidale Dumaresq Local Environmental Plan 2012.* And unformed Crown roads.
Local Government	Armidale Regional Council
Subdivision	As the project life will exceed 25 years, multiple subdivisions are expected to be included as part of the project development, including: Subdivision of land for the location of assets which will become the property of TransGrid (substation) and Subdivision of land for the ongoing operation of residual agricultural areas and residential dwellings.
Solar array	Number of panels: 405,888 Area of panels: approximately 162.5 ha Row spacing: approximately 4.5 -5.5 m (with 5.5 m being preferred) The 2 m x 1 m solar panels would be arranged in single rows mounted on either fixed tilt or single axis trackers with a maximum height not exceeding 3 m above the natural ground level. The PV mounting structure would comprise steel posts driven approximately 2.5 m into the ground using a small pile driver.
Substation	Approximately 1 ha 330 kV outdoor substation Up to two 330/33 kV transformers Maximum height of 6m subject to final design
Energy storage	Located within the central portion of the site with the substation lot and occupying an area of approximately 0.13 ha. With an electricity storage capacity of up to 40 MWh and comprising of lithium ion batteries with inverters. The battery will consist of approximately 20 containers (each being approximately 40 foot in length).

Proposal element	Description
Site Access	The site access point is located at the intersection of New England Highway and an unnamed Crown road (Figure 1-4).
Access tracks	Internal access tracks: approximately 18.8 km of 6 m wide unsealed gravel; approximately 12 ha.
Operations and maintenance building x 1	One 40-foot container building approximately 3 m height (including foundation)
Security fencing, lighting and CCTV	Steel security fence 2 m high with. Security system with CCTV and local flood lighting.
Construction hours	Standard daytime construction hours would be 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays. Any construction outside of these standard construction hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g. to make work safe.
Construction timing	12 months commencing Q3 2021
Workforce	Construction – approximately 125 staff during peak construction (approximately 3 months). Operation – Up to 5 full time equivalent staff.
Operation period	Up to 30 years
Decommissioning	The site would be returned to its pre-works state. All above ground infrastructure would be removed to a depth of 500 mm. The site would be rehabilitated consistent with land use requirements. All infrastructure would be removed with the exception of the substation.
Capital investment	Estimated $152 million

4.2. PROPOSAL LAYOUT

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and results in a Proposal that responds appropriately to the site constraints for the Tilbuster Solar Farm.

To inform the development of the most appropriate proposal, a Preliminary Environmental Assessment (PEA) of the Proposal Site was undertaken in the early planning stages to determine environmental constraints associated with the site. The PEA was used to assist with designing the solar farm layout and planning the detailed methodologies for the EIS. Environmental constraints can be defined as factors which affect the 'developability' of a site and include physical, ecological, social and planning factors. A map of these constraints was prepared for the PEA (Environmental, NGH, 2018). Following the detailed field investigations, the mapping has been further refined and is presented in Figure 1-4. This process demonstrates how the Proposal has appropriately responded to the site's constraints. With reference to the site's key constraints, the Proposal assessed in this EIS has:

Biodiversity	• Avoided key areas of habitat connectivity and larger, more intact areas of wooded vegetation.

	• Located ancillary facilities in areas with no or poor condition native vegetation. • Committed to management measures to manage the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site. • Committed to offset impacts that cannot be avoided, in accordance with the Biodiversity Conservation and Environment Protection and Biodiversity Conservation Acts.
Heritage	• Three ‘no impact zones’ have been established in order to avoid impact on 14 isolated finds, four artefact scatters, two cultural trees and three scarred trees.
Watercourses	• Buffered waterways in accordance with their classification and the “Guidelines for Riparian Corridors on Waterfront Land”, for 2nd order and above streams, to minimise impacts on hydrology and water quality.

4.3. SUBDIVISION

The Proposal would require subdivision of the Proposal Site within the Armidale Regional LGA in order to:

- Consolidate land to be retained by the existing landowner and
- Subdivide land to provide for a new TransGrid substation.

4.3.1. Consolidation of lots

The following Table 4-2 summarises the proposed configuration. A proposed subdivision plan is provided in Figure 4-1.

Table 4-2 Proposed Subdivision of Lots

Lot/DP	Existing Lot size	Subdivision for Proposal	Residual Land
	Currently owned and used by the associated land-owner.	**Would contain the solar array and associated infrastructure**	**This land would be retained by the current landowners for the purpose of carrying out agricultural activities**
Lot 1 DP 585523	108 ha	152 ha	385 ha
Lot 1 DP 225170	537 ha	60 ha	48 ha
Lot 3 DP 800611	232 ha	87 ha	145 ha

Land retained by the landowner of Lot 1 DP 585523, Lot 1 DP 225170 and Lot 3 DP 800611 would be consolidated into one larger ‘Lot A’ of 578 ha. The balance of the land proposed for solar farm proposal site would be consolidated into one larger ‘Lot B’ of 299 ha.

The Armidale Dumaresq LEP (2012) allows for lands under Zone RU1 Primary Production, to be subdivided to create a lot of a size that is less than the minimum size of 200 ha, as long as no dwelling is present or erected on such lot.

Based on the land use precedent and the absence of any dwellings the remainder of this lot would comply with the Armidale Dumaresq LEP In accordance with section 4.38 of the EP&A Act, development consent may be granted to the subdivision as part of this SSD application despite the proposed lot size being prohibited under the Armidale Dumaresq LEP. This is addressed in further detail in Section 5 of this EIS.

Consolidation would reduce any potential fragmentation and alienation of land, allowing continued agricultural practices by the landowner during and after the operation of the solar farm. The proposed subdivision would not have an impact on surrounding land uses, would not be incompatible with a preferred land use and would facilitate the management of an approved land use on the Proposal Site. The proposed consolidation is detailed in Figure 4.2.

4.3.2. Subdivision for TransGrid assets

The proposal would require the subdivision of the proposed Lot B of a small 1 ha lot for the proposed substation. The remainder of the land comprising Lot B (292.92ha) would be retained by the Enerparc for the solar farm.

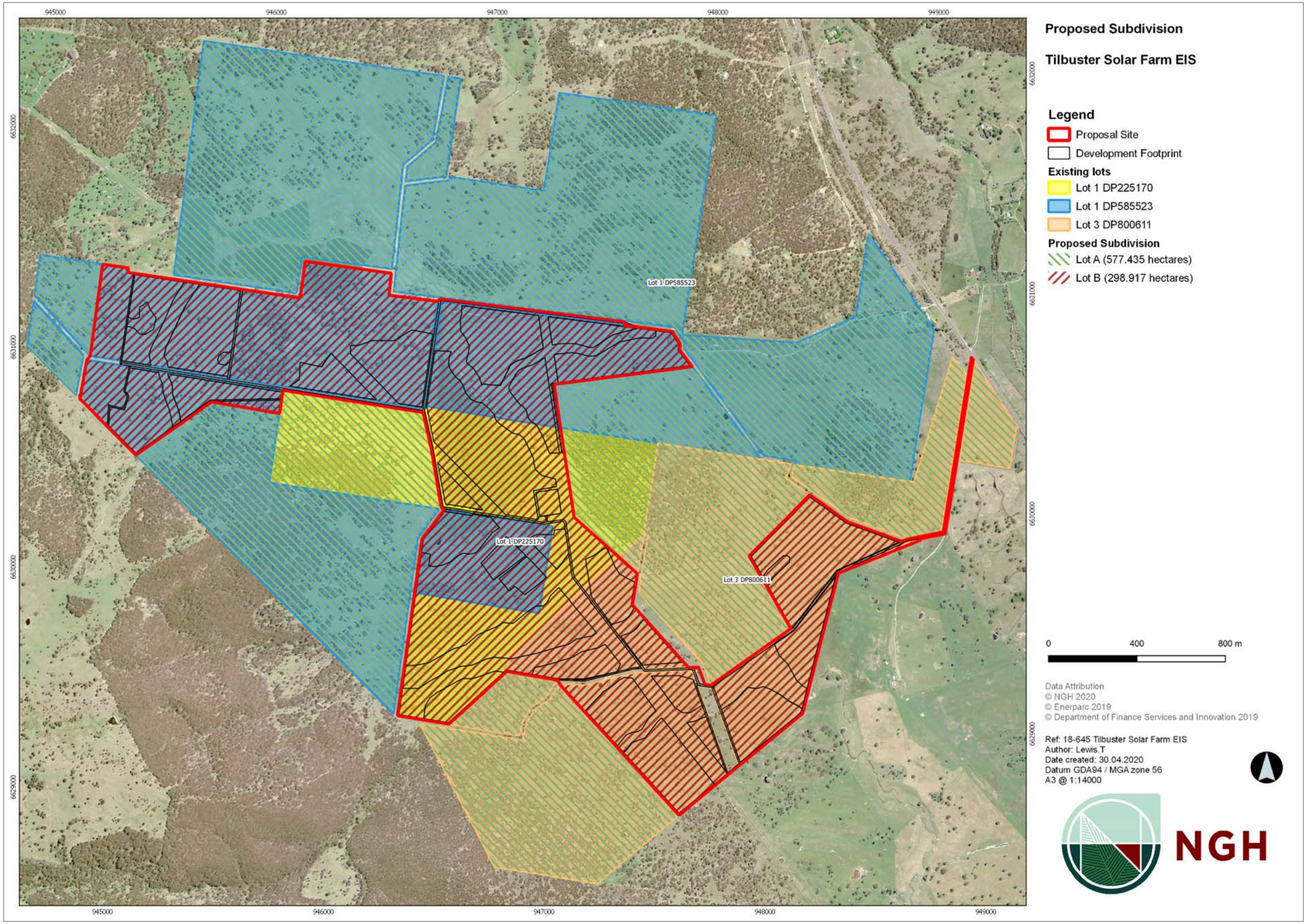

Figure 4-1 Proposed subdivision and consolidation of lots.

4.4. PROPOSED INFRASTRUCTURE

The Proposal involves the construction of ground-mounted solar arrays and associated infrastructure required for the operation of the solar farm. Infrastructure includes:

- Solar arrays
- Power Conversion Units (PCU's)
- Medium voltage collection systems
- Substation
- Transmission connection network
- Ancillary infrastructure
- Site access and internal access tracks
- Energy Storage facility
- Security and fencing

Each infrastructure component is described in detail below. The indicative infrastructure layout is shown in Figure 1-4.

4.4.1. Solar arrays

The solar arrays would consist of PV solar panels that would be grouped into arrays. Fixed and tracking systems are both considered feasible and would include the following:

1. Fixed tilted array: solar panels would be configured in a north facing orientation and at an angle of 20 degrees; or
2. East-west horizontal tracking systems: solar panels would be mounted on single axis trackers that would track sun from east-west. Approximately 6,036 tracker tables are to be installed – each consisting of approximately 84 modules for a total of 507,024 modules. The tracker tables are to be mounted on up to 302 tracker motors (20 tables per motor)

It is anticipated that up to 405,888 solar panels (fixed tilt) would be installed with the capacity to generate 150 MW (AC). The individual solar panel dimensions would measure approximately 2 m x 1 m, providing a surface area of 2 m^2 per solar panel.

The solar arrays would be 2 – 3 m high at most (reflecting the tallest tracking option) with a row spacing of approximately 4.5 m subject to detailed design. The solar arrays would be installed on steel piles that are driven or screwed into the ground at a depth of approximately 2 – 3 m.

Detailed design, availability and commercial considerations at the time of construction would inform the final quantity of solar panels and layout configuration.

Figure 4-1 Typical fixed tilted system (source: Willowbrook Solar Farm)

Figure 4-2 Typical single-axis tracking system (source: Solar Power World 2015)

4.4.2. Power Conversion Units (PCUs)

For large scale solar farms, a central inverter design (Power Conversion Unit (PCU)) is more efficient in comparison to installing smaller capacity string inverters. The selection of PCUs will be dependent on the tendering process which will be finalised during the detailed design phase of the solar farm. The PCUs are to be located throughout the solar array field and convert the power collected from direct current (DC) energy into grid-compatible alternating current (AC) energy.

The solar arrays are divided into blocks which have an approximate generation of 6 MW depending on size and the selection of modules. This would allow for a maximum of approximately 30 PCUs each consisting of:

- Two inverters
- Power transformers to step the voltage up for transmission to the substation
- Associated control equipment

Subject to final design, the PCUs may be housed in a container or skid with maximum dimensions measuring up to 12 m long, 3 m high and 3 m wide (Figure 4-2).

Figure 4-2 Typical containerised PCU.

4.4.3. Medium voltage collection systems

The on-site electrical collection systems would be medium voltage (typically 33 kV) and predominantly run underground. These would generally follow site access tracks from each power conversion unit to the onsite electrical substation. Cables would be buried to a depth of 600 mm – 1200 mm in accordance with appropriate standards.

Cables would be required to cross the main waterways onsite. The cable crossings would be designed in accordance with *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (Office of Water, 2010), to minimise erosion and protect the water way function.

In some instances, overhead cabling may be required to facilitate adverse geotechnical conditions, or other technical impairments.

4.4.4. Substation and transmission network connection

A new substation would be constructed within the development footprint to step up the solar farm electrical output voltage to match the transmission grid voltage (330 kV). While the design is yet to be finalised, it is expected that the substation would be an area occupying approximately 100 m by 100 m with a compound area of 1 ha. The area would contain transformers, associated switchgear and control and protection equipment, and may include a control building, switch room and drainage and oil containment system. The proposed substation is expected to be a three-breaker mesh laid out in a breaker and a half arrangement to provide good reliability. The substation would be surrounded by a security fence. A Gravel hardstand would be placed under and around the substation compound to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards.

Each inverter would feed power to the solar farm substation. The separate inverter inputs would be fed via control and monitoring equipment within the substation before all the inputs would be combined prior to the transformer. Two transformers may be deployed depending on final project technical and commercial requirements, and of the receiving network operator (TransGrid). The substation will be located in the centre of the site as near as possible to the TransGrid 330kV transmission line, which will provide the point of connection between the power exported from the site and the electricity grid.

The solar farm would connect from the on-site substation to the existing TransGrid 330 kV Armidale to Dumaresq transmission line.

4.4.5. Ancillary infrastructure

A site office and staff amenities building would be constructed in close proximity to the substation. These buildings would include:

- Control and protection equipment.
- Staff amenities including kitchen and bathroom.
- Workshop and storage facilities.
- Water tanks.
- Wastewater system.
- 33 kV switchgear.

A maintenance building would be established in close proximity to the site office and would provide storage for spare parts, maintenance equipment, and a workshop. A temporary laydown area for construction equipment and parking would be refined within the detailed design. This area would be rehabilitated once the development moves into the operational phase.

The location of all ancillary infrastructure is shown on Figure 1-4.

No existing residential dwellings are located within the Proposal Site. As such, no change in use or material change to these buildings is part of this proposal.

4.4.6. Site access and internal tracks

The Proposal Site would be accessed from the existing unnamed Crown road via the New England Highway, a State Arterial Road under the care and management of TfNSW. The unnamed Crown road is unsealed and currently provides access to a farm shed on the adjacent property. The intersection on the New England Highway is proposed to be widened and realigned in accordance with Austroads and TfNSW guidelines to accommodate simultaneous truck movements and provide adequate sightlines for vehicles entering and exiting the site. The site access would be used during construction and operation and would 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.

Up to 18.8 km of 6 m wide internal access tracks would be constructed to allow for the safe delivery, unloading and installation of key components such as the power conversion stations, PV panels, transformers and switching equipment. Approximately 3.7 km of the new access tracks would occupy paper roads with would require a licence from DPIE Crown Lands.

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

Proposed construction upgrades to these access ways are discussed in Section 8.6.

The internal access tracks would also require approximately nine waterway crossings within the site. The design of the waterway crossings would be in accordance with the following publications, to minimise erosion and protect the waterway function:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull, S. and Witheridge, G, 2003)
- *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI, 2003).
- *Guidelines for Watercourse Crossings on Waterfront Land* (DPI, 2012)

4.4.7. Energy storage facility

The Proposal provides for an energy storage facility which will be located within the development footprint and is likely to be lithium-ion technology. Storage requirements will be for 40MWh or less with the selection of technology and exact location to be determined during detailed design. The energy storage system would consist of approximately 20 containers each 40ft in length and would occupy an area of approximately 0.13 ha. The energy storage infrastructure would be installed during the operational phase of the project.

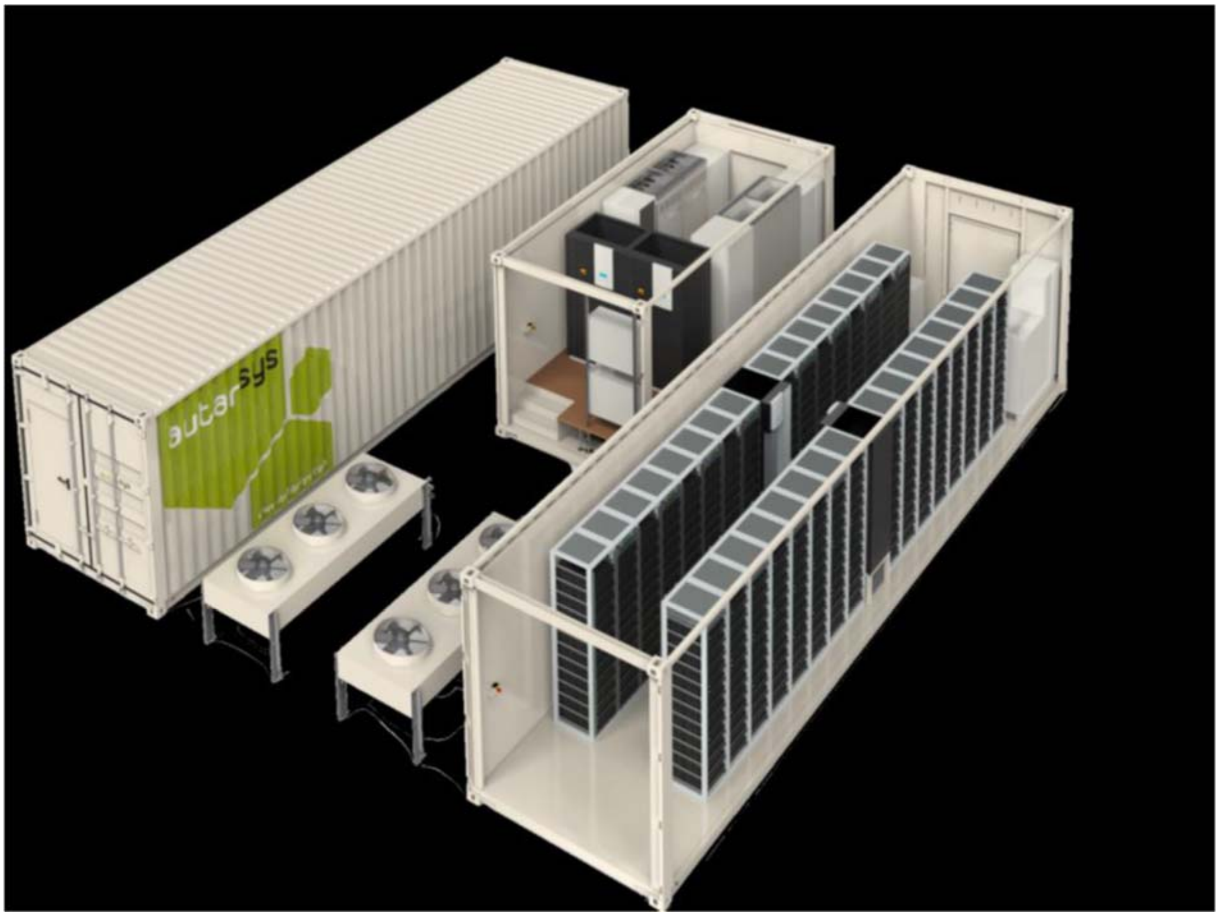

Figure 4-3 Typical energy storage unit (Source: Autarsys)

4.4.8. Security and fencing

A security fence approximately 2.4m high would be constructed around the perimeter of the site infrastructure areas. The final location of the security fence would be dependent on the detailed design of infrastructure. Inside this fence a minimum 10 m wide asset protection zone (APZ) will be maintained to provide for bush fire control and tanker access.

CCTV cameras and security lighting would be also provided around the onsite substation, maintenance building and offices.

4.5. PRECONSTRUCTION WORKS

The Proposal may include early works (activities that would commence prior to the construction phase) including:

- Installation of fencing and CCTV.
- Use of temporary site access points (e.g. existing farm accesses).
- Artefact salvage
- Geotechnical drilling and/or surveying.
- Establish ancillary facilities including the site compound and laydown areas.

- Slashing and or removal of areas of non-native vegetation.

4.5.1. Temporary construction facilities

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

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking for construction worker's transportation. When the construction work is completed, a small car park would be retained for maintenance staff and occasional visitors.
- Temporary staff amenities.

The staff amenities would be designed to cater for the peak number of construction staff expected to be onsite and would include:

- Sanitary modules with water flush systems connected to holding tanks. The tanks would be fitted with high level alarms and they would be pumped out regularly.
- Water tanks.
- Changing rooms.
- Lunchrooms.
- Administrative offices.
- Covered walkways.
- Emergency muster point.
- Generator – if required.
- Electrical, data and water reticulation.

A steel or concrete water storage tank would be installed near the entrance to the site for firefighting and other non-potable water uses. Rainwater tanks to be installed beside the site buildings for staff amenities. Suitable fire extinguishers would be maintained at site buildings.

4.6. CONSTRUCTION

4.6.1. Construction activities

The construction phase is expected to last approximately 12 months with a peak construction period of 3 to 4 months. The main construction activities would include:

- Construction of the internal track system, upgrade of existing access points/intersections, preliminary civil works and drainage.
- Installation of steel post and framing system for the solar panels.
- Installation of underground cabling (trenching) and installation of inverter.
- Installation of PV panels.
- Construction of control room, switch room and storage building.
- Construction of the substation, powerline, and grid connections works.
- Installation of PCUs and energy storage.
- Testing and commissioning.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.
- Landscaping.

Pending the finalisation of the construction schedule, it is expected some stages of construction would occur concurrently.

4.6.2. Site preparation and earthworks

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

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of approximately 2.0 – 3.0 m.
- Construction of internal access tracks and access points and associated drainage.
- Decommissioning of dams currently within the development footprint which would involve filling the dams with soil excavated from other parts of the site.
- Removal of existing fences.
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, substation and maintenance building.
- Excavating cable trenches up to 1,000 mm deep.

The ground disturbance from pile foundations would be less than approximately 0.2% (representing approximately 0.5 ha) of the total development footprint. Panels within the solar array area would sit above the ground and existing ground cover vegetation would be maintained underneath the panels. Approximately 56% of the groundcover on the site would be affected by shading to varying degrees depending on time of year and time of day. Monitoring ground cover to ensure species selection is appropriate forms part of the Proposal 's commitments.

Apart from the permanent development footprint (approximately 178 ha), any disturbed areas would be restored to vegetation (groundcover) after construction.

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

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

4.6.3. Materials and resources

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

Labour, machinery and equipment

It is anticipated that approximately 125 construction personnel would be required onsite during the peak construction period of approximately 4 months. Construction supervisors and the construction labour force, made up of labourers and technicians, would be hired locally where possible. The number of construction personnel is estimated based on a number of project assumptions including the size of the project and hours and days of work. Enerparc has recent experience in solar farm development, including the Trundle Solar Farm and has made assumptions based on their previous project to provide an estimated number of workers required for the proposal.

It is anticipated that most workers would be local, and those who were not would use existing accommodation within the local area such as Armidale, Uralla and Guyra.

The machinery and equipment required for the construction of the Proposal would include earthmoving machinery and equipment for site preparation, cable trenching and laying equipment, post-driving equipment, assisted material handling equipment (forklifts and cranes), machinery and equipment for connection infrastructure establishment, and water trucks for dust suppression. Typical quantities of such machinery and equipment for this Proposal are listed in the table below.

Table 4-3 Estimated machinery and equipment

Plant Description	Estimated Number of Items
Small pile driving rig	5
Crane	2
Drum roller	2
Padfoot roller	2
Wheeled loader	2
Dump truck	4
30t Excavator	3
Grader	3
Chain trencher	2
Water truck	3
Telehandler	2
Forklift	2

Materials

Proposed resource materials for construction are listed in the table below. These figures are estimated and would be confirmed during the detail design phase of the Proposal.

Table 4-4 Estimated material resources

Resource	Estimated Quantity
Gravel (access tracks)	122,400 m^3
Sand (bedding for cables)	5,000 m^3
Concrete (PCU, Substation and buildings)	500 m^3
Estimated no of solar panels	405,888

Water requirements

Non-potable water requirements are anticipated to be an upper limit of 200 kL/day and total up to 7 ML for the construction phase.

Potable water requirements are anticipated to be approximately 0.3 ML during the construction phase. Detailed water requirements would be determined by Engineer Procure Construct (EPC) contractors.

Non-potable water would likely be sourced from rainwater tanks and a local water holder and potable water would be sourced from a commercial potable water supplier. Non-potable water would ideally be sourced locally in Armidale and trucked onsite. Given the drought conditions, access to local water supplies including Dumaresq Dam, council standpipes and local water holders and will be subject to future availability. Details of the water source will hence depend on local supplies and subject to determination by EPC contractors. Upon preliminary consultation with Armidale council, it is anticipated that water will likely need to be sourced from private bores.

Water use and water quality is discussed in detail in Section 8.1.

4.6.4. Access and haulage route

Intersection upgrades

A single access point is proposed for site access. Austroads Guide to *Traffic Management Part 6: Intersections, Interchanges and Crossings* specifies the turning treatment required at intersections. Based on swept path analysis for 19 m B-double trucks that will access the site, the intersection of New England Highway / site access would require upgrading.

A Basic Right Turn (BAR) and Basic Left Turn (BAL) features are the proposed minimum requirement. Shoulder widening would be required on the western and eastern road alignment of the New England Highway site access intersection.

The final design would be determined in consultation with TfNSW and the local council during detailed design and completed in accordance with TfNSW requirements. A diagram of the intersection is illustrated in Figure 8-14, further discussions of the intersection upgrade is provided in Section 8.6. Appropriate sight line distances of greater than 285 m would be maintained at the intersection.

Haulage

Where possible, goods and services for the solar farm would be sourced locally. The bulk of the imported and manufactured components of the solar farm would be sourced overseas and arrive at port Botany in Sydney.

Materials would be transported by road from port via the Pacific Motorway, Hunter Expressway and New England Highway to the Proposal Site.

It is expected that the haulage route for heavy and over-dimensional vehicles, during construction would be from Armidale then north to the site via New England Highway. The larger transformers would likely be delivered by low loaders on up to four occasions. The proposed haulage route is an approved 19m B-double route on the RMS Restricted Access Vehicles Map.

Materials would generally be transported to the site on heavy vehicles up to B-double and would include, but not limited to the following:

- PV solar panels.
- Piles, mounting structures and frameworks.
- Electrical equipment and infrastructure including cabling, auxiliary electrical equipment and machinery, inverters, switchgear, and the onsite substation (and transformer).
- Construction and permanent buildings and associated infrastructure.
- Earthworks, grading and lifting machinery and equipment.

Specialist oversize equipment including the grid connection transformer and 200 Tonne cranes would require oversized vehicles to transport them to the Proposal Site. This equipment would have 'Oversize' transport management in place.

The road network is able to accommodate the traffic generated by the development during the construction and operational period. Further, the cumulative impact of the site traffic with nearby developments is expected to be minimal. A design, in accordance with the Traffic Impact Assessment undertaken by Amber (Appendix I), for the intersection of the site access with New England Highway, will ensure the access will operate in a safe manner and will be able to accommodate the maximum design vehicle expected to access the site.

A Construction Traffic Management Plan (CTMP) would be prepared to manage this aspect of the works.

Transport and access impacts are discussed in detail in Section 8.6.

Traffic movements

The proposed timeline for the Proposal indicates that approximately 30 employees would be required during the first month rising to 125 employees during the peak construction period while the solar panels are erected and commissioned concurrently. The delivery trucks would predominantly be Medium Rigid Vehicles (MRV) and would not be larger than typical trucks using the existing local roads in the area. However, the traffic study has considered heavy rigid Vehicles (HRV) for intersection, road widths and turning paths assessments.

During peak construction, up to 125 site personnel would be required to undertake the works. It is understood that 2 shuttle buses will be provided that can accommodate approximately 50 staff. The remaining 75 staff will access the site using private vehicles. Assuming a conservative vehicle occupancy rate of 1.35 for workers, the site is expected to generate 52 light/shuttle bus vehicle movements during each of the peak periods.

Approximately 18 trucks will access the site per day during peak construction periods. The delivery trucks will predominantly be Medium and Heavy Rigid Trucks (MRV/HRV), six of which would be water tankers. Articulated Vehicles (AV) will occasionally be used to transport larger plant such as the PV panels.

Therefore, it is anticipated that during peak construction the site could generate up to 36 heavy and 104 light vehicle movements per day. It is expected that up to four one-way movements of oversized vehicles would be required for transport of the transformer and 200 Tonne cranes.

Estimated total and maximum daily traffic movements during construction and peak construction are shown in Table 4-5, and detailed traffic volumes and requirements are shown in Table 8-33.

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

Table 4-5 Estimated traffic volumes and requirements for the Tilbuster Solar Farm

Type of vehicle	Estimated Vehicles over construction duration (12 months)	Estimated peak maximum daily number of trips (one way)
Light vehicle (car/4WD)	9,000	58
Shuttle bus	500	8
MRV/HRV	950 (including 254 water tankers)	22 (including 6 water tankers)
AV/B-double/Semi-trailer	884	14
Total	**11,884**	**102**

4.6.5. Construction work hours

Construction activities would be undertaken during standard daytime construction hours:

- Monday – Friday: 7am - 6pm
- Saturday: 8am – 1pm

There may, however, be a need to work outside these hours due to, for example:

- To avoid disrupting traffic when delivering bulky equipment
- To avoid taking outages of existing high voltage transmission lines during periods of high load
- To undertake emergency work to avoid serious injury or loss of property

Any construction outside of these standard construction hours, if required, would only be undertaken with prior approval from relevant authorities.

4.7. OPERATION

4.7.1. Operation activities

Activities undertaken during operation would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays as required.
- Routine visual inspections, general maintenance and cleaning operations of the substation.
- Vegetation management Vegetation management within the development footprint in accordance with the fire management and biodiversity management plans.
- Site security response (24 hr), if required.
- Site operational response (24 hr), if required.
- Pest plant and animal control, as required.

4.7.2. Water requirements

During operation, non-potable water would be required for cleaning panels, onsite toilet and showers, landscaping and animal care. Potable water would be required for the workers and rainwater would be collected onsite. In terms of quantities required, the operational water use volumes during operation would be minimal; the water required for staff amenities is estimated to be approximately 100 kL per annum. Panel cleaning may be required in dry conditions when cropping operations in the locality are generating dust. In cases of prolonged drought, water would be trucked to site as required.

4.7.3. Transport and access

The travel demand during the operation phase of the Proposal is anticipated to be significantly less than the construction phase. It is estimated that the daily peak travel demand during operation would be approximately 6 light vehicles movements a day.

4.7.4. Personnel and work hours

A total of five equivalent full time staff would be employed onsite when the solar farm is operational. Associated work would be undertaken during the standard working hours of:

- Monday – Friday: 7am - 6pm
- Saturday: 8am – 1pm

Work would only be undertaken outside of these hours in an emergency and would be kept to a minimum.

4.7.5. Lighting and CCTV

There would be no permanently lit night lighting installed within the array, but lighting would be included in each inverter station for maintenance purposes. There would also be maintenance lighting installed at the substation that would only be used in case of emergency, and continuous security lighting at the operation and maintenance building. All operational lighting would be designed to reduce disturbance to neighbouring properties and would be utilised only when there are staff on site or during emergency situations.

Security lighting (likely infra-red) and CCTV cameras would be installed on posts up to 3 m high adjacent to the security fencing and operation and maintenance buildings. These would only be activated when the automatic security system senses an unauthorised site entry.

4.7.6. Refurbishment and upgrade

The solar plant operator may replace or upgrade solar panels or other infrastructure within the existing development envelope during the projected 30 year life of the solar plant. It is anticipated that the batteries that would be used in energy storage system would have a life of 15 years, and would likely need to be replaced at least once during the life of the solar farm.

If any upgrade works during the life of the solar plant would extend beyond the proposed Development Footprint or alter the nature or scale of environmental impacts, the proponent would consult with DPIE regarding the need for further assessment or approval.

4.8. DECOMMISSIONING AND REHABILITATION

The Proposal is expected to operate for up to 30 years until which the solar farm would either be upgraded (pending additional approvals) or decommissioned. The decommissioning of the Tilbuster Solar Farm would include the removal of infrastructure and rehabilitation of the land to its pre-works state. Once rehabilitated, the land will be evaluated based on post-solar farmland use requirements. All above ground infrastructure is to be removed to a depth of approximately 500mm.

The key tasks of decommissioning would include:

- The removal of solar arrays including piling foundations. The materials will be properly sorted for recycling or reused if appropriate
- Cabling works installed would be removed and recycled where appropriate
- All site amenities and solar farm equipment would be removed including buildings, PCUs, energy storages, onsite substation and associated equipment.
- Perimeter fencing would be removed

4.9. INDICTIVE TIMELINE

An indicative timeline for the Proposal is outlined in Table 4-6. The commissioning of the solar plant would likely be phased. It is expected that the solar plant would be commissioned progressively in 1-3 phases before full commissioning at the end of the 12 month construction period.

Table 4-6 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	3rd Quarter 2021	12 months
Operation	1st Quarter 2022	30 years
Decommissioning	2052	9 months

4.10. CAPITAL INVESTMENT

The Tilbuster Solar Farm would have an estimated capital investment of $174 million. A quantity surveyor's report confirming the capital investment has been provided to DPIE.

5. PLANNING CONTEXT

This section sets out the legislative planning context for the Proposal. This includes:

- The permissibility of the Proposal under relevant Environmental Planning Instruments (EPIs), including relevant State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).
- The reason the Proposal is declared a State Significant Development (SSD).
- Evaluation of the Proposal against relevant NSW, local, State and Commonwealth legislation (Acts and Regulations).

This section also identifies any additional approvals which would apply to the Proposal.

5.1. PERMISSIBILITY

The Proposal is defined as electricity generating works and is permissible with consent under clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP). Consent may be granted under Part 4 of the EP&A Act.

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

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

5.2. ENVIRONMENTAL PLANNING INSTRUMENTS

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

5.2.1. State Environmental Planning Policies

State Environmental Planning Policy (State and Regional Development) 2011

The aims of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) are to identify development that is SSD, which are major projects that require approval from the Minister for Planning, Infrastructure and Environment or delegate (Independent Planning Commission, Secretary or other public authority).

Clause 20 of Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* defines SSD as including:

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

The Tilbuster Solar Farm would have an estimated capital investment cost greater than $30 million and is therefore considered SSD under Part 4 of the EP&A Act.

State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) was introduced to facilitate the effective delivery of infrastructure across the state by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW.

The Proposal is defined as electricity generating works and is permissible with consent under clause 34(7) of the ISEPP. Consent may be granted under Part 4 of the EP&A Act.

The proposed Tilbuster Solar Farm would be located within a rural zone (RU1 Primary Production), under the Armidale Dumaresq Regional LEP. This zone is a prescribed zone for the purpose of clause 34(7). The Proposal is therefore permissible with consent under the ISEPP.

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

The *Rural Lands SEPP 2008* has been repealed and replaced by the *Primary Production and Rural Development SEPP 2019*. The aims of this new Policy are as follows:

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

Specific to this proposal, it is anticipated that:

- 0.21 ha high value agricultural land (BSAL) would be impacted by the development footprint.
- The land capability of the site would be retained, with reference to base line soil testing and rehabilitation commitments post decommissioning.
- For the operational life of the solar farm, the resting / shading impacts of the solar farm may actually improve soil capability, in comparison to current agricultural activities, particularly in drought conditions.
- The site is sufficiently small that it does not represent a significant proportion of the local agricultural economy and would therefore not affect harvest logistics in the locality.
- The economic benefits of the Proposal will out weight the current agricultural activities, in terms of employment during operation and other economic stimulus, occurring mostly during construction.

The Proposal is considered compatible with the relevant aims of this policy.

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

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

"…development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

(a) to human health, life or property, or

(b) to the biophysical environment,

and includes a hazardous industry and a hazardous storage establishment"

'Potentially offensive industry' defined as:

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

SEPP 33 provides for systematic assessment of potentially hazardous and offensive development for the purpose of industry or storage. For development proposals classified as 'potentially hazardous industry' the policy requires a preliminary hazard analysis (PHA) to determine risks to people, property and the environment.

A checklist and a risk screening procedure developed by DPIE is used to help determine whether a development is considered potentially hazardous industry (DOP, 2011). Appendix 3 of the Applying SEPP 33 guidelines lists industries that may fall within SEPP 33; the lists do not include solar farms and energy storage facilities. The hazardous development status of the Proposal is assessed in Section 8.11. The development is not considered hazardous within the context of SEPP 33.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

This SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

Koalas are listed under the *Biodiversity Conservation Act 2016* as a vulnerable species. The SEPP applies to each local government area listed in Schedule 1. Armidale is listed in Schedule 1 of SEPP 44 and the Proposal Site has potential Koala habitat. Appendix E and Section 7.1 outlines the potential impact of the Proposal on Koala Habitat. A referral to the Commonwealth Department of Environment and Energy commenced on 4th August 2020, and a significant impact is anticipated. On 1st September 2020, the proposed Tilbuster Solar Farm was determined to be a controlled action for impacts on MNES (Bluegrass, Koala, Greater Glider and Box – Gum Woodland) and supplementary SEARs were issued for the proposal and have been addressed in the BDAR.

State Environmental Planning Policy No. 55 - Remediation of Land

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

Clause 7 of the SEPP requires that the remediation of land be considered by a consent authority in determining a development application.

A search of the NSW EPA contaminated land public record (EPA, 2019a) was undertaken for contaminated sites within the Armidale LGA on 23 September 2019. Five former sites and one current site were returned for the LGA none of which are in the vicinity of the Proposal Site. The online list of NSW contaminated sites notified to the EPA (EPA, 2019b) was also searched on 23 September 2019. There are several sites listed in Armidale and surrounding areas, but none are in the vicinity of the Proposal Site.

There may be a risk of contamination associated with agricultural activities (e.g. pesticides, petrochemicals, hydrocarbon contamination) or asbestos construction or insulation materials on the Proposal Site. However, there was no evidence of this during the site assessment. Contamination is addressed in detail in Section 7.3.

5.2.2. Local Environmental Plans

Armidale Dumaresq Local Environmental Plan 2012

The Proposal area is located within the Armidale Regional LGA. Environmental provisions of the Former LGA (Armidale Dumaresq) are still applied under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Dumaresq LEP).

(2) The particular aims of the plan are:

- *(a) to encourage the orderly management, development and conservation of resources by protecting, enhancing and conserving:*
  - *i. land of significance for agricultural production, and*
  - *ii. timber, minerals, soils, water and other natural resources, and*
  - *iii. areas of high scientific or recreational value, and*
  - *iv. native plants and animals, including threatened species, populations and ecological communities, and their habitats, and*
  - *v. places and buildings of heritage significance*
- *(b) to provide a choice of living opportunities and types of settlement.*
- *(c) to facilitate development for a range of business enterprises and employment opportunities,*
- *(d) to ensure that development is sensitive to both the economic and social needs of the community, including the provision of community facilities and land for public purposes,*
- *(e) to ensure that development has regard to the principles of ecologically sustainable development and to areas subject to environmental hazards and development constraints,*
- *(f) to provide for flexibility on applying certain development standards, where compliance with such standards may be unreasonable or unnecessary in the circumstances of a particular development, and there is sufficient justification for varying the standards on environmental planning grounds.*

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

The Proposal is not located within land zoned as water sensitive under the LEP. The Proposal Site is not located within biodiversity sensitive land, as mapped in the LEP. The LEP does not contain any mapping of flood prone land.

Land zoning

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

The objectives of the zone RU1 – Primary Production 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.*
- *To allow for non-agricultural land uses that will not restrict the use of other land in the locality for agricultural purposes.*

The Proposal would harness a renewable natural resource (solar energy) for the life of the solar farm. While activities associated with the solar farm would impact on land available for primary production, it would diversify the current land use and income stream from agricultural use to include electricity generation. Managed sheep grazing is expected to be undertaken throughout the operation of the solar farm to reduce biomass and associated risk of fire where required. Minimising fragmentation and alienation of resource land and land use conflicts has been taken into consideration during the development of the Proposal and is addressed in detail in Section 7.3.1.

The reversibility of the Proposal and limited ground disturbance would result in the availability of the land for primary production or other alternative permissible rural land use at the end of the life of the Proposal (expected to be 30 years). Upon decommissioning of the proposal, the development footprint would be rehabilitated to restore land capability to pre-existing agricultural use.

It is also important to note that solar farms do not preclude the use of land for primary industry production. Some agricultural and production activity is still possible during operation of the solar farm (e.g. strategic grazing). The Proposal would not restrict the use of other land in the locality for agricultural purposes because impacts to the land would be limited to within the Proposal Site.

Subdivision

Under clause 23F of the *Conveyancing Act 1919*, the Registrar-General can refuse to register a transaction in relation to the lease of part of an existing lot unless the boundaries of each part into which the land is divided follows the boundaries of an existing lot. There is an exception for a lease where the term does not exceed 5 years.

As such, because the lease of the solar Plant land will exceed 5 years, the Registrar-General will not register the lease unless the leased lot is subdivided so that the lease is for the whole of that lot.

Therefore, the Proposal includes a subdivision of Lot 1 DP 585523, Lot 1 DP 225170 And Lot 3 DP 800611 to create a lot for the purposes of the Solar Farm lease ('Lot B') and a lot to accommodate the residual land ('Lot A')

Clause 2.6 of the Armidale Dumaresq LEP provides that "Land to which this Plan applies may be subdivided, but only with development consent". However, clause 4.1(3) states that "The size of any lot resulting from a subdivision of land to which this clause applies is not to be less than the minimum size shown on the Lot Size Map in relation to that land". The minimum lot size which applies to the Proposal Site is 200 ha. Therefore, the creation of a lot which is less than 200 ha is prohibited under the Armidale Dumaresq LEP. This prohibition applies to the substation lot. The solar farm lot and residual lot are permissible with development consent.

While the Armidale Dumaresq LEP therefore prohibits the subdivision of land to create the substation lot, section 89E(3) of the EP&A Act allows DPIE to grant development consent to development which is partly prohibited.

Consent for State significant development

……..

(3) Development consent may be granted despite the development being partly prohibited by an environmental planning instrument.

A subdivision plan is shown in Figure 4-1 and a copy of the Landholders consent for the lodgement of Application has been provided separately to DPIE.

Development Control Plans and Council policies

The *Armidale Dumaresq Development Control Plan 2012* (Armidale Dumaresq DCP) applies to all land within the Armidale Regional LGA. Part 1 of the Armidale Dumaresq DCP provides site analysis requirements for all development in the LGA. The objectives of Part 1 are to:

- *To encourage thoughtful planning, including lot layout and the design of new development, that considers the site advantages and constraints to maximise the effective use of the site.*
- *To reduce the risk to landowners and the public of loss of life; injury; or damage to property.*
- *To provide guidance on suitable passive and active protection measures relating to siting, layout, design and construction techniques, and landscaping where site constraints and hazards occur.*
- *To ensure that the lot layout and the design of new development minimises the environmental impact of development, and the impact on the amenity of the locality and the streetscape.*

Clause 11 of the *State and Regional Development SEPP 2011* provides that development control plans do not apply to SSD. Notwithstanding, the Proposal complies with the objectives of the Armidale Dumaresq DCP by considering the constraints and advantages of the site to maximise effective use of the site. Site selection is discussed in Section 3.

5.3. NSW LEGISLATION

5.3.1. Environmental Planning and Assessment Act 1979

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

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

1. *The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.*
2. *The promotion and coordination of the orderly and economic use and development of land.*
3. *The protection, provision and coordination of communication and utility services.*

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

vii. *Ecologically sustainable development.*

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

Matters for consideration

Section 4.40 (formerly section 89H) of the EP&A Act provides that Section 4.15 (formally section 79C) applies to the determination of Development Applications (DAs) for SSD. Under Section 4.15 of the EP&A Act, the consent authority is required to consider several matters when determining a DA under Part 4. These matters are listed in Table 5-1 and assessed in terms of their relevance to the proposal.

Table 5-1 Matters of consideration under the EP&A Act

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant Environmental Planning Instruments (EPIs) are discussed in Section 5.2.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority;	There are no draft instruments relevant to the proposal.
Any development control plan (DCP);	The Armidale Regional LGA has the *Armidale Dumaresq Development Control Plan 2012.* However, clause 11 of the SRD SEPP provides that DCPs do not apply to SSD.
Any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4;	There are no planning agreements that have been entered into, nor are any planning agreements proposed that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration);	Clause 92 of the EP&A Regulation requires consideration of: • The Government Coastal Policy for development applications in certain local government areas; and • The provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters is relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that applies to the land to which the development application relates;	Repealed and no longer applicable.

Provision	Relevance to the proposal
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in Sections 7 and Section 8of this EIS. This EIS demonstrates that the environmental impacts of the Proposal have been avoided or minimised through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development;	The suitability of the site for the development is assessed in Section 3. Characteristics that make it suitable for development of a solar farm are identified and justified.
Any submissions made in accordance with this Act or the regulations; and	Feedback and direction from the public during the preparation of the EIS to maximise opportunities for public engagement. Public submissions would be sought and responded to as part of the EIS determination process. The proponent would consider and respond to any submissions made in relation to the Proposal in a Submissions Report or Preferred Project Report following the public exhibition period.
The public interest.	A number of public benefits are relevant to the Proposal as discussed in section 2. Specifically, these relate to: • Reducing fossil fuel emissions that that contribute to climate change. • Meeting State and Australian Government policies to increase renewable energy supply. • Providing local employment and regional development opportunities.

Environmental Planning and Assessment Regulation 2000

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

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

5.3.2. Legislation to be applied

Under Section 4.42 of the EP&A Act, several authorisations cannot be refused if they are necessary for and consistent with an approved SSD, these are outlined below.

- An aquaculture permit under Section 144 of the *Fisheries Management Act 1994*.
- An approval under Section 15 of the *Mine Subsidence Compensation Act 1961*.
- A mining lease under the *Mining Act 1992*.
- A production lease under the *Petroleum (Onshore) Act 1991*.
- An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in Section 43 of that Act).
- A consent under Section 138 of the *Roads Act 1993*.

- A licence under the *Pipelines Act 1967*.

Only two acts are relevant to the proposal, these are discussed in Section 5.3.4 and 5.3.5.

5.3.3. Approvals that do not apply

Under Section 4.41 of the EP&A Act, SSD developments do not require the following authorisations:

(a) *concurrence under Part 3 of the Coastal Protection Act 1979.*

(b) *a permit under Section 201, 205 or 219 of the Fisheries Management Act 1994.*

(c) *an approval under Part 4, or an excavation permit under Section 139, of the Heritage Act 1977.*

(d) *an Aboriginal heritage impact permit under Section 90 of the National Parks and Wildlife Act 1974.*

(e) *an authorisation referred to in Section 12 of the Native Vegetation Act 2003 to clear native vegetation or state protected land.*

(f) *a bush fire safety authority under Section 100B of the Rural Fires Act 1997*.

(g) *a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the Water Management Act 2000.*

Even though the Proposal does not require these authorisations, the potential impact of the Proposal on these items such as heritage, waterways and native vegetation are assessed in this EIS.

5.3.4. Roads Act 1993

The *Roads Act 1993* (Roads Act) is administered by Roads and Maritime Services, local councils or the Department of Industry - Land. Roads and Maritime Services has jurisdiction for classified roads, local councils for non-classified roads and the Department of Industry - Land for road reserves or Crown roads.

The Roads Act regulates the carrying out of various activities in, on and over public roads. Under Section 138, the consent of the appropriate roads authority is required to:

(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*

(e) *connect a road (whether public or private) to a classified road.*

The Proposal includes one primary access point for its operation and construction as discussed in Section 8.6. Consent would be required from Roads and Maritime (New England Highway) and DPIE - Crown Lands.

5.3.5. Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides an integrated system of licensing for certain polluting activities within the objective of protecting the environment. Schedule 1 of the POEO Act describes activities for which an Environment Protection Licence is required.

Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works, however does not include solar power. The Proposal would not be a scheduled activity under the Act and an EPL is not required.

The Proposal would be managed to ensure pollution risks are minimised during the construction and operation phases. Measures have been incorporated into the EIS to ensure risks to soils, waterways and air quality are avoided or minimised. The Environment Protection Authority would be notified if a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.

Legal requirements for the management of waste are also established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Waste minimisation and management is addressed in Section 8.10 of the EIS.

5.3.6. Heritage Act 1977

This Act aims to conserve heritage values. The Heritage Act defines 'environmental heritage' as those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance. A property is a heritage item if it is listed in the heritage schedule of the local Council's Local Environmental Plan or listed on the State Heritage Register, a register of places and items of particular importance to the people of NSW. Under Section 89J of the EP&A Act, an approval under Part 4 or a permit under Section 139 of the *Heritage Act 1977* would not be required for a State Significant Development. The Proposal is unlikely to directly or indirectly affect any items of heritage significance (refer Section 8.4).

5.3.7. Crown Lands Management Act 2016

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

Numerous Crown Roads (paper roads) are located across the site. The identified paper roads are confirmed to be Crown Land by Armidale Lands Office. Enerparc have consulted with DPIE – Crown Lands and intend on acquiring a licence to utilise the crown roads for access, pending project approval.

5.3.8. Aboriginal Land Rights Act 1983

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

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

5.3.9. Mining Act 1992

The main objective of the *Mining Act 1992* is to encourage and facilitate the discovery and development of mineral resources in New South Wales, having regard to the need to encourage ecologically sustainable development. A database search conducted on November 7, 2019 of the Resource and Energy Title Services portal revealed no current exploration applications or licences, assessment lease applications or leases, or mining or production applications or leases for the site or locality in the DPIE (Resources and Energy) MinView database or Common Ground Viewer, including for coal, minerals, petroleum and gas.

5.3.10. Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) establishes a regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments and activities. The Act contains provisions relating to flora and fauna protection (repealing parts of the *National Parks and Wildlife Act 1974*), threatened species and ecological communities listing and assessment (repealing the *Threatened Species Conservation Act 1995* and section 5A of the EP&A Act), a biodiversity offsets scheme (BOS), a single biodiversity assessment method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The Act is supported by the *Biodiversity Conservation Regulation 2017.* This Act has been considered in the preparation of this EIS and in the provision of a BDAR (Appendix E).

5.3.11. Biosecurity Act 2015

The *Biosecurity Act 2015* repealed the *Noxious Weeds Act 1993* and provides a framework for the prevention, elimination and minimisation of biosecurity risks. The Act and supporting *Biosecurity Regulation 2017* provide for the establishment and functions of Local Control Authorities for weeds (LGA or County Councils), and weed control obligations on public and private land. The EIS provides for the control of priority weeds occurring at the Proposal Site as part of the proposed works (refer Section 7.1).

5.3.12. Water Management Act 2000

The aim of the *Water Management Act 2000* (WM Act) is to ensure that water resources are conserved and properly managed for sustainable use benefiting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and in-stream uses, as well as to provide for the protection of catchments. Freshwater sources throughout NSW are managed via Water Sharing Plans (WSPs) under the WM Act. Key rules within the WSPs specify when licence holders can access water and how water can be traded.

Under section 89J of the EP&A Act, SSD developments do not require a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

The Proposal Site is located in an area subject to the following water sharing plans:

- Water Sharing Plan for the Macleay Unregulated and Alluvial Water Sources
- Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources.

Water entitlements within the locality are held by Armidale Regional Council. Council holds a Water Supply Work Approval and Water Use Approval licence under the *Water Management Act 2000*.

Potential impacts on water resources are assessed in section 8.1, and on waterways in section 7.5.

5.3.13. Conveyancing Act 1919

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

When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under *s*.23F is required when the total of the original term of the lease, together with any option of renewal, is more than five years.

Subdivision is required as part of the Proposal (refer Section 4.3).

5.3.14. Waste Avoidance and Resource Recovery Act 2001

Waste management during the proposed works would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The objectives of the Act are:

a) to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,

b) to ensure that resource management options are considered against a hierarchy of the following order:

i. avoidance of unnecessary resource consumption,

ii. resource recovery (including reuse, reprocessing, recycling and energy recovery),

iii. disposal,

c) to provide for the continual reduction in waste generation,

d) to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste,

e) to ensure that industry shares with the community the responsibility for reducing and dealing with waste,

f) to ensure the efficient funding of waste and resource management planning, programs and service delivery,

g) to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis,

h) to assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997.

Waste minimisation and management is addressed in Section 8.10 of the EIS.

5.4. COMMONWEALTH LEGISLATION

5.4.1. Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act provides an assessment and approval process for actions likely to cause a significant impact on Matters of National Environmental Significance (MNES). The nine MNES are:

- World Heritage properties.
- National Heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- Nuclear actions (including uranium mines).
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- A water resource, in relation to coal seam gas development and large coal mining development.

Approval by the Commonwealth Environment Minister is required if an action is likely to have a significant impact on MNES. Assessments of significance based on criteria listed in Significant Impact Guidelines 1.1 issued by the Commonwealth (DAWE, 2013) are used to determine whether the proposed action is likely to have a significant impact (i.e. is likely to be considered a 'controlled action').

A search of the Commonwealth Protected Matters Search Tool (coordinate search, undertaken on 2 September 2019 indicates that there are no World Heritage or National Heritage areas or items within the Proposal Site (Table 5-1). No areas of Commonwealth land were identified, and no Commonwealth heritage places were identified.

The potential impacts to listed threatened species and communities including, those specified in Attachment A of the Supplementary SEAR's are assessed in the Biodiversity Development Assessment Report (Appendix E) and summarised in Section 7.1 of this EIS.

Table 5-2 Summary of EPBC Act Protected Matters Report search results

Protected Matter	Entities within the 10km search area
World Heritage Properties	0
National Heritage	0
Wetlands of International Importance (Ramsar)	4
Threatened Ecological Communities	3
Threatened Species	29
Migratory Species	12
Listed Marine Species	18
Commonwealth land	0
Commonwealth Heritage places	0
Critical habitats	0
Commonwealth reserves (terrestrial)	0
State and Territory reserves	3
Regional Forest Agreements	1
Invasive species	28
Nationally Important Wetlands	1

Specifically, impacts to both Koala and Greater Glider to have the potential to generate a significant impact and will likely generate an offset requirement. A significant impact to Bluegrass and therefore the requirement to offset, was not concluded to be likely, based on the assessment undertaken pursuant to the EPBC Act.

5.4.2. *Native Title Act 1993*

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

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

Native title may exist in areas such as:

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

A search of the National Native Title Tribunal Registers on 24 September 2019 found one Native Title Claim, Gomeroi People (NC2011/006) located approximately 31 km west of the Proposal Site. There is currently one active application within the Armidale Regional LGA (NN2018/002) that has not yet been determined.

The development site is located on freehold land and not subject to any native title claims at this time.

5.4.3. Renewable Energy (Electricity) Act 2000

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

- Encourage the additional generation of electricity from renewable sources.
- Reduce emissions of greenhouse gases in the electricity sector.
- Ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth Government's RET. This includes solar energy.

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

The Tilbuster Solar Farm would need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

5.4.4. Hazardous Waste (Regulation of Exports and Imports) Act 1989

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

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

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

5.5. OTHER RELEVANT POLICIES AND MATTERS

5.5.1. Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In NSW, the concept has been incorporated into legislation including the *Environmental Planning and Assessment Act 1979* and Regulation and the *Protection of the Environment Administration Act 1991*.

Based on the likely costs and benefits of the proposed solar farm, the Proposal is considered to comply with the principles of Ecologically Sustainable Development. ESD principles and their relationship to the design, construction and ongoing operations of the Proposal are identified in Table 5-3.

Table 5-3 Assessment of the Proposal against the principles of Ecologically Sustainable Development

(a) The precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: ***(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*** ***(ii) an assessment of the risk-weighted consequences of various options.***
The precautionary principle has been adopted in the assessment of impact; all potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been included to address the uncertainty. A 'worst case' impact assessment has been undertaken to account for the uncertainty in the final impact footprint.
(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
Potential impacts of the Tilbuster Solar Farm are likely to be localised and reversable and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Importantly, the Tilbuster Solar Farm provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing the carbon emissions produced in comparison to alternative fossil fuel electricity generation options.
(c) conservation of biological diversity and ecological integrity— namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.
The impacts of the Proposal on biodiversity, including EPBC listed species, have been assessed in detail in the BDAR in Appendix E. As required, the assessment considers the hierarchy of avoidance, minimisation and offsetting only as a last resort. In response to the site's constraints, the Proposal can be seen to avoid areas of higher conservation value. Management prescriptions to minimise the impacts of the works form commitments of project and an offset obligation for residual impacts is also included.

(d) improved valuation, pricing and incentive mechanisms— namely, that environmental factors should be included in the valuation of assets and services, such as: ***(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and*** ***(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, and*** ***(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.***
Attributes of the Proposal Site such as the existing native vegetation, land capability, soil and hydrology have been valued in terms of their broader contribution to the catchment and catchment processes, at a local and broader level. The long term impacts have been considered and the project commitments ensure that natural resource use and pollution risks have been fully assessed and costs would be solely borne by the proponent. The detail of some final design and mitigation will be part of a competitive tender process to maximise the benefits and minimise the costs of environmental management solutions.

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in Section 9.2 provide an auditable set of environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the Tilbuster Solar Farm at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development is justifiable and would be ecologically sustainable within the context of ESD.

5.5.2. NSW Large-scale Solar Energy Guideline for State Significant Development 2018

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

The objectives of the guideline are to:

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

The Proposal has addressed the requirements of the guidelines through the assessment of environmental impacts (Sections 7 and 8), site suitability (Section 3), community and agency consultation (Section 6) and policy and framework requirements (Section 5).

5.6. APPROVALS AND LICENCES

Table 5-4 lists licences that have been identified as relevant to the proposal.

Table 5-4 Summary of licences required

Instrument	Licence or approval requirement
EP&A Act, Part 4	SSD applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPIE.
Roads Act, section 138	Any works to public or classified roads requires consent under this act from the road authority. TfNSW is the roads authority for the New England Highway.
***Local Government Act 1993*, Section 68**	Approval is required to operate an onsite sewage management system and to draw water from a council standpipe. Consent from Armidale Regional Council would be required for use of a standpipe and to operate an onsite sewage management system.
Workcover Notification	Exceedance of 10,000 kg of lithium-ion batteries requires Workcover notification.
Oversize Overmass Permit	An oversize overmass permit will be required from the relevant road authority (Council and/or TfNSW) for any oversized vehicles.

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

6. CONSULTATION

6.1. AGENCY CONSULTATION

6.1.1. Secretary's Environmental Assessment Requirements (SEARs)

As the Proposal is classified as SSD, a PEA was prepared, and SEARs were requested. These were provided by DPIE on 12 October 2018 (Appendix A). The SEARs are intended to guide the structure and content of this EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

The following sections provide a summary of the SEARs from the various agencies and cross reference where specific issues are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice. This additional consultation with agencies is also summarised below.

Table 6-1 SEAR's and section they are addressed in this EIS

Issue summary	Addressed in this EIS
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* The EIS must include the following:	
A stand-alone executive summary	An executive summary is provided at the beginning of this EIS.
A full description of the development, including: • Details of construction, operation and decommissioning. • A site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of separate approvals process). • A detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.	The Proposal is described in Section 1.2. • A site plan is included as Figure 1-4. No infrastructure within this plan is part of a separate approvals process. • A detailed constraints map updated throughout the assessment process and used to inform the design is provided as Figure 1-3.
A strategic justification of the development focusing on site selection and the suitability of the Proposal Site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential)	Evaluation of alternatives has demonstrated the site is compatible and suitable for the development of a solar farm, Sections 3.1 to 3.6. A strategic justification of the Proposal is provided in Section 3.7.
An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:	• Site context is provided in Section 1.2.2, and the existing environment of the site is described in Section 7 and Section 8.

Issue summary	Addressed in this EIS
• a description of the existing environment likely to be affected by the development; • an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; • a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and • a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	• Detailed information regarding environmental legislation relevant to the Proposal is included in Section 5. • Commensurate with the level of impact, detailed assessment, mitigation and monitoring are included in Section 7 and Section 8.
A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS	A consolidated set of mitigation measures is included in Section 9.2
Reasons why the development should be approved having regard to: • Relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; • The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and • Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development	• Key matters under the EP&A Act and ESD principles are addressed in Section 5.3.1. • A summary of feasible alternatives and why the Proposal should be approved is included in Section 3. • A summary of suitability of the Proposal with respect the potential land use conflicts and surrounding land use is included in Section 7.3.1
A detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter	Consideration of the proposals capability to contribute to the National Electricity Market is addressed in Section 2.2.2.
The EIS must also be accompanied by a report from a suitably qualified person providing:	

Issue summary	Addressed in this EIS
A detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived	The Capital Investment Report has been provided separately.
Certification that the information provided is accurate at the date of preparation	Certification by the authors precedes the Executive Summary, page xiv.
The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).	Landowners consent has been provided separately.
The EIS must address the following specific issues:	
Biodiversity • An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values. • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM. • Assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.	A Biodiversity Development Assessment Report (BDAR) has been completed and is summarised in Section 7.1. The BDAR is provided in full in Appendix E.
Heritage • including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.	• An Aboriginal Cultural Heritage report (ACHA) has been completed and is summarised in Section 7.2. The ACHA is provided in full in Appendix F. • Consultation undertaken as part of the ACHA is included in Section 6.2. • Historic heritage is addressed in Section 8.4.
Land	

Issue summary	Addressed in this EIS
• an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including: • a consideration of agricultural land, flood prone land, Crown lands (including Crown roads), mining, mineral or petroleum rights; • a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and • a cumulative impact assessment of nearby developments; • an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including: • consideration of the zoning provisions applying to the land, including subdivision, and; • completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and a description of measures that would be implemented to remediate the land following decommissioning in accordance with State Environmental Planning Policy No 55 - Remediation of Land.	• An assessment of agricultural land impacts is included in Section 7.3.1. • An assessment on the impact of flood prone land is included in Section 7.5 and Section 8.1. • An assessment of the impacts on Crown Lands has been included in Section 7.3.1. • An assessment of the potential for erosion to occur is included in Section and a soil survey is committed to prior to construction to inform remediation of impacts from construction, operation and decommissioning. • Cumulative impacts are considered in Section 8.12 • A Land Use Conflict Risk Assessment is included in Section 7.3.1 • Consideration of the zoning provisions including subdivision is provided in Section 5.2.2 • Land remediation following decommissioning is addressed in Sections 5.2.1 and 7.3.1.
Visual • including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	An assessment of visual impact, including a photomontage, has been included in Section 8.1 and Appendix J.
Noise • including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry 2017 and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	A Construction and Operational Noise and Vibration assessment has been completed and has been summarised in Section 8.2. The full noise assessment is provided as Appendix H.

Issue summary	Addressed in this EIS
Transport – including an assessment of the site • an assessment of the peak and average traffic generation, including any over-dimensional vehicles and construction worker transportation; • an assessment of the likely transport impacts to the site access route (including New England Highway), site access point, any Crown land, particularly in relation to the capacity and condition of the roads; • a cumulative impact assessment of traffic from nearby developments; • a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and • a description of the measures that would be implemented to mitigate any transport impacts during construction;	• A Traffic Impact Assessment (TIA) was completed and is summarised in Section 8.6. The full TIA is provided as Appendix I.
Water: • an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; • details of water requirements and supply arrangements for construction and operation; and • a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004);	• An assessment if water impacts is provided in Section 7.5 and Section 8.1. • Details of water requirements and supply are detailed in Section 8.1. • A description of erosion and sediment control measures are provided in Section 7.3.5.
Hazards and Risks • A preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazard Industry Planning Advisory Paper No. 6 – Guidelines for	• A preliminary risk screening is provided in Section 8.11. • An assessment of bushfire risks is included in Section 8.7. • An assessment of Electromagnetic fields is included in Section 8.8. • An assessment of potential hazards is included in Section 8.11.

Issue summary	Addressed in this EIS
Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011). • An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure.	
Socio-Economic – including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	• An assessment on potential socio-economic impacts of the Proposal is included in Section 8.5.
The EIS consultation process includes:	
During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Armidale Regional Council. The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	• Consultation is summarised in Section 6.
The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	• Issues raised during consultation and how they are addressed in this EIS are included in Section 6.

6.1.2. Supplementary SEARs

On 1 September 2020, the proposed Tilbuster Solar Farm was determined to be a controlled action for impact on the following matter of national significance (MNES) protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Threatened species and communities

The proposal will be assessed by NSW under an accredited assessment in accordance with section 87 of the EPBC Act. These requirements are a supplement to the NSW SEARs and should be addressed in conjunction with those requirements.

Issue summary	Addressed in this EIS
Relevant regulations	
The Environmental Impact Statement (EIS) must address all matters outlined in Schedule 4 of the EPBC Regulations and all the matters outlined below in relation to the controlling provisions.	Specific matters required by Schedule 4 were included in the EPBC referral which was publicly exhibited: EPBC 2020/8716. On 1 September 2020, the proposal was determined a controlled action.
Project description	
The title of the action, background to the action and the current status.	The title, background and current status is included in Section 1 of this EIS.
The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of National Environmental Significance (MNES).	The location and description of the works is included in Section 4.
How the action relates to any other actions that have been, or are being taken in the region affected by the action.	Cumulative impacts in relation to the proposed action have been addressed in Section 8.12.
How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	A description of the works including design parameters is included in Section 4.
Impacts	
The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: • a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; • a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; • analysis of the significance of the relevant impacts; and • any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Impacts on relevant EPBC Act listed species and communities are addressed in Section 7.1 and the BDAR (Appendix E). • Direct impacts are included in Section 7.1 of the BDAR. • Indirect impacts are included in Section 7.2 of the BDAR.

Issue summary	Addressed in this EIS
Avoidance, mitigation and offsetting	
For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action, including: • a description and an assessment of the expected or predicted effectiveness of the mitigation measures; • any statutory policy basis for the mitigation measures; • the cost of the mitigation measures; • an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; • the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Proposed avoidance and mitigation measures to deal with the potential impacts of the proposal are addressed in Section 7.1 and the BDAR (Appendix E). Section 8 of the BDAR provides mitigation measures to avoid and minimise impacts. All impacts and measures are relevant to: • Koala • Bluegrass • Greater Glider *Petauroides volans* • *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*
Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	The requirement to settle an EPBC offset obligations will be undertaken in accordance with the NSW offset rules where applicable to do so consistent with the endorsed bilateral agreement. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.
For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: • conservation advice or recovery plan for the species of community; • relevant threat abatement plan for the species; • wildlife conservation plan for the species; and • any strategic assessment.	Commonwealth guidelines and policy statements have been considered in relation to relevant matters likely to be impacts in the BDAR (Appendix E).
Assessment requirements	

Issue summary	Addressed in this EIS
The EIS must identify each EPBC Act listed threatened species and community likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	Impacts on relevant EPBC Act listed species and communities are addressed in Section 7.1 and the BDAR (Appendix E). • Threatened species and communities are addressed in Section 7.5 of the BDAR. • Appendix F of the BDAR (EPBC habitat assessment evaluations) supports section 7.5 of the BDAR. The evaluation considers all entities returned in the PMST search and in the supplementary SEARs. In consideration of entity habitat requirements, the surveys undertaken onsite, the habitat that is available onsite and the likelihood of occurrence, the potential for impact is determined in this table. • Where entities are deemed to have less than a low risk of impact, an EPBC Assessment of Significance is undertaken (Appendix G of the BDAR). The assessments also assist to target mitigation strategies as required. • Only for those entities where a significant impact is evaluated as likely to occur, are Commonwealth offsets required; Koala and Greater Glider.
For each of the EPBC Act listed threatened species and communities likely to be impacted by the action the EIS must provide a separate: • description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; • details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements;	Threatened species and communities are addressed in Section 7.5 of the BDAR.

Issue summary	Addressed in this EIS
• description of the relevant impacts of the action having regard to the full national extent of the species or community's range; and • description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; • identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; • description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established. • details of how the current published NSW Biodiversity Assessment Methodology has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and • details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the NSW Biodiversity Assessment Methodology and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites;	
Any significant residual impacts not addressed by the NSW Biodiversity Assessment Methodology may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy.	An offset requirement is considered to be required for Koala and Greater Glider. The requirement to settle an EPBC offset obligations will be undertaken in accordance with the NSW offset rules where applicable to do so consistent with the endorsed bilateral agreement. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.
Information in relation to any other approvals of conditions required must include the information prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) of the EPBC Regulations 2000.	Proposed avoidance and mitigation measures to deal with the potential impacts of the proposal are addressed in Section 7.1 and the BDAR (Appendix E). Section 8 of the BDAR provides mitigation measures to avoid and minimise impacts. All impacts and measures are relevant to:

Issue summary	Addressed in this EIS
	• Koala • Bluegrass • Greater Glider *Petauroides volans* • *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*
Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.	Information about the proponent is provided in Section 1.2.4 and the EPBC referral which was publicly exhibited: EPBC 2020/8716
For information given in the EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested, and what uncertainties (if any) are in the information.	Information sources are provided in the reference list of the BDAR provided in Appendix E and Section 11 of this EIS. Reference citation makes clear published from non – published (ie website) sources. Areas of uncertainty, specifically around the impacts of shading, are stated clearly and conservative assumptions made in place of reliable data.

6.1.3. Relevant guidelines

Table 6-2 Guidelines and section they are addressed in this EIS

Guideline	How the guideline has been addressed
Biodiversity	
Biodiversity Assessment Method (OEH)	Biodiversity Assessment, Section 7.1 and Appendix E.
Threatened Species Assessment Guidelines - Assessment of Significance (OEH)	
Biosecurity Act 2015	
Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DoI – L&W)	Water assessment and mitigation measures, Section 7.5 and Section 8.1.
Policy and Guidelines for Fish Habitat Conservation and Management (DoI – L&W)	
Fisheries Management Act 1994	
Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)	Heritage assessment, Section 7.2, Section 8.4, and Appendix F.

Guideline	How the guideline has been addressed
Code of Practice for Archaeological Investigations of Objects in NSW (OEH)	
Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW (OEH).	
NSW Heritage Manual (OEH)	
Land	
Primefact 1063: Infrastructure proposals on rural land (DoI – L&W)	Land use, Section 7.3.1.
Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA)	Social and economic impacts, Section 8.5.
Local Land Services Act 2013	Biodiversity assessment, Section 7.1 and Appendix E.
Australian Soil and Land Survey Handbook (CSIRO)	Land and soil assessment Section 7.3. Land use, Section 7.4.
Guidelines for Surveying Soil and Land Resources (CSIRO)	
The land and soil capability assessment scheme: second approximation (OEH)	
Land Use Conflict Risk Assessment Guide (DoI – L&W)	Land use, Section 7.4.
Noise	
NSW Noise Policy for Industry (EPA)	Construction and Operational Noise and Vibration assessment, Section 8.2and Appendix H.
Interim Construction Noise Guideline (EPA)	
NSW Road Noise Policy (EPA)	
Transport	
Guide to Traffic Generating Developments (RTA)	Proposal description, Section 1.2. Traffic assessment, Section 8.6 and Appendix I.
Austroads Guide to Road Design & relevant Australian Standards	
Austroads Guide to Traffic Management	
Water	
Managing Urban Stormwater: Soils & Construction (Landcom)	Land and soil assessment, Section 7.3. Water assessment, Section 8.1.
Floodplain Development Manual (OEH)	Proposal description, Section 1.2. Water assessment, Section 8.1. Flooding assessment, Section 7.5.
Guidelines for Controlled Activities on Waterfront Land (DoI – L&W)	
Water Sharing Plans (DoI – L&W)	

Guideline	How the guideline has been addressed
Floodplain Management Plan (DoI – L&W)	
Guidelines for Watercourse Crossings on Waterfront Land (DoI – L&W)	
Hazards and risks	
Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DPE)	Hazard assessment, Section 8.11.
Multi-Level Risk Assessment (DPE)	
Waste	
Waste Classification Guidelines (EPA)	Resource use and waste generation, Section 8.10.
Electric and Magnetic Interference	
ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields	Electric and magnetic fields, Section 8.8.
Environmental Planning Instruments	
State Environmental Planning Policy (State and Regional Development) 2011	NSW Legislation, Section 5.2.1
State Environmental Planning Policy (Infrastructure) 2007	
State Environmental Planning Policy (Rural Lands) 2008	
State Environmental Planning Policy No. 44 – Koala Habitat Protection	
State Environmental Planning Policy No. 55 – Remediation of Land	
Armidale Dumaresq Local Environmental Plan 2012	Local Environnent Plans, Section 5.2.2.

6.1.4. Agencies' additional comments and consultation

As part of preparing the EIS for the development application, the SEAR's require that the relevant State or Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders be consulted.

The issues raised through consultation with these entities are provided below.

Table 6-3 Additional Agency comments and section they are addressed in the EIS and consultation

Issue raised	How issue has been addressed
TransGrid	
• The project scope description should include all ancillary electricity transmission works (all works associated with connection to the National Electricity Market, such as ancillary substation works, transmission line works (direct and upstream), and	A description of the Proposal and all associated infrastructure and land parcels is included in Section 4.

<table>
<tr><th>Issue raised</th><th>How issue has been addressed</th></tr>
<tr><td>telecommunications works) that would be necessary for the construction and operation of the Project.
The EIS should identify all land parcels affected by these works and include them within the project boundary.</td><td></td></tr>
<tr><td colspan="2">Roads and Maritime (now TfNSW)</td></tr>
<tr><td>Roads and Maritime requests that the Environmental Assessment be supported by a Traffic Impact Assessment (TIA) prepared by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Roads and Maritime Supplement and RTA Guide to Traffic Generating Developments.
The total impact of existing and proposed development on the road network with consideration for a 10 year horizon.
The volume and distribution of traffic generated by the proposed development.
Intersection sight distances at key intersections along the nominated access route/s to the site.
Existing and proposed site access standards.
Details of proposed improvements to affected intersections, in particular assessments of impacts on safety and efficiency of junctions with the classified road network.
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 of potential glare/reflectivity generated from on-site infrastructure towards public roads.
Details of a Transport Management Plan (TMP) to identify and manage impacts of construction and operational traffic on the safety and efficiency of the affected road network. The TMP may include temporary measures such as Traffic Control Plans to address construction related traffic at specific locations. The TMP should include a Driver Code of Conduct, which may include, but not be limited to the following;
A map of the primary haulage routes highlighting critical locations.
Safety initiatives for haulage through residential areas and/or school zones.
Code of Conduct and induction process for haulage vehicle operators and regular toolbox meetings.
A complaint resolution and disciplinary procedure.
Any community consultation measures for peak construction or haulage periods.</td><td>A Traffic Impact Assessment (TIA) has been prepared and is included in Appendix I and summarised in Section 8.6.

Consultation between the traffic impact specialist (Amber) and TfNSW was undertaken on 4th September 2019, a summary is of issues raised and outcomes is provided below:
TfNSW noted they had safety concerns in relation to rear-end crashes, and that an Auxiliary Left Turn Lane Treatment (AUL) would be sufficient in managing this risk.
Given the left turn traffic volumes would only occur during the AM peak when staff are accessing the site, TfNSW noted that they would consider a Basic Left Turn Treatment (BAL) but would require justification as to why a BAL would be sufficient, including recommended traffic management measures.
TfNSW also noted that they would consider providing a smaller turning lane as they did not necessarily want a turn lane that would need to be maintained post-construction.
TfNSW noted their understanding of the short-term impact of the construction stage of solar farms in general and that these impacts are manageable with appropriate mitigation.</td></tr>
<tr><td colspan="2">NSW Rural Fire Service</td></tr>
</table>

Issue raised	How issue has been addressed
The NSW RFS recommends that the SEARs for the project include a requirement to address the follow, having regard to the requirements of 'Planning for Bush Fire Protection 2006': • potential bush fire threats to the facility; • potential hazards to fire fighters; • management of bush fire (including grass fire) impacting on, and structural fire emanating from, the proposed solar farm and its associated infrastructure; • firefighting water supplies; • vehicle access and defendable space around the solar farm; • land and vegetation management opportunities; • proposed emergency management procedures; and • the extent to which the proposed subdivision conforms with, or deviates from the standards, specific objectives and performance criteria of 'Planning for Bush Fire Protection 2006'. As part of any consent issued for the project, the NSW RFS will require the proponent to develop a Fire Management Plan, in consultation with the local NSW RFS District Fire Control Centre.	Bushfire has been considered in Section 8.7 and Hazardous Materials and Development have been considered in Section 8.11.
Office of Environment and Heritage (now Environment, Energy and Science)	
The EIS should include an assessment of the potential impacts on biodiversity, including threatened species, populations, ecological communities, or their habitats likely to occur on or near the subject site, as well as Aboriginal cultural heritage values, historic heritage, water, flooding and soils.	A Biodiversity Development Assessment Report (BDAR) is provided in Appendix E and summarised in Section 7.1. An Aboriginal Cultural Heritage Assessment (ACHA) Report has been included in Appendix F and Section 7.2. A Hydraulic and Hydrological Analysis has been included in Appendix G and summarised in Section 7.5.
Heritage Council of NSW	
The EIS must include a Heritage Impact Statement (HIS), prepared in accordance with Heritage Division, Office of Environment and Heritage, guidelines. The HIS should identify any places of heritage significance within the State Significant Development (SSD) site or in the vicinity and assess their significance and the impacts of the Proposal on these and provide mitigation recommendations where appropriate. The HIS should also include a baseline Historical Archaeological Assessment prepared by a suitably qualified and experienced Historical Archaeologist. The Baseline assessment should identify what relics, if any, are likely to be present within the SSD site or in the vicinity, assess their significance and consider the impacts from the Proposal on this potential resource.	Non-indigenous heritage is considered in Section 8.4.
Fire and Rescue NSW	
Without limiting the scope of the emergency response plan (ERP) requirements of Clause 43 of the Work Health and	Bushfire has been considered in Section 8.7 and Hazardous Materials and

Issue raised	How issue has been addressed
Safety Regulation 2000 (the Regulation), the following matters are recommended to be addressed: • That a comprehensive ERP is developed for the site. • That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents. • That the ERP details the appropriate risk control measures that would need to be implemented to safely mitigate potential risks to the health and safety of firefighters and other first responders (including electrical hazards). • Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. • That two copies of the ERP (detailed in recommendation 1 above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s. • Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC). The LEMC is a committee established by Section 28 of the State Emergency and Rescue Management Act 1989. LEMCs are required to be established so that emergency services organisations and other government and non-government agencies can proactively develop comprehensive inter agency local emergency procedures for significant hazardous sites within their local government area. The contact details of members of the LEMC can be obtained from the relevant local council.	Development have been considered in Section 8.11.
DPIE – Resources and Geoscience	

Issue raised	How issue has been addressed
In fulfilling the Secretary's Requirements relating to the State's mineral resources and rights to assess and extract those resources, the Division requires the following project specific requirements to be addressed in the EIS: • The proponent should undertake an updated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date referenced map. It should also be noted in the EIS there are no operating quarries or mines in the vicinity. The search referenced in the PEA should be updated for the EIS. • Should exploration license application (ELA) 5706 be granted prior to submission of the EIS, the proponent must make contact with the titleholder to determine their level of interest and provide authentic consultation to the Division. This should include a letter of notification of the Proposal to the title holder including a map indicating the solar farm Proposal area (including associated electricity transmission infrastructure) in relation to the exploration title boundaries, and a letter of response from the title holder to the proponent. If responses are not received from the titleholder, the Proponent is to contact the Division. • The Division recommends the proponent register a MinView account profile where users can set an alert to be notified by email when a title changes or is due to expire. An alert may be set up to notify the proponent when changes to the status of ELA 5706 occur. Details regarding registration are provided on the webpage via the above link. The Division can provide contact details for the titleholder if required. • Consultation with the Division in relation to the proposed location of any offsite biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.	Exploration Licenses are considered in Section 7.4. Further consultation was undertaken on 7 April 2020 to ascertain whether ELA 5706 has been granted. Diversion of Resources and Geoscience responded on 17th April 2020 outlining that the application for ELA 5706 was withdrawn. There are currently no other licence applications, licences or titles within the Tilbuster Solar Farm Proposal Site.
NSW Department of Industry - Water	
• The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased. • A detailed and consolidated site water balance. • Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.	Water supply and quality are considered in Section 8.1. Relevant legislation is discussed in Section 5.

Issue raised	How issue has been addressed
• Proposed surface and groundwater monitoring activities and methodologies. • Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans (available at https://www.industry.nsw.gov.au/water).	
Department of Primary Industry - Lands	
• The authorised use and/or disposal of Crown roads and land affected by the Proposal should be addressed within the EIS.	Crown roads and land are addressed in Section 7.4. Additional consultation was undertaken on 19 September 2019 regarding crown roads within the site. Recommendation was given to apply for a license while concurrently applying to purchase these Crown roads.
Department of Primary Industry - Fisheries	
• The EIS should specifically address impacts on the aquatic ecology of waterways or any Key Fish Habitats (defined as Third order streams or larger (Strahler Stream Ordering System)) such as Duval Creek and some of its tributaries and controls to be established for tracks, cabling, transmission lines or road upgrades within these Key Fish Habitats. To achieve this, an aquatic ecological environmental assessment should be prepared in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013).	Aquatic ecology and key fish habitat are discussed in Section 7.1.
Department of Primary Industry - Agriculture	
• The proposed solar farm development footprint is to be developed adjacent a small area (0.21ha) of agricultural land that is mapped as Biophysical Strategic Agricultural Land (BSAL). The proposed development is stated to cover a reasonable area (150ha) of productive agricultural land. The EIS should include the following: • Assessment of impacts to agriculture; • A Land Use Conflict Risk Assessment; • Rehabilitation and Decommissioning/Closure Management Plans; and • A biosecurity risk assessment.	Compatibility with existing land uses, including agriculture, are addressed in Section 7.4.

6.2. ABORIGINAL COMMUNITY CONSULTATION

The consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the *Aboriginal cultural heritage consultation requirements for proponents 2018* (ACHCRP) guide provided by OEH. The guide outlines a four-stage process of consultation as follows:

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

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

Stage 1. In accordance with Stage 1 (step 4.1.2), letters requesting information about any known Aboriginal cultural knowledge holders were sent to the following:

- NSW BCD North East Regional Branch
- Armidale Local Aboriginal Land Council (LALC)
- Armidale Regional Council
- Northern Tablelands Local Lands Services
- The Registrar, *Aboriginal Land Rights Act 1983*
- National Native Title Tribunal
- Native Title Services Corporation Limited

An advertisement was placed in the Armidale Express on 10 July 2019 and all Aboriginal stakeholders identified by the above agencies were then contacted on 29 July 2019 in accordance with Stage 1 (step 4.1.3). At the completion of Stage 1, a total of seven groups were registered for the project. The list of RAPs is provided in Appendix F. In accordance with step 4.1.6, the names and details of the RAPs were forwarded to the LALC and BCD.

As a result of this process, ten groups and an individual contacted the consultant to register their interest in the proposal.

The groups and individuals who registered interest were:

- Nunnawunna Aboriginal Corporation
- Iwatta Aboriginal Corporation
- Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants
- Cheryl Kitchener
- Anaiwan Traditional Owners Aboriginal Corporation
- Larissa Ahoy
- Garby Elders
- Armidale LALC

No other party registered their interest, including the other entities and individuals recommended by BCD.

Stage 2. On the 13 August 2019, an Assessment Methodology document for the Tilbuster Solar Farm was sent to all registered parties. This document provided details of the background to the proposal, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the proposal. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. A second version of the methodology incorporating the completion of test excavation in accordance with the SEARs and the Code of Practice was supplied to RAPs on 4 October 2019. All comments received have been incorporated into this ACHA as appropriate and are outlined in Table 6-4.

Table 6-4 Responses to methodology

RAP	Comment	NGH Response
Nunnawunna Aboriginal Corporation	**Agrees with methodology.**	**N/A**
Iwatta Aboriginal Corporation	Agrees with methodology.	N/A
Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants	Agrees with methodology.	N/A
Cheryl Kitchener	Agrees with methodology.	N/A
Anaiwan Traditional Owners Aboriginal Corporation	Agrees with methodology.	N/A
Larissa Ahoy	Response combined with Anaiwan response.	N/A
Garby Elders	No response.	N/A
Armidale LALC	No response.	N/A

No other comments were provided from other registered parties.

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

The fieldwork was organised and three of the registered parties were asked to participate in fieldwork. These included six personnel as representatives of the three RAP groups. The fieldwork was undertaken on the 24th and 25th of September and continued on the 11th of November through to the 15th of November 2019.

The Aboriginal community representatives who participated in the field survey were:

- Rhonda Kitchener (Nyakka Aboriginal Corporation)
- Colin Ahoy (Nunnawunna Aboriginal Corporation)
- Anthony Simon (Nunnawunna Aboriginal Corporation)
- Tyson Ahoy (Nunnawunna Aboriginal Corporation)
- Steven Ahoy (Iwatta Aboriginal Corporation)
- Jocelyn Blair (Iwatta Aboriginal Corporation)

Stage 4. In May 2020 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the Proposal (this document) was forwarded to each registered Aboriginal party inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document.

6.2.1. Aboriginal Community feedback

Community consultation occurred throughout the assessment stage. The draft Aboriginal Cultural Heritage Assessment (ACHA) was provided to each of the Registered Aboriginal Parties (RAPs) and feedback was sought on the recommendations, the assessment, and any other issues of importance.

Responses received from the RAPs on the draft ACHA report are included in Table 6-5.

Table 6-5 Cultural Information Provided by RAPs and responses to Draft ACHA

Organisation	Comments	NGH Response
Iwatta Aboriginal Corporation	This information has been restricted for the publicly available copy of this report.	This information has been incorporated into Section 6 of this ACHA report included in Appendix F.
Nunnawanna Aboriginal Corporation	"Due to the land of the solar farm being developed behind Mt Duval which is of high significance to the Anaiwan people, I would like to recommend that a RAP should be present when the solar farm developers are erecting their fence as the boundary of the solar farm will impact the knapping site at AS1 in figure 5.1. In the case of salvaging of all the artefacts I would like them to be stored in a display case at the Armidale Cultural Centre and Keeping Place."	This response has been incorporated into the recommendations.
Nyakka Aboriginal Cultural Heritage Corporation Archaeological & Cultural Heritage Consultants	"Thanks for the report, it's very informative as a scientific report, unfortunately it's clear that the information regarding the local landscape has been omitted from the report. Regarding Cultural Heritage Values, I would like it noted that I spoke to you about the Women's sites within the cultural landscape which Tilbuster is part of, too many times Women's sites and business is left out of the reports and our value to the cultural record is diminished or not recognised. If not too late I would at least like this to be noted in this section. For the management of the artefacts which will be recovered from the project area, we would like the axes displayed at the Armidale Aboriginal Cultural Centre and other artefacts buried on Country land outside the project area."	NGH responded that some information that had been provided in writing by Iwatta regarding cultural sites, including women's sites, had been included in the report, specifically Section 6, however it had been redacted from draft reports supplied to all RAPs except Iwatta, in order to avoid breaching confidentiality. Management of artefacts has been included in the recommendations.

6.3. COMMUNITY CONSULTATION

Enerparc has undertaken consultation with the local community in developing the Proposal in line with the Australian Energy Agency's (ARENA's) *Establishing the social license to operate large scale solar facilities in Australia: insights from social research for industry* (ARENA, n.d.). Consultation activities were informed by *Beyond Public Meetings: Connecting community engagement with decision making* (Twofold Consulting, 2007). *Large-scale solar energy guideline for state significant development December 2018* (NSW Government, 2018).

6.3.1. Community Consultation Strategy

Effective engagement requires an understanding of community stakeholders and prioritisation of potential impacts. In order to contribute effectively, the community needs to understand the Proposal and specific areas of interest to them. The aim of the consultation process for Tilbuster Solar Farm has been to provide the community with the required information to engage effectively.

A Community Consultation Strategy (CCS), provided in Appendix C, was developed for the proposal. The CCS identifies ways to inform the community about Tilbuster Solar Farm and facilitate engagement within the community.

The CCS identifies:

- Community stakeholders for the project.
- Issues / risks related to the engagement of each stakeholder group.
- A consultation strategy for each stakeholder group.
- A set of consultation activities against the project development timeline.

Stakeholders were identified as those potentially being impacted by the solar farm Proposal or having an interest in the proposal. The CCS sets out consultation requirements with interested parties including adjacent neighbours, near neighbours, local businesses, special interest groups and representative bodies. The plan also includes strategies for consultation with the local community and the broader community within the region.

The Proposal has been developed iteratively in response to agency and community input. Measures to reduce adverse impacts and promote positive impacts have been incorporated in the EIS. The CCS further aims to ensure that there is ongoing effective liaison with the community.

6.3.2. Community and stakeholder consultation activities to date

In accordance with the CCP, a range of community engagement tools have been used with regard to the proposal. These are summarised in Table 6-6.

Table 6-6 Community and stakeholder consultation activities to date

Date	Description of activity
General	
2/10/2018	Launch of project website including project information, updates and contact details https://tilbustersolarfarm.com.au Establishment of dedicated email address for questions and feedback info@tilbustersolarfarm.com.au
8/10/2018	Interview with journalist from Bloomberg New Energy Finance
19/02/2020	Open house community information session at the Armidale Regional Council chambers in Armidale. Event held by Enerparc and NGH to provide further information and an opportunity for community members to provide feedback. Consultation with representative from Armidale Regional Council, two adjacent landowners and one local engineering/surveying contractor.
Associated landowner	
18/03/2018 (ongoing)	Enerparc met with the associated landowner to discuss: • Lease of land • Suitability of land • Potential for continued utilisation of grazing land after completion of solar farm construction. Consultation has been ongoing throughout the assessment process.
22/11/2019	Received Landowners consent to lodge the DA and associated documentation.
Adjacent neighbours	
18/03/2018	Enerparc met with an adjacent landowner to discuss: • Lease of land • Suitability of land • Potential for continued utilisation of grazing land after completion of solar farm construction. The land was included within the Proposal Site boundary with the PEA, however the landowner later decided not to be involved at this stage.
6/09/2018	Enerparc meeting with the sole visually impacted resident at their residence located on Lot B DP 392067. The discussion included and offer of a photomontage and possibility for vegetative screening mitigations if requested.
15/08/2019	NGH site visit to resident at Lot B DP 392067. Reiteration of possibility of preparation of photomontage and vegetative screening mitigation. Enerparc Project Manager contact details provided.

Date	Description of activity
4/10/2019 – 24/2/2020	Further consultation between Enerparc, visually impacted resident at Lot B DP 392067 and their solicitor. The discussion aimed to extend the offer for a photomontage again and open a dialogue about the potential for vegetation screen as mitigation depending on the outcome of the photomontage.
2/3/2020	Enerparc provided information to resident at Lot B DP 392067 to inform of upcoming open house event, and provided an opportunity to discuss any issues.
6/3/2020	Community member spoke to Enerparc noting their support for renewable energy projects in general and asked to be included in the further project updates.
28/10/2020	Consultation undertaken with landowner at 11924 New England Highway in relation to concerns about the potential visual impact. Enerparc responded to queries and presented zone of visual influence map showing that there would not be a view of solar farm infrastructure from the property.
19/02/2020 **21/02/2020** **26/03/2020**	Ongoing Discussion with the landowner at Lot 4 DP 800611 in relation to a building entitlement at the property, and the potential for visual impacts and financial impacts. Enerparc has committed the following: *In the event that a Development Application for a residential dwelling on Lot 4 DP800611, the proponent would undertake consultation with the landowner in relation to potential visual impacts and provide fund towards establishing appropriate screening.*
Broader community	
10/09/2018	A Project newsletter update was mailed to all identified residents within 4km of the Proposal Site. Newsletter update includes project information relating to the Preliminary Environmental Assessment and Enerparc contact information. Paid return postage for Feedback Forms also provided.
15/10/2018	Radio interview with ABC Radio New England.
17/10/2018	ABC New England North West Interview online post.
11/10/2019	Project newsletter update posted to all identified residents within 4km of the Proposal Site – details project updates, progress in the SSD approval process and upcoming community Open House Event.
20/01/2020	Invitation to community Open House Event mailed to all identified residents within 4km proximity of the Proposal Site.
4/02/2020 – 11/02/2020	Advertisement of Open House Event in three local newspapers inviting all members of the community to attend and learn more about the project. Newspapers in which the invitation appeared were: • Guyra Gazette • Guyra Argus • Armidale Express
19/02/2020	Open House Event held at Armidale Regional Council Chambers hosted by the Enerparc Project Manager and two representatives from NGH with the aim of providing a wide range of information from the EIS and answering any questions regarding the EIS, project development details, and the NSW SSD approval process.

Date	Description of activity
Small local businesses	
10/10/2018 - ongoing	Ongoing consultation with local contractors and labourers interested in the construction of the Tilbuster Solar Farm.
15/10/2018	Discussion in relation to providing an opportunity to quote for construction work with local electrical contractor. Enerparc committed to keeping the contractor informed closer to construction.
University of New England (UNE)	
3/03/2020 **16/03/2020**	Consultation with the UNE Geology department who currently hold two field trips to investigate the 'red rocks' and other geologically interesting areas within the Proposal Site. Enerparc has noted that while the field trips would not be able to be continued during pre-construction and construction, Enerparc are open to further discussions of continued field visits and/or collaboration with UNE during the operations phase should the Proposal receive Development Consent.
TransGrid	
18/05/2018	Enerparc commenced the connection process with TransGrid Enerparc.
15/6/2020	Revised Enquiry sent to TransGrid to update connection enquiry response
20/7/2020	TransGrid provide revised enquiry response including subdivision requirements. Evidence of this consultation is confidential and has been provided to DPIE separately.
20 July 2020 **(ongoing)**	Enerparc reconfirmed the proposed connection with TransGrid via the connection process on 20 July 2020. Enerparc will continue to liaise and hold meetings with TransGrid as needed and dictated by the Connection Process. Easement and free hold discussions with TransGrid have not begun but will commence in due course.
Armidale Regional Council (ARC)	
27/6/2018	Enerparc met with ARC who raised the following items as key concerns: • Visual impact of the proposed solar farm • Potential for upgrades to access roads / intersections • Transfer of ownership of Crown roads • Cultural heritage assessment • Potential for continued utilisation of grazing land after completion of solar farm construction.
10/02/2020	Consultation with ARC including discussions of upcoming Open House Event.
19/02/2020	General discussion in relation to environmental issues addressed in the EIS with the Coordinator Development (ARC) who attended the open house event.

6.3.3. Results of community consultation

Generally, questions and issues raised by the community centred around the following:

- Potential for visual impacts
- Potential for work during the construction phase

Six people attended the open house session held on 19th February 2020 and included:

- 2 were the associated landowners,
- 1 was a representative of Armidale Regional Council,
- 2 were adjacent non-associated neighbours
- 2 was a local engineering/surveying contractor

Of the four non-associated attendees:

- 2 raised concerns relating to visual impact
- 2 were supportive of renewable energy generation
- 1 showed interest in hosting a biodiversity offset site
- 1 showed interest in employment opportunities during the construction phase
- 1 showed interest in general solar farm impacts including biodiversity, hydrology, visual impacts, waste and contamination and fire.

Feedback forms were distributed at the open house community information session in Armidale of which none were returned.

6.3.4. Continued engagement

Engagement activities in the CCS extend throughout the determination period, and emphasis would be placed on submissions received during the EIS exhibition period.

The CCS would be reviewed regularly, as well as at key transition phases of the Proposal development (e.g. prior to construction or operation). The strategy would continue to guide engagement activities at all phases of the proposal, ensuring that engagement is appropriate and in line with good practice and proactive in maximizing the benefits of the Proposal to the local community.

7. ASSESSMENT OF KEY ISSUES

7.1. BIODIVERSITY (FLORA AND FAUNA)

A Biodiversity Development Assessment Report (BDAR) has been prepared by NGH; appended in Appendix E and summarised in this section. The aim of the BDAR is to address the requirements of the *Biodiversity Conservation Act 2016* (BC Act). Preparation of a BDAR is a requirement of the Proposal's SEARs.

The Biodiversity Assessment Methodology (BAM) is the required assessment methodology for developments that trigger the NSW Biodiversity Offsets Scheme (BOS), under the BC Act. This report follows the field work methodologies and assessment required by the BAM and determines the offset obligation required to account for impacts that cannot be avoided. Accredited assessors under the BC act lead field work, authored and reviewed the report and carried out offset calculations.

Land Category Assessment

As Category 1 Land regulatory maps are not yet publicly available, an assessment of whether the cleared areas meet the definition of the Category 1 - exempt land was undertaken (included within the BDAR). The following information was analysed:

- NSW Land Use mapping (OEH 2017)
- Woody Vegetation layer (OEH 2015)
- Sensitive Regulated Land and Vulnerable Regulated Land Mapping
- Historic aerial imagery

This was used to define areas that would not be subject to the BAM.

Native vegetation surveys

A site overview was undertaken on the 13th – 15th of August 2018. The entire subject land was surveyed by one ecologist with the aim of confirming the Plant Community Types (PCTs) present, along with their extent and condition by way of rapid data collection techniques. Random meander searches were conducted to gain an overview of the plant species present and determine variation within vegetation types. Potential PCTs were identified using the BioNet VC based on the native species present, landform, physiography and location in the IBRA subregion. The PCTs were then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Detailed floristic surveys were then undertaken over the 26th – 30th November 2018 by two ecologists over the 18th – 21st November 2019. The surveys were undertaken using the methodology presented in the BAM. The required number of vegetation integrity plots of 20 m by 50 m were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation.

Candidate species surveys

Targeted surveys were undertaken over two visits to the development site from August 2019 to November 2019 inclusive. Candidate species that could not be surveyed during these survey windows were assumed to occur. Detailed survey methods and effort are provided in the BDAR. Relevant candidate species are identified below.

Threatened species polygons and targeted survey locations are shown in Figure 7-1 below.

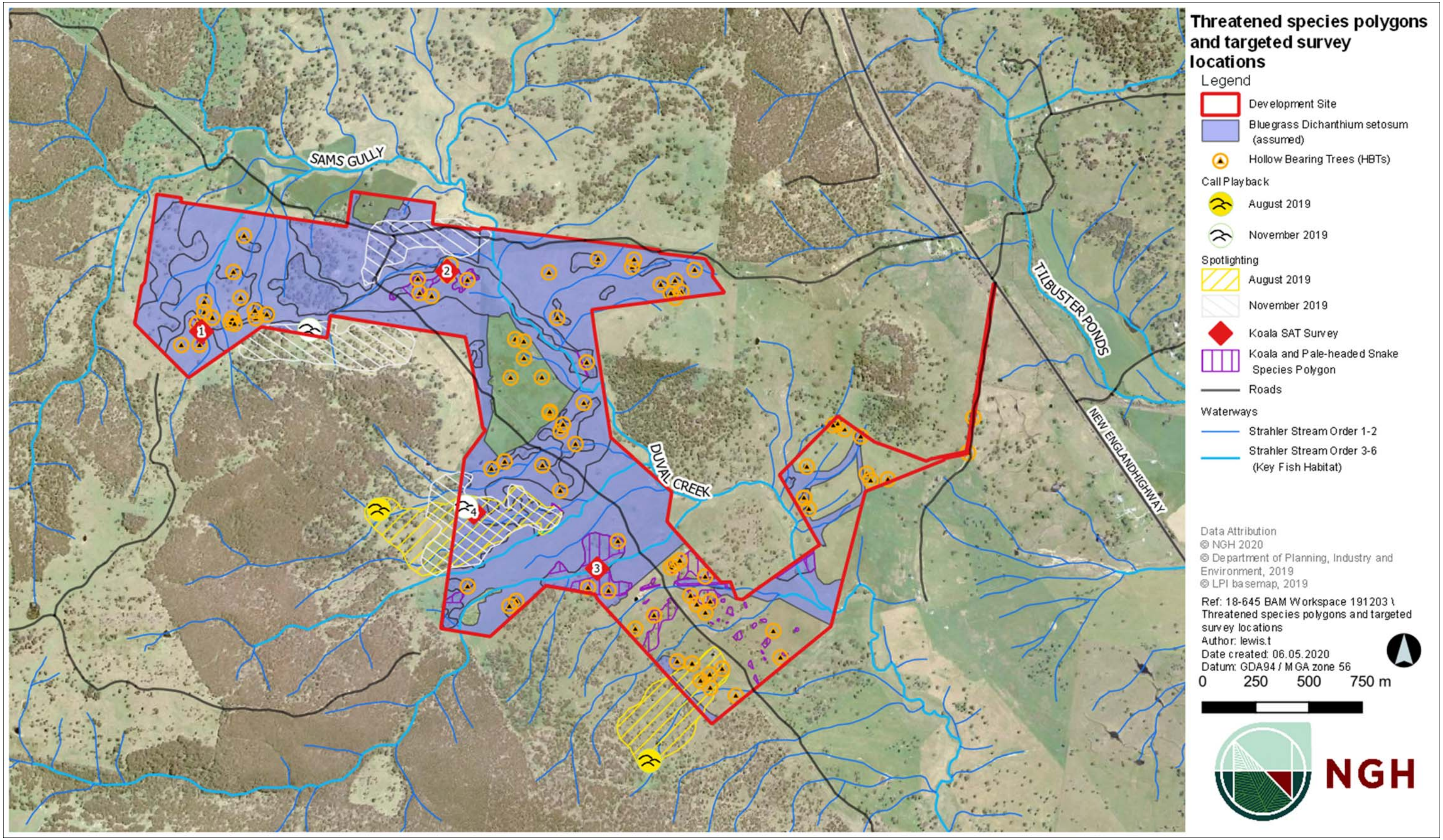

Figure 7-1 Threatened species polygons and targeted survey locations

Commonwealth matters

An EPBC Act protected matters report was undertaken on 2 October 2019 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. Relevant to biodiversity, these include:

- Wetlands of International Importance
- Threatened Ecological Communities
- Threatened species
- Migratory species

One community and two species have been identified as relevant to the proposal and are discussed below.

7.1.1. Existing environment

Site description

The majority of the development site has been cleared of native vegetation, and purposed for stock grazing, which is the dominant land use in the area. About 241.2 ha of native vegetation occurs within the development site, comprised of:

- 55.2 ha of treed areas dominated by Broad-leaved Stringybark *Eucalyptus caliginosa*. This community generally occurs in higher elevations and may be associated with rock outcropping. Where it extends into lower lying areas, Yellow Box and Blakely's Red Gum are common associates. Scattered trees over Category 1 land (see below) and Category 2 land that has been cropped also occur.
- 23.5 ha of treed areas dominated by Yellow Box and Blakely's Red Gum on valley floors. Scattered trees over Category 1 land (see below) and Category 2 land that has been cropped also occur.
- 6 ha of dry sclerophyll forest where Tenterfield Woollybutt *Eucalyptus Banksia* occurs with Stringybarks, Yellow Box and Blakely's Red Gum.
- 156.5 ha of modified and grazed grasslands, derived of the communities above, that have a long history of grazing and pasture improvement.
- About 68.8 ha of non-native occurs including exotic vegetation, cropped Category 1 exempt lands and cropped Category 2 lands.

Plant Community Types (PCTs) and zones

Three PCTs were identified within the development site:

- PCT 567: Broad-leaved Stringybark – Yellow Box shrub/grass open forest of the New England Tableland Bioregion
- PCT 575: Tenterfield Woollybutt – Silvertop Stringybark open forest of the New England Tableland Bioregion
- PCT 704: Blakely's Red Gum – Yellow Box grassy open forest or woodland of the New England Tableland Bioregion

All areas of PCTs 567 and 704 are considered to constitute the BC Act listed community *White box Yellow box Blakely's red gum woodland*. Some areas are considered to constitute the federally listed counterpart

White box – Yellow box – Blakely's red gum grassy woodlands and derived native grasslands. PCT 575 does not constitute a state or federally listed community.

PCTs and TEC's within the Development Site are shown in Figure 7-2 below.

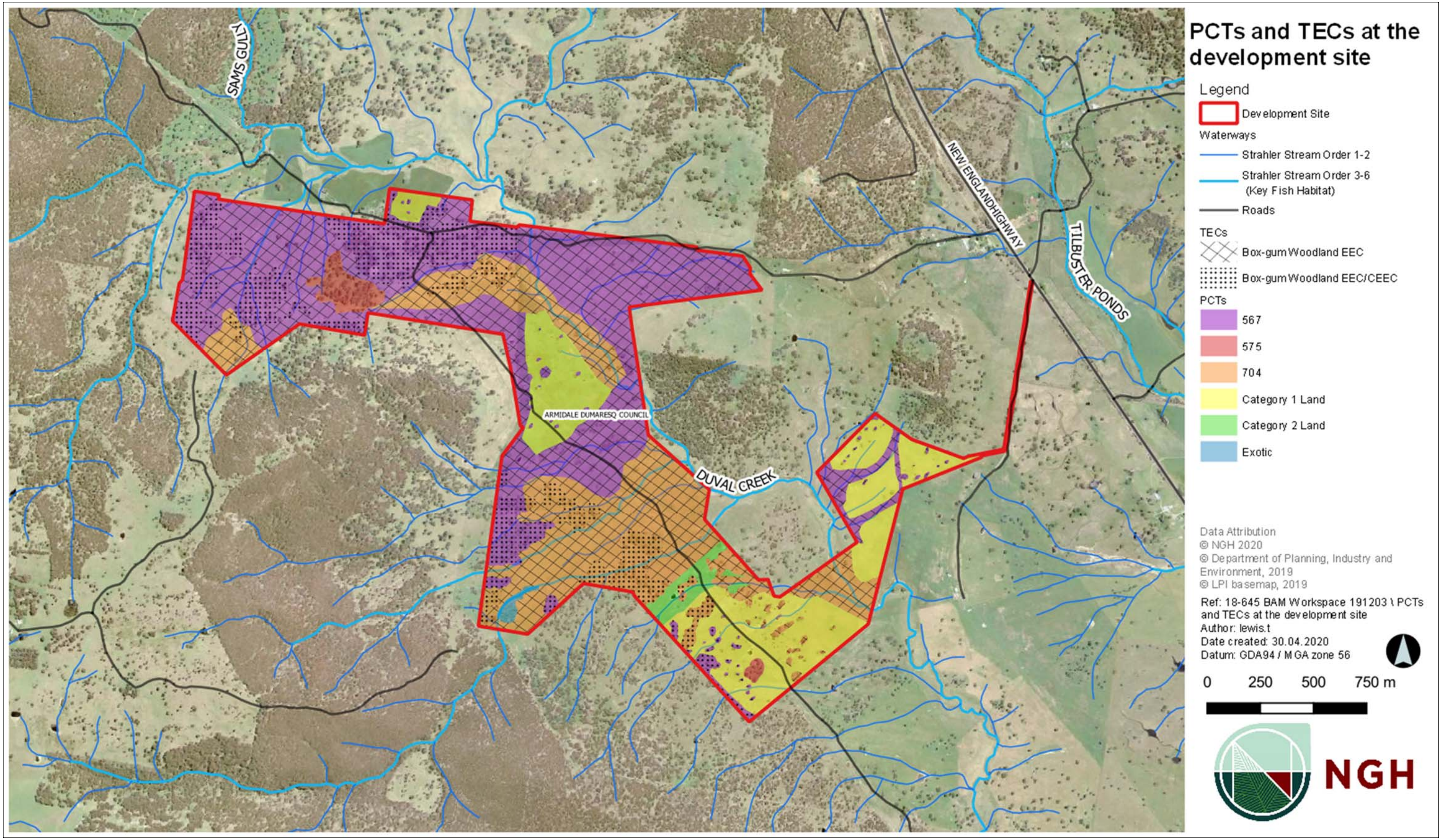

Figure 7-2 PCTs and TECs within the Development Site.

Threatened species

No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to the ecosystem credit requirement for the proposal.

The candidate species listed below were generated by the BAM and are those that are considered to have habitats present at the development site. Details of the survey methodologies and results are provided in the BDAR.

Of all the candidate species surveyed, two species credits species, Southern Myotis *Myotis macropus* and Koala *Phascolarctos cinerus*, were recorded during target surveys in November 2019. Tow further species credit species, Pale-headed Snake *Hoplocephalus bitorquatus* and Bluegrass *Dichanthium Setosum*, were not surveyed for and are assumed to occur based on habitat presence, albeit sub-optimal. For all other species either lack of habitat constraints or targeted survey has justified that they can be excluded from the assessment. These four generate species generate a species credit requirement, based on their estimated habitat areas onsite (defined by species polygons, areas shown below).

Table 7-1 Summary of species credit species requiring surveys and survey results

Species Credit Species	Biodiversity risk weighting	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Bertya ingramii Narrow-leaved Bertya	3	Surveyed November 2019	No	NA
Boronia granitica Granite Boronia	2	Surveyed November 2019	No	NA
Burhinus grallarius Bush Stone-curlew	2	Surveyed November 2019	No	NA
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	2	Surveyed August 2019	No	NA
Dichanthium setosum Bluegrass	2	Assumed to occur	Yes	120.1 ha
Eucalyptus magnificata Northern Blue Box	2	Surveyed August 2019	No	NA
Eucalyptus nicholli Narrow-leaved Black Peppermint	2	Surveyed August 2019	No	NA

Species Credit Species	Biodiversity risk weighting	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	2	Surveyed August 2019	No	NA
Hieraaetus morphnoides Little Eagle (Breeding)	1.5	Surveyed August 2019	No	NA
Hoplocephalus bitorquatus Pale-headed Snake	2	Assumed to occur	Yes	12.6 ha
Lophoictinia isura Square-tailed Kite (Breeding)	1.5	Surveyed November 2019	No	NA
Myotis macropus Southern Myotis	2	Surveyed November 2019. Recorded during survey.	Yes	57.2 ha
Ninox connivens Barking Owl (Breeding)	2	Surveyed August 2019	No	NA
Petaurus norfolcensis Squirrel Glider	2	Surveyed August and November 2019	No	NA
Phascolarctos cinereus Koala (Breeding)	2	Surveyed August and November 2019 Recorded during November 2019 survey	Yes, sections of the development site containing higher frequency of feed trees considered to constitute important habitat for breeding	12.6 ha
Tyto novaehollandiae Masked Owl (Breeding)	2	Surveyed August 2019	No	NA

7.1.2. Potential impacts

Direct and indirect impact types

Potential impacts to biodiversity during the construction and operational phases are anticipated to include:

- Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)
- Displacement of resident fauna
- Injury or death of fauna
- Disruption to connectivity
- Removal of habitat features e.g. 86 hollow-bearing trees
- Shading by solar infrastructure
- Existence of permanent solar infrastructure
- Impact to geological features

Indirect impacts of the proposal are anticipated to include:

- Inadvertent impacts on adjacent habitat or vegetation
- Reduced viability of adjacent habitat due to edge effects
- Reduced viability of adjacent habitat due to noise, dust or light spill
- Transport of weeds and pathogens from the site to adjacent vegetation
- Increased risk of starvation, exposure and loss of shade or shelter
- Loss of breeding habitats
- Rubbish dumping
- Earthworks and mobilisation of sediments
- Increase risk of fire

Biodiversity impacts have been assessed at a worst-case scenario, based on detailed plans that have been revised and altered with a reduction in impacts to higher quality vegetation. Consideration has been given to avoiding and minimising impacts to biodiversity where possible during the design revision. Design options have been assessed against key environmental, social and economic criteria. Mitigation and management measures will be put in place to adequately address impacts both direct and indirect impacts.

Prescribed impacts

The following prescribed biodiversity impacts are relevant to the proposal:

a) Impacts of development on the habitat of threatened species or ecological communities associated with:
   - karst, caves, crevices, cliffs and other geological features of significance, or
   - rocks, or
   - non-native vegetation

The removal of Red Rock is not considered to impact the persistence of any threatened species or communities as none are considered likely to utilise this habitat or rely on it.

b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

The treed areas that would be impacted by the proposal generally have inconsistent canopies which fail to connect areas of habitat surrounding, and that encroach on the development site. As such, these patches are unlikely to be utilised for movement across arrange by threatened species that require a contiguous canopy for traversal such as gliders. For these species, consistently treed areas surrounding that development site are more likely to be used. Therefore, the removal of treed areas proposed, whilst constituting a reduction in habitat varyingly connected to higher quality habitat outside the development site, is considered unlikely to encumber threatened species such as arboreal mammals from moving across their range.

As the development site would be fenced by 2 m high chain wire fencing, threatened species that may utilise the ground for traversal such as Koala, would be hindered from doing so. Mitigation measures proposed, including Koala friendly fencing, would mitigate this impact. However, some disruption to the present movement of individuals, whose home ranges may intersect with the development site, is unavoidable.

The proposal is not considered likely to prevent highly mobile threatened species such as avifauna and microbats from moving across their range.

c) Impacts of development on movement of threatened species that maintains their life cycle

For highly mobile threatened species such as birds and microbats, the degree of vegetation removal proposed is considered unlikely to impede such species from undertaking any movement that maintains their life cycle. Several individual Koala may have home ranges that overlap with the development site. Though this movement would be hindered via fencing generally, Koala friendly fencing would mean that this movement would not be prevented absolutely. It is considered unlikely that movement of Koala would be impeded to such a degree that the bioregional persistence of the species is impacted. The proposal is not considered likely to prevent highly mobile threatened species such as avifauna and microbats from carrying out the movement that is required to complete their life cycle.

d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)

A hydrological assessment completed for the proposal (Footprint 2020), did not predict a significant impact on flood behaviour within the floodplain as a result of the proposal, as flood levels, depths, velocities and hazards remaining relatively would remain relatively unchanged. Nevertheless, there is be some small change in the hydrology of the development site, however, this is considered unlikely to greatly detriment the threatened species and ecological community present.

e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Vehicle strikes, to threatened species such as Koala, are not considered to be a likely occurrence. Should they occur in isolation as a worst case scenario, they are unlikely to have substantive consequences on the local and bioregional persistence of Koala.

Potential Serious and Irreversible Impact Entities

One threatened ecological community listed as a potential SAII entity in the Guidance to assist a decision-maker to determine a serious and irreversible impact would be impacted by the proposal; White Box-Yellow Box- Blakely's Red Gum Woodland (Box-gum Woodland EEC). Up to 126.5 ha of Box-gum Woodland EEC would be impacted by the proposal. No threshold has yet been defined by DPIE for the extent of Box-gum Woodland EEC to be removed that constitutes a serious and irreversible impact. An assessment against the SAII criteria is provided in the BDAR.

There are no SAII candidate species recorded at the development site.

No further species were considered to be potential SAII entities.

Offset requirement

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

- 78 ha of PCT 567, generating 422 ecosystem credits
- 0.9 ha of PCT 575, generating 14 ecosystem credits
- 48.5 ha of PCT 704, generating 185 ecosystem credits.

The recorded or assumed presence of these species credit species generated the following species credits:

- 564 species credits for Bluegrass for the proposed removal of 120.1 ha of assumed habitat
- 185 species credits for Pale-headed Snake for the proposed removal of 12.6 ha of assumed habitat
- 185 species credits for Koala for the proposed removal of 12.6 ha of breeding habitat
- 228 species credits for Southern Myotis for the proposed removal of 57.2 ha of habitat.

Commonwealth matters

All areas of PCTs 567 and 704 are considered to constitute the BC Act listed community *White box Yellow box Blakely's red gum woodland*. Some areas are considered to constitute the federally listed counterpart *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*. PCT 575 does not constitute a state or federally listed community.

An additional assessment of impacts on entities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was completed for:

- Koala
- Bluegrass
- Greater Glider *Petauroides volans*
- *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*

These impacts have been assessed in accordance with the EPBC Act guidelines and in the case of Greater Glider and Koala, referral to the Federal Department of Environment is recommended on the basis of the proposal potentially resulting in a significant impact to either or both species. Supplementary SEARs were addressed as part of the BDAR. In the cases of Koala and Greater Glider, the proposal is considered to have the potential to generate a significant impact and are considered to require offsets. A significant impact to Bluegrass was not concluded to be likely, based on the assessment undertaken pursuant to the EPBC Act, and therefore offsets are not proposed. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval. The BOS is endorsed by the Commonwealth for offsetting threatened entities.

7.1.3. Safeguards and mitigation measures

Table 7-2 Safeguards and mitigation measures for biodiversity impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Avoid critical life cycle events: • Where practicable, hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts	C		

ID	Safeguards and mitigation measures	C	O	D
	• If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur			
2	Clearing protocols to include: • Pre-clearing checklist • Tree clearing procedure • Staged habitat removal • Unexpected threatened species finds procedure • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance	C		
3	Relocate habitat features: • Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	C		
4	Manage noise impacts: • Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		
5	Reduce impacts of light spill • Avoid Night Works • Direct lights away from vegetation	C	O	
6	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operation activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	C		
7	Program construction activities to avoid impacts: • Where practicable, time construction activities outside Koala breeding season • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur	C		

ID	Safeguards and mitigation measures	C	O	D
8	Protect significant environmental features: • Fencing from buffer of riparian zones and drainage lines	C		
9	A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: • Management protocol for declared priority weeds under the *Biosecurity Act 2015* during and after construction • Weed hygiene protocol in relation to plant, machinery, and fill • The weed management procedure would be incorporated into the Biodiversity Management Plan.	C	O	
10	Staff training and site briefing to communicate environmental features: • Site induction • Toolbox talks • Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	C	O	
11	Preparation of a Construction Flora and Fauna Management Plan that would include protocols for: • Protection of native vegetation to be retained • Best practice removal and disposal of vegetation • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist • Weed management • Unexpected threatened species finds • Rehabilitation of disturbed areas	C		
12	Protect connectivity: • No use of barbed wire fencing as it provides a hazard to fauna such as Koala, Greater Glider and microbats • Fencing adjacent to areas of the development site that are connected to areas of bushland outside the development site are to include Koala friendly structures to aid traversal of Koala across their range	C		
13	Fencing to protect features: • Fencing from buffer of riparian zones, drainage lines and farm dams to be retained • Development site to be fenced entirely during construction and operation	C	O	

7.2. ABORIGINAL HERITAGE

Aboriginal heritage sites are likely to be present within the Proposal area. As such, the Proposal will likely impact on Aboriginal heritage sites and objects which are protected under the NSW *National Parks and Wildlife Act 1974* (EP&A Act). In accordance with the SEARs, an Aboriginal Cultural Heritage Assessment (ACHA) has been prepared to assess the presence or absence of Aboriginal objects, their significance and the potential for the Proposal to impact these sites.

7.2.1. Approach

A specialist ACHA was undertaken by NGH (Appendix F.) to provide an assessment of the Aboriginal cultural values associated with the Tilbuster Solar Farm (Proposal) site and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded.

The full report is provided in Appendix F and is summarised below. Note: unless stated otherwise, the assessment below considers the full scope of works proposed as per the development footprint provided by Enerparc.

The ACHA Report was prepared in line with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) .
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010a)
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (DECCW, 2010b)

The consultation with Aboriginal stakeholders was undertaken in accordance with clause 60 (formerly 80C*) of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the (ACHCRP) guide. The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix F. As a result of this process, seven Aboriginal organisations or individuals contacted the consultant to register their interest in the Proposal . The groups who registered interest were:

- Nunnawanna
- Iwatta Aboriginal Corporation
- Nyakka Aboriginal Culture Heritage Corporation Archaeological & Cultural Heritage Consultants
- Cheryl Kitchener
- Anaiwan Traditional Owners Aboriginal Corporation
- Larissa Ahoy
- Garby Elders

A project methodology was provided for comment, which was provided to the above registered Aboriginal parties (RAPs) as well as Armidale Local Aboriginal Land Council. An archaeological survey was then undertaken in September 2019, which identified that surface artefact densities were moderate to high and the team determined that additional survey as well as a limited test excavation programme was required in order to adequately assess the Proposal area. An amended methodology for the completion of the additional works was then provided to the RAPs and Armidale LALC, after which, the additional fieldwork was undertaken in November 2019. Representatives of three groups: Nunnawanna, Iwatta and Nyakka participated in the fieldwork with two NGH archaeologists each day. A copy of the draft ACHA report was provided to the registered Aboriginal parties for review and comment on 1 June 2020 and any comments received (refer Section 6.2.1) were incorporated into the final ACHA report. The final report is provided at Appendix F.

7.2.2. Archaeological context

The assessment included a review of the relevant information available for the Proposal area relating to the existing landscape of the Proposal area. Included in this was a search of the AHIMS database which identified 15 registered sites within five kilometres of the Proposal Site, within one less than 300 metres from the northern boundary. No previously registered sites were identified within the Proposal Site.

The results of previous archaeological surveys in close proximity to the Proposal area show that there are sites and artefacts present throughout the landscape. There is a notable dominance of artefacts either as isolated finds or artefact scatters. There appears to be a pattern of site location that relates to the presence of potential resources for Aboriginal use, in particular the local area contains a wide variety of suitable raw stone materials of the manufacture and maintenance of stone tools. The Aboriginal site modelling for the region to date suggests that while Aboriginal sites may be expected throughout all landscapes the most archaeologically sensitive areas occur in proximity to water courses on the wooded (or formerly wooded) ridges which provide elevated locations suitable for camping.

The Aboriginal land use of the area has been subject to a large number of studies, undertaken both as a result of development projects as well as academic or community research. However, much of this work is still ongoing and currently inaccessible. It is possible however, to ascertain that proximity to raw materials and resources was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the current archaeological record of that activity is currently limited.

A detailed understanding of Aboriginal land use of the project area is lacking, as few in depth studies completed in the local area are accessible. It is possible, however, to ascertain that proximity to water sources and raw materials was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the current archaeological record of that activity is limited.

Solar farm developments are proceeding throughout the south eastern Australian landscape. The majority of these projects are based in landscapes similar in topography to the current project area. These landscapes also mainly consist of grids of panels located on broad, level paddocks, set away from the riparian zone, though they are still within less than 200 metres of water courses.

Per the results of Godwin’s studies, it is noted that proximity to water is one of the defining factors for the presence of sites containing higher densities of artefacts (Godwin, in Appleton 1990). Results from the work of Appleton and predecessors including McBryde (1977) indicate that the most common site type in the region is surface artefact sites, with closed sites such as shelters occurring only on the scarps and slopes of the upper slopes areas.

Appleton (2000:30, as cited in Davies 2002) notes, for the New England region, that the majority of sites are stone artefact sites including scatters and isolated finds, located in the following contexts:

- In proximity to geological outcrops or deposits of suitable raw material resources such as quartz, quartzite, jasper, silcrete, chert, chalcedony, metamorphosed greywacke and other siliceous sedimentary rocks, or redeposited fine grained volcanics;
- Adjacent to watercourses including rivers, creeks or gullies, especially junctions of watercourses, which contain raw materials as listed above; or
- On ridges and spurs, or other locations with views over watercourses, waterholes or swamps, or over access routes of the area such as saddles.

Based on this information, it is assessed that the Tilbuster Solar Farm Proposal area has moderate to high potential to contain Aboriginal objects, particularly in association with the raised spurs and low ridges adjacent to Duval Creek. This section of Duval Creek is in proximity to a number of outcrops of notable raw stone materials including quartz, silcrete and jasper. The creek itself also contains a gravel bed likely to include suitable stone materials.

7.2.3. Potential impacts

The Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 150 MW (AC) to be supplied directly to the national electricity grid. The installation of the arrays will involve extensive ground surface disturbance, as will the construction of site facilities such as operations buildings, parking perimeter fencing, access tracks throughout the site, and the planting of vegetation screens.

The assessment of the significance of Aboriginal archaeological sites is currently undertaken largely with reference to criteria outlined in the ICOMOS Burra Charter (Marquis-Kyle and Walker 1994). The survey participants agreed that all sites hold cultural value to the Aboriginal community, with particular reference to a number of significant cultural sites located close to the Proposal area in association with Mt Duval and other landmarks. The impact to the scientific values of the 77 artefact sites and nine trees if they were to be impacted by the Proposal is considered moderate to high. There were no aesthetic values and no historic values identified in association with the Proposal area however the location does present an opportunity for education of the general public to the Aboriginal occupation and use of the area.

An assessment of the proposed development footprint has identified that of the total number of sites, 45 are within the proposed impact zones of the array and site facilities, including 23 isolated finds, 18 artefact scatters and three scarred trees and one cultural tree. Table 7-3below outlines the impacts to the known sites within the Proposal area, based on the information provided.

Table 7-3 Identified Risk to Sites

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Tilbuster Solar Farm IF1	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF2	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF3	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF4	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF7	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF8	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Tilbuster Solar Farm IF9	Low	Nil	N/a	N/a	Include within fencing of ST1. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF10	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF11	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF12	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF13	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF14	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF15	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF16	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF18	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF19	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF21	Low	Nil	N/a	N/a	No action required. Current fencing must remain.
Tilbuster Solar	Low	Nil	N/a	N/a	No action required. Current fencing must remain.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Farm IF22					
Tilbuster Solar Farm IF23	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF24	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF25	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF26	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF27	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF28	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF29	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF30	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF31	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF32	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF33	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Tilbuster Solar Farm IF34	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF35	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF36	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF37	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF38	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF39	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF40	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF41	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF42	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF43	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF44	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Farm IF45					
Tilbuster Solar Farm IF46	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF47	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF48	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF49	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF50	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm IF51	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF52	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm IF53	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS1	Moderate	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS2	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS3	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Tilbuster Solar Farm AS4	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS5	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS6	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS7	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS8	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS9	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS10	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS11	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS12	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS13	Low	Nil	N/a	N/a	No action required. Current property fencing must remain. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS14	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Farm AS15					
Tilbuster Solar Farm AS16	Moderate	Direct	Partial	Partial loss of value	Salvage objects within footprint prior to development. Property fencing must remain to protect remainder of site.
Tilbuster Solar Farm AS17	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS18	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS19	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm AS20	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS21	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS22	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS23	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS24	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS25	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS26	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Tilbuster Solar Farm AS27	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
Tilbuster Solar Farm AS28	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm ST1	Moderate-High	Nil	N/a	N/a	Fencing with a buffer of 5m minimum to be placed around site (including IF9).
Tilbuster Solar Farm ST2	Moderate-High	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm ST3	Moderate-High	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm ST4	Moderate-High	Indirect	Total	Total loss of value unless fencing clearly demarcates you cannot work within 5m of this area	Fencing with a buffer of 5m minimum to be placed around site
Tilbuster Solar Farm ST5	High	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.
Tilbuster Solar Farm ST6	Moderate-High	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.
Tilbuster Solar Farm CT1	Low (note the site is of cultural significance)	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
Tilbuster Solar Farm CT2	Low (note the site is of cultural significance)	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.
Tilbuster Solar Farm CT3	Low (note the site is of cultural significance)	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.

7.2.4. Safeguards and mitigation measures

A series of site-specific safeguards have been developed to manage the cultural heritage impacts of the proposal.

Table 7-4 Safeguards and mitigation measures for impacts to heritage

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A cultural heritage management plan must be prepared for the protection and management of the following sites to be impacted: IF1,2,3,4,7,10 11, 14, 15, 16, 19, 23, 24, 25, 26, 27, 29, 32, 34, 35, 36, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50.. This should be prepared prior to construction and will be relevant for all phases of the project. Approval to be gained for the **surface salvage** of these sites. This must occur prior to construction.	C		
2	A cultural heritage management plan must be prepared for the protection and management of all IFs outside the impact zone (8, 9, 10, 11, 18, 30, 31, 33, 38, 39, 51, 52, 53, 54), This should be prepared prior to construction and will be relevant for all phases of the project. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and **must therefore <u>not</u> be impacted by incidental activity.**	C	O	D
3	A cultural heritage management plan must specify that current fencing must remain and IF21 and IF22 will not be impacted. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and must therefore not be impacted by incidental activity.	C	O	D
3	A cultural heritage management plan must be prepared for the protection and management of all artefact scatters to be impacted (AS 2, 3, 4, 5, 6, 7,10, 11, 12, 14, 15, 17, 20, 21, 22, 23, 24, 25, 27). This should be prepared prior to construction and will be relevant for all phases of the project. Approval to be gained for the **surface salvage** of the sites. This must occur prior to construction. Monitoring of topsoil removal at sites AS24 and 25 is likely to be requested by RAPs.	C		
4	A cultural heritage management plan must be prepared for the protection and management of all artefact scatters to be impacted (AS16). This should be prepared prior to construction and will be relevant for all phases of the project. Approval to be gained for the **surface salvage of the objects within the design footprint for AS16.** This must occur prior to construction. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and **must therefore not be**			

ID	Safeguards and mitigation measures	C	O	D
	impacted by incidental activity (part of AS16 not within the development footprint).			
5	A cultural heritage management plan must be prepared for the protection and management of all AS outside the impact zone (AS1, 8, 9, 13, 18, 19, 26, 28). This should be prepared prior to construction and will be relevant for all phases of the project. For fencing to be constructed in proximity to AS1, a RAP should be present during the construction process for this area to ensure protection of the site. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and **must therefore <u>not</u> be impacted by incidental activity.**	C	O	D
6	A cultural heritage management plan must be prepared for the protection and management of all ST and CTs outside the impact zone (ST2, and CT1 and CT3), This should be prepared prior to construction and will be relevant for all phases of the project. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and **must therefore <u>not</u> be impacted by incidental activity.**	C	O	D
7	A cultural heritage management plan must be prepared for the protection and management of ST, 5, 6 and CT2. This should be prepared prior to construction and will be relevant for all phases of the project. It is recommended that the proposed design is modified to exclude any impact to these sites plus a 5m buffer surrounding each of them. However, if this is not possible further negotiation with RAPs is required regarding this issue.	C		
8	A cultural heritage management plan must be prepared for the protection and management of ST1 and ST4)... This should be prepared prior to construction and will be relevant for all phases of the project. Fencing to be placed a minimum of five metres from these sites in order to prevent any impacts to the scar or the health/condition of the trees. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and must therefore not be impacted by incidental activity.	C	O	D

7.3. LAND AND SOIL ASSESSMENT

7.3.1. Approach and methods

Impact on land capability and resource values of the Proposal Site and locality have been assessed with reference to a site inspection and the following resources:

- NSW Land and Soil Capability Assessment Scheme.
- NSW eSPADE and SEED portal information databases.
- Primefact 1063 Infrastructure proposals on rural land.
- Biophysical Strategic Agricultural Land and Important Agricultural Land identification processes.
- Landholder, ABS and ABARES agricultural production.

7.3.2. Existing environment

Topography and geology

The topography of the Proposal Site is generally undulating with forested hills boarding the site. The elevation is typically between 1050 – 1150 m Australian Height Datum (AHD). The Proposal Site is bound by steep terrain to the north and west with a 20% gradient and ridgeline elevations of approximately 1160 – 1260 m AHD. Native vegetation has been removed from much of the area, particularly within the broad open valleys which tend to be dominated by grasses and used for pastoral purposes.

The Proposal Site located within the Armidale Plateau IBRA subregion. The Armidale Plateau subregion is characterised by and undulating plateau at around 1100 metres with broad valleys, stepped landscape across basalt flows with valleys steepening towards the Great Escarpment Gorges. Geology of the plateau is characterised by fine grained permo-carboniferous sedimentary rocks, multiple tertiary basalt flows and granites.

The New England Geological Map (1:500 000 1973/333) indicates the geology underlying the Proposal Site consists of Permian and Carboniferous Geological sequences. The northern component of the Proposal Site is within the Dummy Creek Conglomerate (Pd) and the southern component in the Sandon Beds Formation (cs).

- Pd Dummy Creek conglomerate: comprising pebble conglomerate, coarse sandstone and massive mudstone
- Cs Sandon Beds: comprising greywacke, claystone, chert, jasper and black volcanic.

A contrast in soils of the subregion is evident through the friable well drained soils on the upper slopes and compact poorly drained soils of the lower slopes. Soil types vary between black earths along valley floors, inconstant stony loams and dark loamy alluvium in swampy valleys (DE&E 2016).

In general, the Proposal Site is characterised by 'Dingo Spur Meta-sediments' (DSM) according to the landscape information provided by Mitchell (Mitchell Landscapes) (DECC, 2002), a description for which is provided in Table 7-5.

Table 7-5 Description of the Dingo Spur Meta-sediments (Dsm) (DECC, 2002)

Dingo Spur Meta-sediments
Steep ranges and hills intersected by a dendritic drainage pattern leading into deep gorges with high waterfalls on the Great Escarpment, extends west onto the tablelands. Gorges incised into faulted, steep dipping Devonian quartzose sandstone, greywacke, massive argillite and slate. Tablelands area on Permo-Carboniferous mudstone, lithic sandstone, tuff, slate, hornfels and some schist. General elevation 300 to 1400m, local relief 600m. Shallow stony loam on steep scree slopes with moderate organic content. Shallow gradational loam and sandy loam elsewhere with deeper uniform profiles in low valleys.

Australian Soil Classification

Four soil types occur across the subject land. Soil types are described in Table 7-6 and shown in Figure 7-3.

Table 7-6 Australian Soil Classification relevant to the Proposal Site

Soil type	Characteristics and limitations
Kurosols, natric	• Generally have a weak structure in the surface with a firm to hardsetting surface condition. • Strongly acidic subsoils. • Sometimes dispersive in the subsoil. • Potential for high salt levels, resulting in scalding and erosion risk. • Generally low to moderate fertility. • Poorly to moderately drained with low plant available water holding capacity.
Kurosols	• Generally have a weak structure in the surface with a firm to hardsetting surface condition. • Strongly acidic subsoils. • Sometimes dispersive in the subsoil. • Potential for high salt levels, resulting in scalding and erosion risk. • Generally low to moderate fertility. • Poorly to moderately drained with low plant available water holding capacity.
Vertosols	• Well – structured surface with a surface condition that is self-mulching, cracking, firm and sometimes crusting. • High shrink-swell properties. • Dispersive subsoils (unless formed on dolomite or limestone). • Potential for high salt levels in subsoils. • Often very fertile.
Kandosols	• Generally loose to firm surface. • Generally not dispersive. • contain very low salt levels. • Low to moderate fertility. • Dominantly neutral pH and well drained. • Readily degrade to produce dusty conditions.

During a site inspection undertaken on 14 August 2019 the following were observed:

- Low groundcover due to drought conditions (Figure 7-5);
- Extensive gully erosion of Duval Creek Banks (Figure 7-4);
- No evidence of salinity; and
- Area mapped as ASC Vertosols appear degraded (Figure 7-7).

This site inspection was undertaken during drought conditions and groundcover across the Proposal Site was low. An additional site inspection was carried out on 19 February 2020 during which groundcover was greater following heavy rainfall.

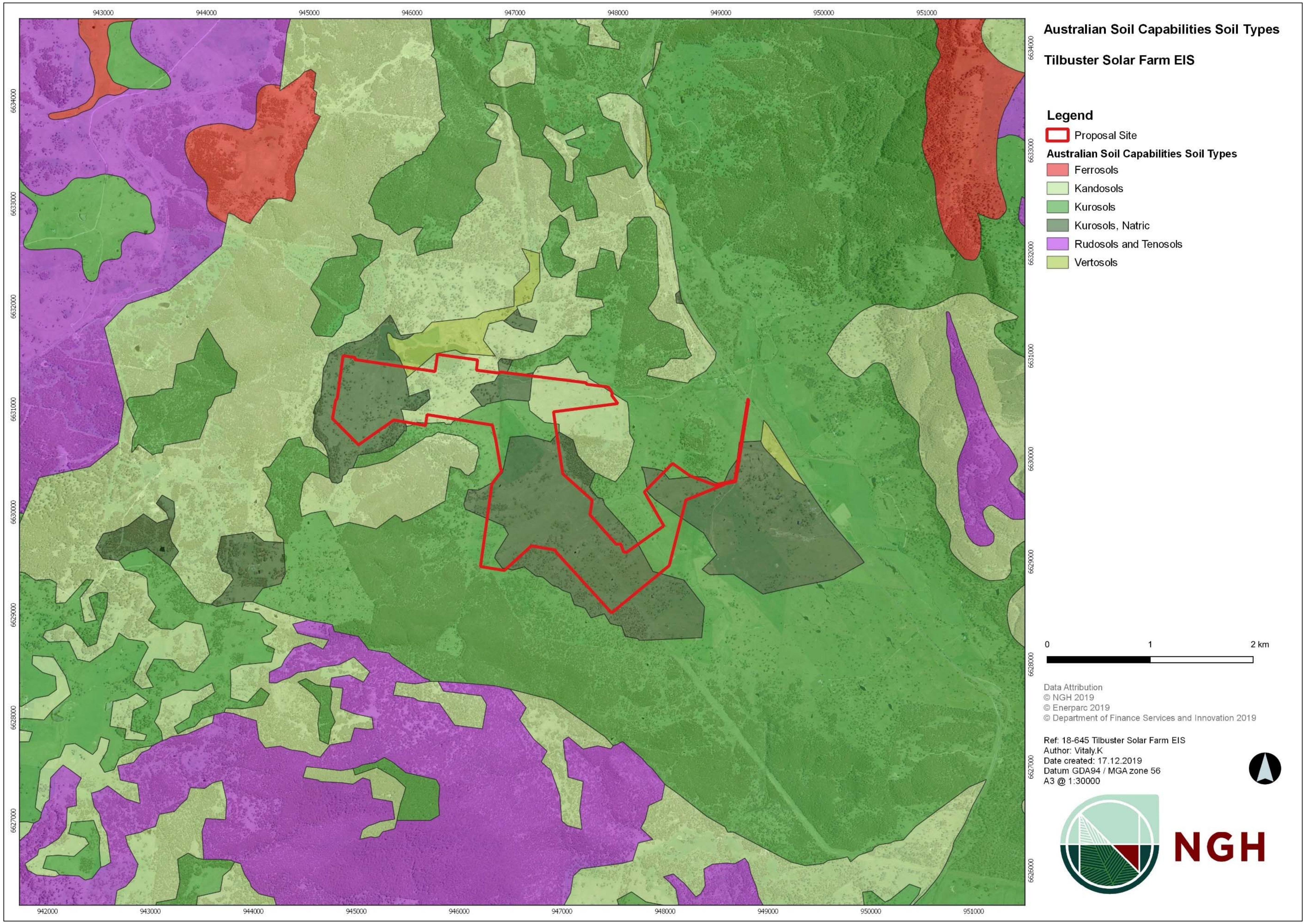

Figure 7-3 Australian Soil Classification associated with the Proposal Site.

Figure 7-4 Gully erosion observed in the south western portion of the site within Duval Creek in area mapped as ASC Kurosols, natric.

Figure 7-5 Central portion of the site showing low ground cover, within area mapped as ASC Kurosol.

Figure 7-6 Western portion of the Proposal Site in area mapped as ASC Kandosols.

Figure 7-7 Northern portion of the Proposal Site in area mapped as ASC Vertosols.

Contamination

A search of the Environmental Protection Authority (EPA) Section 60 of the Contaminated Lands Management (CLM) Act, list of notified sites was conducted on the 23 September 2019 and identified six sites within the Armidale LGA, the closest of which located approximately 9.3 km south of the Proposal Site.

A search of Section 58 of the CLM Act record of notices was conducted on the 23 September 2019 and identified no sites within the Armidale LGA.

It is noted that the site has a history of agricultural land use and as such, agricultural sites may contain buried rubbish including contaminants such as herbicides that may be encountered during excavation. No indications of potential sources of contamination were identified during the site assessment.

Acid Sulfate Soil

The Australian Resource Information System (ASRIS) database indicates there is a low probability of acid sulfate soils occurring within the Proposal Site

Land and soil capability

The Land and Soil Capability Assessment Scheme (OEH, 2012) provides land and soil capability (LSC) classes useful for broad-scale assessment of land capability. The eight classes describe land capability ranging from extremely high capability land (class 1) to extremely low capability land (class 8). A pre-determined set of biophysical land and soil features including landform position, slope gradient, drainage, climate, soil type and soil characteristics are used to determine potential land and soil hazards.

The hazard with the most limitations is used to determine the final LSC class (Table 7-7). These classes are used to inform long-term land management practices with the aim of ensuring degradation to soil, land, air and water resources does not occur.

The Proposal Site located on land mapped LSC Class 3 (high capability land), class 4 (moderate capability land), class 5 (moderate – low capability land) and class 6 (low capability land). An overview of the general description of the LSC classes present, and the proportion of which located in the Proposal Site is provided in Table 7-7.

Table 7-7 Land and Soil Capability classes within the Proposal Site.

LSC Class	Capability description	Area (ha) and percentage within the proposal site	Area (ha) and percentage within the development footprint
3	**High capability land:** Land has moderate limitations and is capable of sustaining high impact land uses such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However careful management of limitations is required for cropping and	0.64 (0.002%)	0.21 (0.001%)

LSC Class	Capability description	Area (ha) and percentage within the proposal site	Area (ha) and percentage within the development footprint
	intensive grazing to avoid land and environmental degradation.		
4	**Moderate capability land:** Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.	182.88 (59%)	112.58 (63.2%)
5	**Moderate–low capability land:** Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.	67.67 (21.8%)	40.30 (22.6%)
6	**Low capability land:** Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation	58.82 (19%)	25.58 (14.4%)

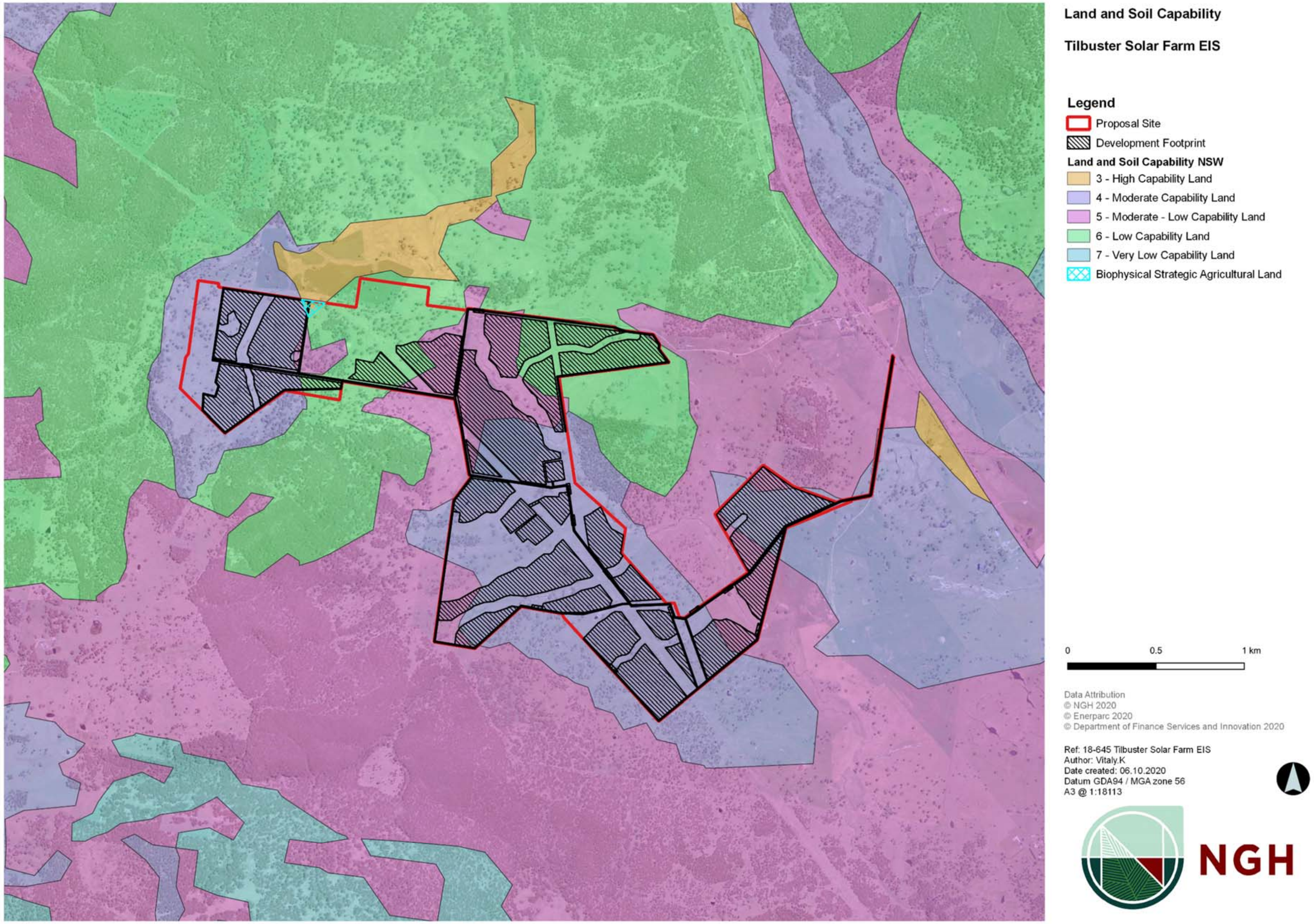

Figure 7-8 Land and Soil Capability associated with the Proposal Site

Biophysical Strategic Agricultural Land

Biophysical Strategic Agricultural Land (BSAL) is land which features the best quality soil and water resources and can sustain high levels of productivity. Similar to the land capability mapping, BSAL is not extensively ground truthed. The purpose of mapping BSAL is to ensure competing land use proposals on this category of land are managed effectively. Proposals for State significant coal seam gas or mining sites that occur on BSAL land are subject to an independent Gateway assessment of land and water impacts prior to lodgement of a DA. This Gateway assessment does not apply to solar plants.

The Proposal Site contains 0.64 ha of BSAL, equating to 0.21% of the solar farm site, which coincides with the LSC Class 3 mapped land in Table 7-7. It is noted that this mapping can be course and not ground truthed. Base line soil testing is a better indication of capability and will be undertaken to manage the remediation of disturbed areas during construction and in decommissioning.

During a site inspection undertaken on 14 August 2019, the area mapped as BSAL was rocky, had little groundcover and appeared to be in a degraded condition (Figure 7-7 and Figure 7-9). An existing farm access track traverses a portion of the area mapped as BSAL.

Figure 7-9 Area of Proposal Site mapped as Biophysical Strategic Agricultural Land.

Current land management on the site is dominated by sheep grazing. A small area of forage cropping and hay production from lucerne, and sown improved pasture comprised of barley grass, rye grass, oats and clovers for sheep feed is also present on the site. No sustained cropping is undertaken.

7.3.3. Survey results

The survey strategy was to cover as much of the ground surface as possible within the Proposal area. The surveys conducted for the purposes of this report were undertaken on the 24th and 25th of September and continued on the 11th of November through to the 15th of November 2019. Both surveys were undertaken by two NGH archaeologists, one representative from Nunnawunna Aboriginal Corporation, one representative from Iwatta Aboriginal Corporation and one representative from Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants. The survey followed a systematic approach walking transects in straight lines where possible within areas identified to have at least 70% visibility owing to severe drought, at a spacing between 20 and 30 metres. The shape of the project area and terrain resulted in transects of unusual shape as needed in order to achieve adequate coverage.

Owing to the high levels of visibility and subsequent sparse grass cover broader transects and more coverage of the Proposal area was achievable. Any mature trees within the Proposal area were also inspected for any evidence of Aboriginal scarring (c.f. Long 2005). Notes were made about visibility, photos taken, and any possible Aboriginal objects or features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

The project area was divided into three survey units based on landform: Lower slopes (characterising the majority of the Proposal area); Low-lying swamps; and Upper slopes.

On average visibility within the areas surveyed was very high and averaged more than 80%. Soils within the Proposal area consisted of a grey-brown silty sand which overlies a sandy clay, atop compact clay. Between the five survey participants present per day, over the course of the field surveys, approximately 20,270 metres (20.27 kilometres) of transects were walked across the Proposal area. Allowing for an effective view width of approximately five (5) metres per person, with 5 people present on all but a portion of one day (where one participant had a short absence), a total surface area examined of 496,750 square metres or approximately 49.68 hectares was covered. However, allowing for the visibility restrictions, the effective survey coverage overall is calculated to have been 39.74 hectares or 12.82% of the total Proposal area. Overall, it is considered that the archaeological survey programme achieved sufficient and effective coverage.

Over the course of the two survey periods, 49 isolated finds, 27 artefact scatters, six scarred trees and three cultural trees were identified and recorded. It should be noted that a small number of sites were identified and recorded outside the boundary of the project area where landforms containing artefacts were continuous and during attempts to access certain portions of the project area. These have been incorporated into the results as part of the survey unit to which they lay closest. In general, the majority of the project area comprised very shallow redeposited A horizon silty topsoils laying over very compacted B horizon silty clay.

While Duval Creek is a major stream in the local area, at present it is dry, with the exception of very small areas of moist soil within the gully. Additionally, tributaries of Duval Creek, a number of which are deeply incised and likely to contain water regularly outside of drought periods, were all dry. Numerous dead animals were observed adjacent to these streams and in the creek beds, likely having arrived there in search of water. This indicates that when healthy, Duval Creek and its tributaries form an important source of potable water that attracts flora and fauna which would have been important resources for past Aboriginal people during the last 5,000 years since the climate reached its current condition.

The initial two days of survey identified over 150 artefacts, scattered intermittently across the southern portions of the Proposal area, some clustered in scatters and others comprising isolated finds. During this survey it was also identified that one paddock containing two large artefact scatters, had moderate subsurface potential. As such, it was determined that a limited test excavation programme would be required in order to adequately assess the Proposal area for the purposes of an ACHA. No other areas were identified which contained intact A horizon soils across the Proposal area, likely a combined result of sheep grazing and drought, having caused significant erosion across the local area. The subsurface excavation was undertaken following the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. As such, the basic parameters of the investigation were limited to the methodology outlined in *the Code.*

A total of sixteen 50 cm × 50cm test pit were excavated. Test pits were numbered in sequential order as they were excavated. Two clusters of test pits were placed, one across the northern artefact scatter (AS25) and one towards the southern artefact scatter (AS24). AS24 included two transects of pits, running north to south and the southern cluster included four transects, running east west. Test pits were placed at approximate 20 metre intervals along each of the transects with some shifted to encompass a low order tributary of Duval Creek.

Across the 16 test pits excavated during subsurface investigation of the landform containing AS4 and AS5, nine pits contained artefacts. From all 16 test pits, a total of 4 m^2 was excavated and dry sieved. Test pits depth ranged from 20 centimetre to 40 centimetres, with the majority of test pits excavated to a depth of 30 centimetres below the surface. The total number of artefacts recovered from the test excavation programme was 32, averaging 8 per square metre. It was assessed that no further excavation was required as the site exhibited significant disturbance as a result of ploughing and none of the surface or subsurface artefacts present were assessed to be in situ.

The results of the archaeological survey and test excavation identified over 400 stone artefacts distributed across 76 site locations (including artefact scatters and isolated finds), as well as six scarred trees and three cultural trees. This is in keeping with the expected site types within the region, and the characteristics of the artefacts sites, specifically the dominance of a variety of silcrete types as the raw materials used in the manufacture of stone tools and the presence of backed artefacts, is also consistent with previous studies undertaken in the local area.

7.3.4. Potential impacts

Construction

Soil disturbance

The proposed disturbance area for the Proposal is approximately 178ha, which includes the infrastructure included in Figure 1-4.

The construction of the solar farm would disturb soils through the following activities:

- Establishment of internal access tracks.
- Decommissioning of dams currently on the site, which would involve filling the dams with soil excavated from other parts of the site.
- Removal of existing fences and construction of perimeter security fencing.
- Foundations for the inverter stations, substation and maintenance buildings.
- Establishment of temporary staff amenities and offices for construction.
- Levelling the ground for buildings and structures.
- Localised areas of earth works (cut and fill, grading and compacting) may be required in areas where there is sudden, significant changes in ground slope.
- Construction of internal access roads approximately 6 m in width.
- Excavation of cable trenches up to 1000 mm deep and 0.8 m wide.
- Installation of mounting structures (pile driven or screwed to a depth of approximately 2m).
- Vegetation clearance.

The soil disturbance has the potential to result in the following impacts:

- Reduce soil stability and increased susceptibility to erosion due to vegetation removal or soil exposure, especially if the subsoil is sodic and dispersive.
- Loss of topsoil and impacts on waterways due to increased erosion and sedimentation hazard.
- Reduced soil permeability and increased run-off as a result of soil compaction for internal access roads and hardstand areas.
- Risk of exposing buried contaminant (pesticides and hydrocarbons).

Soil disturbance and is anticipated to be minimal due to the low relief nature of the Proposal Site. The earthworks and excavations associated with the access tracks, buildings and cabling trenches would require removal of vegetation cover and soil disturbance in some areas. The pile driving or screwing of steel posts associated with the installation of arrays and the installation of security fencing would have a small discrete footprint at the pole location and is unlikely to result in substantial soil disturbance. Ground cover would be maintained where possible during the pre-construction and construction stages of the proposal, and would be rehabilitated upon decommissioning. Sheep grazing would be limited to the area within the development footprint as a maintenance strategy to reduce biomass and assist weed management. This would also provide an opportunity to rest, rehabilitate and improve land that has already been degraded by agricultural practices in the areas of the Proposal Site that are not within the development footprint.

Erosion and sedimentation impacts that may arise as a result of construction and decommissioning works can be minimised by carrying out the activities in accordance with the 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, 2008)
- *Volume 2C Unsealed Roads* (DECC, 2008)

Soil compaction occurring as a result of hardstand and access road construction and vehicle movements would reduce soil permeability; this may increase runoff and the potential for concentrated flows across the Proposal Site. Groundcover would be maintained beneath solar panels to control concentrated flows after heavy rainfall events.

Prior to commencement of construction, representative soil samples would be gathered as part of a specialist soil survey in order to establish baseline data on the existing agronomic characteristic of the soil. The survey would include sampling for soil texture and structure, nutrients, acidity and organic matter.

Operation

Soil disturbance

Impacts to soils during operation of the Proposal are expected to be minimal and would be limited to the following:

- Localised soil erosion under the panels from rainfall and cleaning water runoff if ground cover is not maintained beneath the array infrastructure. This is a risk if panels are fixed, but a low risk if panels are tracking. The risk is also influenced by rainfall and groundcover management.
- Ongoing erosion from disturbed areas such as unsealed tracks and drainage structures.

The potential for shading of the groundcover from the panels is considered to be low. As the panels would most likely be tracking, panels would not provide continuous shading. The microclimate created under the panels (reduced surface air movement, evaporation, and ground temperatures) is expected to offset the negative impacts of shading A species mix, which is tolerant of some shading and selected based on findings of the soil survey, would be used for the groundcover at the site. Potential responses to any persistent localised impacts under the array would include revegetation.

All areas disturbed during construction would have been rehabilitated, and groundcover would be established, monitored and maintained. As such, the risk to impact soils during operation are low. Soil stability and erosion throughout the site, including beneath the array, would be regularly monitored during the operation of the Proposal .

Decommissioning

When the solar farm is no longer viable, all above ground infrastructure, with the possible exception of the 330kV substation, would be removed and decommissioning and rehabilitation of the site would commence. The solar arrays would be removed and the steel piles on which they are supported, would be removed. Both the steel piles and the solar panels would be recycled, where possible. All buildings would be removed, including the PCUs together with the associated footings. Cabling would be removed where practical and recycled. Any cabling greater than 500 mm below the ground may be left in place since this would not impact on future agricultural activities on the site once the restoration is complete.

Groundcover management during decommissioning would be ensured through the development and implementation of a Ground Cover Management Plan.

Rehabilitation

Following decommissioning, rehabilitation of the site would be undertaken to restore the site to its pre-existing condition.

A Rehabilitation Plan associated with decommissioning activities would be developed and implemented with the objectives of:

- Returning the land to its pre-solar capability and improving the current state of the land.
- Soil resource management.
- Landform and land use areas.
- Development of completion criteria and monitoring reporting.

The plan would be informed by soil information derived from a soil survey using:

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

7.3.5. Safeguards and mitigation measures

Table 7-8 Safeguards and mitigation measures for biodiversity impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Undertake a base line soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects of soil and groundcover management.	PC		
2	As part of the CEMP, a Soil and Water Management Plan (SWMP) (with erosion and sediment control plans) would be prepared, implemented and monitored during the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions to: • Install, monitor and maintain erosion controls.	C		

ID	Safeguards and mitigation measures	C	O	D
	• Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability. • Manage topsoil in all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period had passed. • Areas of soil disturbed by the Proposal would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.			
3	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial grass cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election. • Soil preparation. • Establishment techniques. • Maintenance and monitoring requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live grass cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live grass cover falls below 70%. Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. I.e. any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible	C	O	D

ID	Safeguards and mitigation measures	C	O	D
4	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.		Design	
5	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act). • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment Induct and train all site staff.	C	O	D
6	The transformers will be filled with oil, and waterproof bunds built around them to manage oil spills.		Design	
7	A protocol would be developed in relation to unexpected discover of buried contaminants within the Proposal Site (e.g. pesticide containers). It would include stop work, remediation and disposal requirements.	C		
8	A Rehabilitation Plan would be prepared to ensure the array site is returned to at least or better than pre-solar farmland and soil capability. The plan would be developed with reference to the base line soil testing and with input from an agronomist to ensure the site is left stabilised, under a cover crop or other suitable ground cover. The soil survey would be based on: • *Australian Soil and Land Survey Handbook* (CSIRO, 2009) • *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008) • *The land and soil capability assessment scheme: second approximation* (OEH, 2012)			D
9	A pest and weed management plan would be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Armidale Regional Council and NSW DPI requirements.	C	O	D

7.4. COMPATIBILITY WITH EXISTING LAND USES

7.4.1. Approach and methods

Potential for impacts on existing and future land uses at and in the vicinity of the Proposal Site have been assessed with reference to:

- Armidale Regional LEP land use zones.
- NSW Government MinView and SEED Portal databases.
- NSW DPI Land Use Conflict Risk Assessment Guide.
- Site inspection and discussion with landowner regarding historic land use and productivity.

7.4.2. Existing environment

The Proposal Site, and all land within approximately 2km, is zoned as RU1 Primary Production under the Armidale Regional LEP (Figure 7-10). There are three existing land uses currently relevant to the Proposal Site, including:

- Agricultural grazing and cropping.
- Residential (three dwellings).
- Crown Land and paper roads.

Land use classifications within the region are shown in Figure 7-11, indicating at a broad level what land uses it may be capable of sustaining. Most of the land in the Proposal Site is classified as grazing on modified pastures. Lesser areas of cropping and grazing on native pastures are also shown within the Proposal Site boundaries. Most of the surrounding land is mapped as

- Grazing on native pastures to the north and west.
- Grazing on modified pastures to the north-east, east and south-east.
- Limited area of cropping to the north and south east.

While the dominant land use by area is grazing on native pastures, it is assumed the higher incomes are obtained per hectare on the modified and cropped areas.

Existing land uses adjacent to the Proposal Site are shown in Table 7-9 and Figure 7-11.

Table 7-9 Land use within the proposal site

Land use	Area (ha)
Managed resource protection	0.007
Grazing native vegetation	36.110
Grazing modified pastures	220.090
Cropping	53.780
Roads	0.020

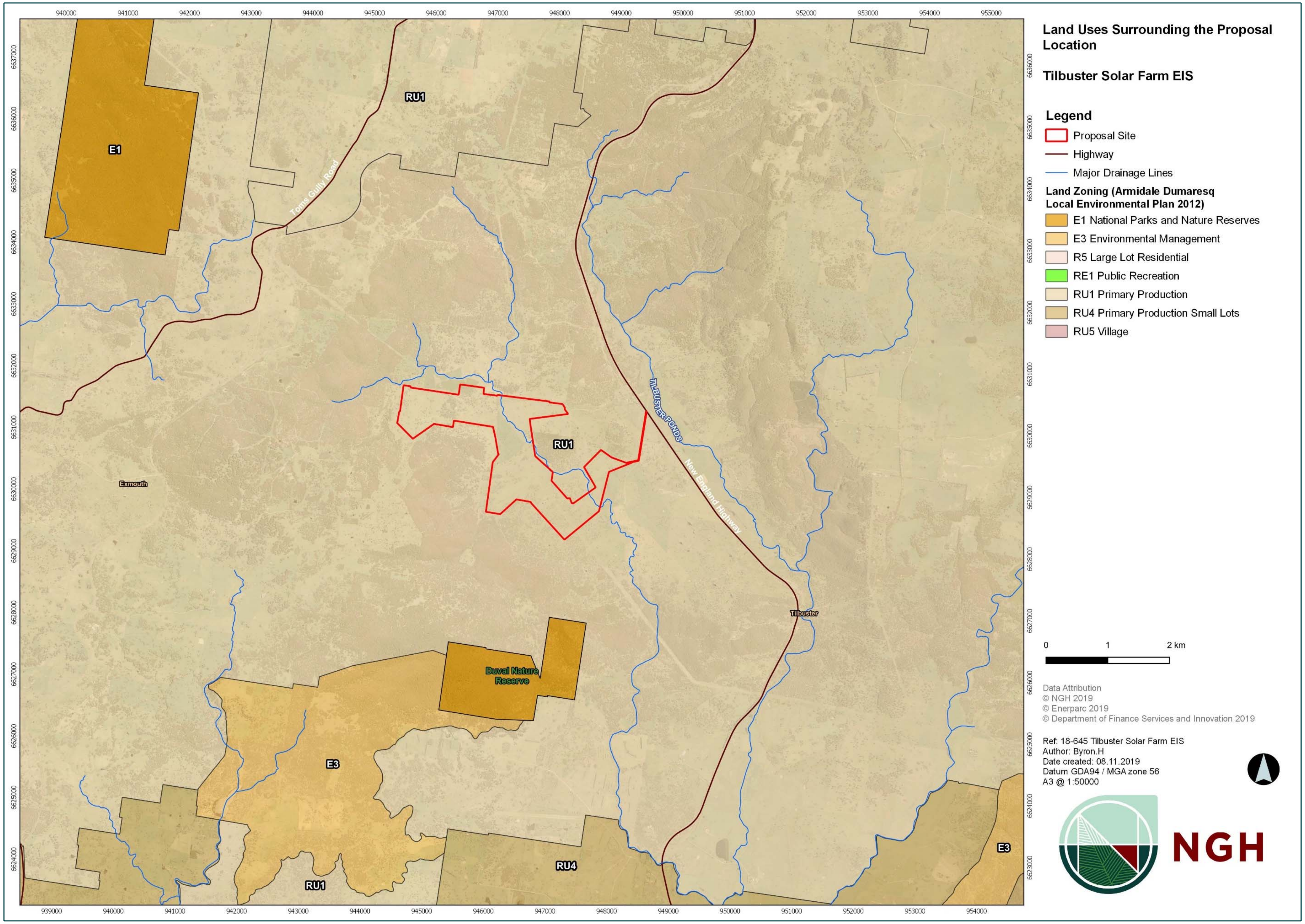

Figure 7-10 Land zoning surrounding the Proposal Site

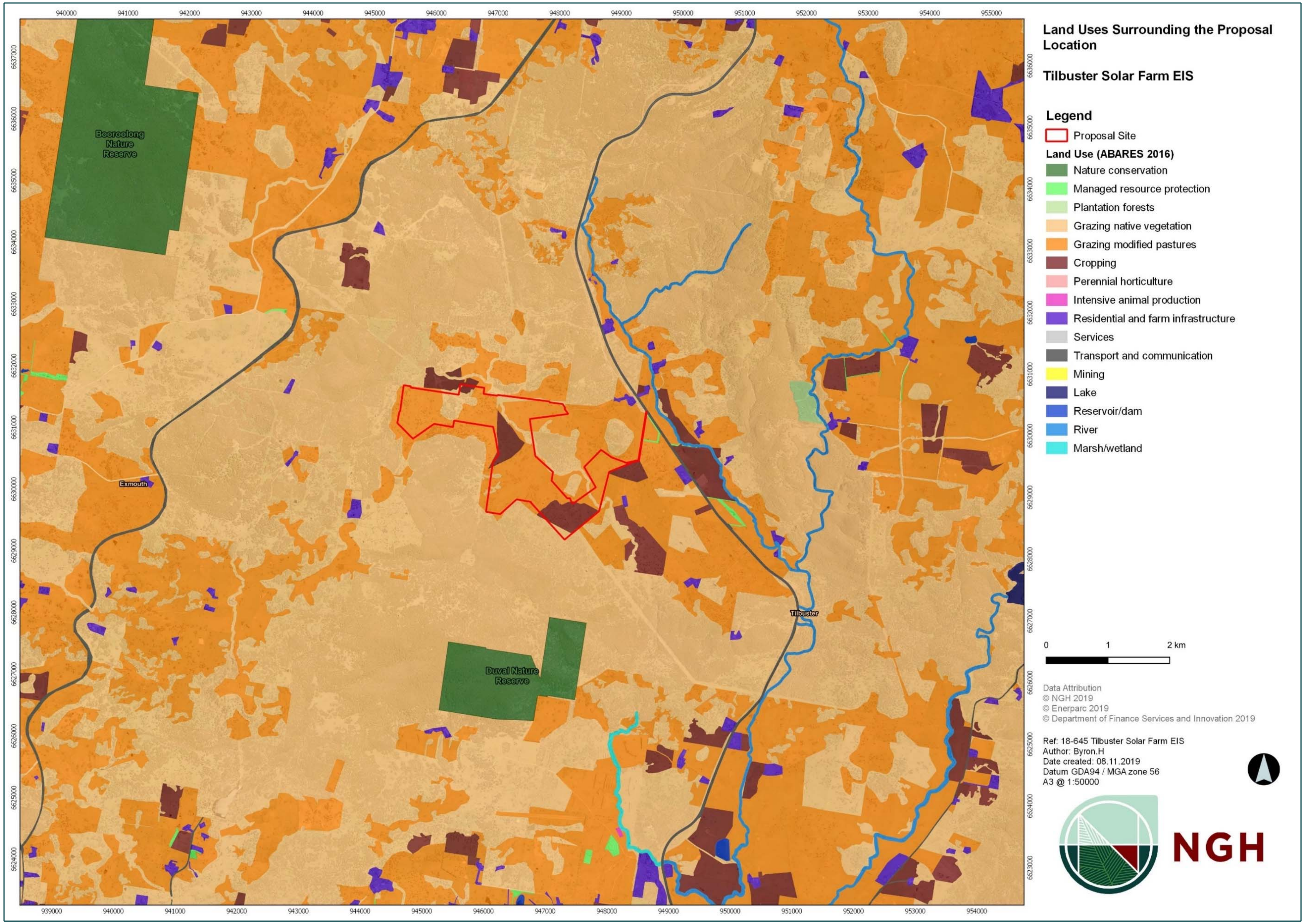

Figure 7-11 Land uses surrounding the Proposal Site

Agricultural production

The Proposal is located within the New England and North West region of NSW which occupies 99,145 km^2 (12.2%) of NSW; 61,702 km^2 (62.2%) of which is agricultural land (ABS, 2016). The most common land uses within the region are grazing, which occurs on 34,973 km^2 (35%) and cropping (predominantly cotton), which occurs on 20,645 km^2 (21%). The number of agricultural businesses has remained relatively stable over recent years in the region from 7,900 in 2014 to 7,904 in 2018 (ABS 2019).

In order of economic contribution, important local industries are cotton, contributing $884 million to the New England and North West region, cattle and calves, contributing $679 million and wheat, contributing $215 million.

The Proposal Site is approximately 310 ha and is mostly comprised of mostly grazed land and a small amount of cropped land. The land currently supports:

- Grazing of around 500 sheep over the entire property.
- A small area of forage cropping and hay production from lucerne.
- A small area of sown improved pasture comprised of barley grass, rye grass, oats and clovers for sheep feed.

Alternative higher value land uses, given the local area, could potentially include wheat but given access to water and soil capability classes, are unlikely to include sustained cropping or the higher value crops such as cotton.

Reserves

Duval Nature Reserve is located approximately 1.4 km south of the Proposal Site and contains many rare species of orchids as well as providing habitat for a diverse range of native fauna. Recreation within Duval reserve is limited as access is across private lands.

Booroolong Nature Reserve is located approximately 4.4 km north-west of the site. It is significant for the refuge it provides for the endangered Booroolong Frog and the endangered Bush Stone-curlew. There are no visitor facilities in the reserve and no known use of the reserve by members of the public, due to access being restricted through private land.

Both reserves are zoned E1 Environmental Protection.

Service infrastructure

An existing TransGrid 330 kV transmission line transects the centre Proposal Site. This transmission line connects to the 330 kV Armidale Substation to the south – west of the Proposal Site and to the Dumaresq substation north of NSW. The Proposal would loop into the existing 330 kV transmission line to connect to the national grid, via a dedicated substation.

Major transport corridors in the area include the Main Northern Railway line and the New England Highway, connecting Armidale to Sydney.

Armidale is an important service centre for the local area and region. It provides high level health and education services, as well as retail and commercial activities and is well positioned for tourism with its proximity to the Waterfall Way and Big Sky Country. The presence of the University of New England impacts on accommodation availability and retain trade; it would be expected to fluctuate with the school year.

Proximity to service infrastructure and accommodation and services for a construction workforce, make the area an attractive location for burgeoning renewable energy industry, set out below, as well as other major projects.

Renewable energy projects

The Approved Metz Solar Farm, proposed by Clenergy, is located 20 km south – east of the Proposal Site and is due to commence construction in Q2 2020. It is unlikely that there would be associated cumulative construction impacts as the anticipated construction timeframes do not overlap.

There are also three solar farm proposals within the vicinity of the Proposal Site:

- Oxley Solar Farm, proposed by Oxley Solar Development would be located approximately 20 km south-south-east of the Proposal Site. The EIS and DA are currently being prepared.
- New England Solar Farm, proposed by UPC Renewables would be located approximately 26 km south of the Proposal Site. Development Consent has been granted and construction is anticipated to commence in Q3 2020.
- Salisbury Solar Farm, proposed by MirrusWind and Energy would be located approximately 41 km south of the Proposal Site. SEARS have been issued by DPIE.
- Tamworth Solar Farm, proposed by Oriens Energy, would be located 120km south-west of the proposal site. The proposal is currently being assessed by DPIE. Construction of the Tamworth Solar Farm is anticipated to commence in late 2020.

In addition to renewable energy major projects, two other major project proposals are located within the vicinity of the Proposal Site:

- Armidale High School, proposed by NSW Department of Education, approximately 13 km south – east of the Proposal Site. Consent was granted of 29 May 2019 and construction has commenced.
- UNE Wright Block Student Housing and Hub Building, proposed by the University of New England, would be located in Armidale, approximately 13 km south – east of the Proposal Site. The EIS and DA are currently being prepared.

Aviation

A number of airports are located within the vicinity of the Proposal Site:

- Armidale approximately 16 km south – west
- Inverell approximately 75 km north – west
- Glen Innes approximately 78 km north
- Tamworth approximately 108 km south – west
- Gunnedah approximately 150 km south – west
- Narrabri approximately 176 km west

Armidale Regional Airport is the closest principle regional airport providing direct flight services to major Australian airports. Other nearby regional airports providing flight services to major Australian airports are Tamworth, Narrabri and Inverell. The remaining airports are smaller scale and are primarily used by light aircrafts, private charter flights and medical services.

Due to the nature of the agricultural industry in the area, there are potentially other smaller (private) airstrips at the locality used for transport or aerial spraying of crops.

Exploration licences and mining leases

There are no mineral, petroleum or coal titles or applications relevant to the Proposal Site as indicated by the MinView database (Resources and Geoscience, 2018). The closest title is ML1064 located approximately 8.7 km south – east of the Proposal Site (Figure 7-12).

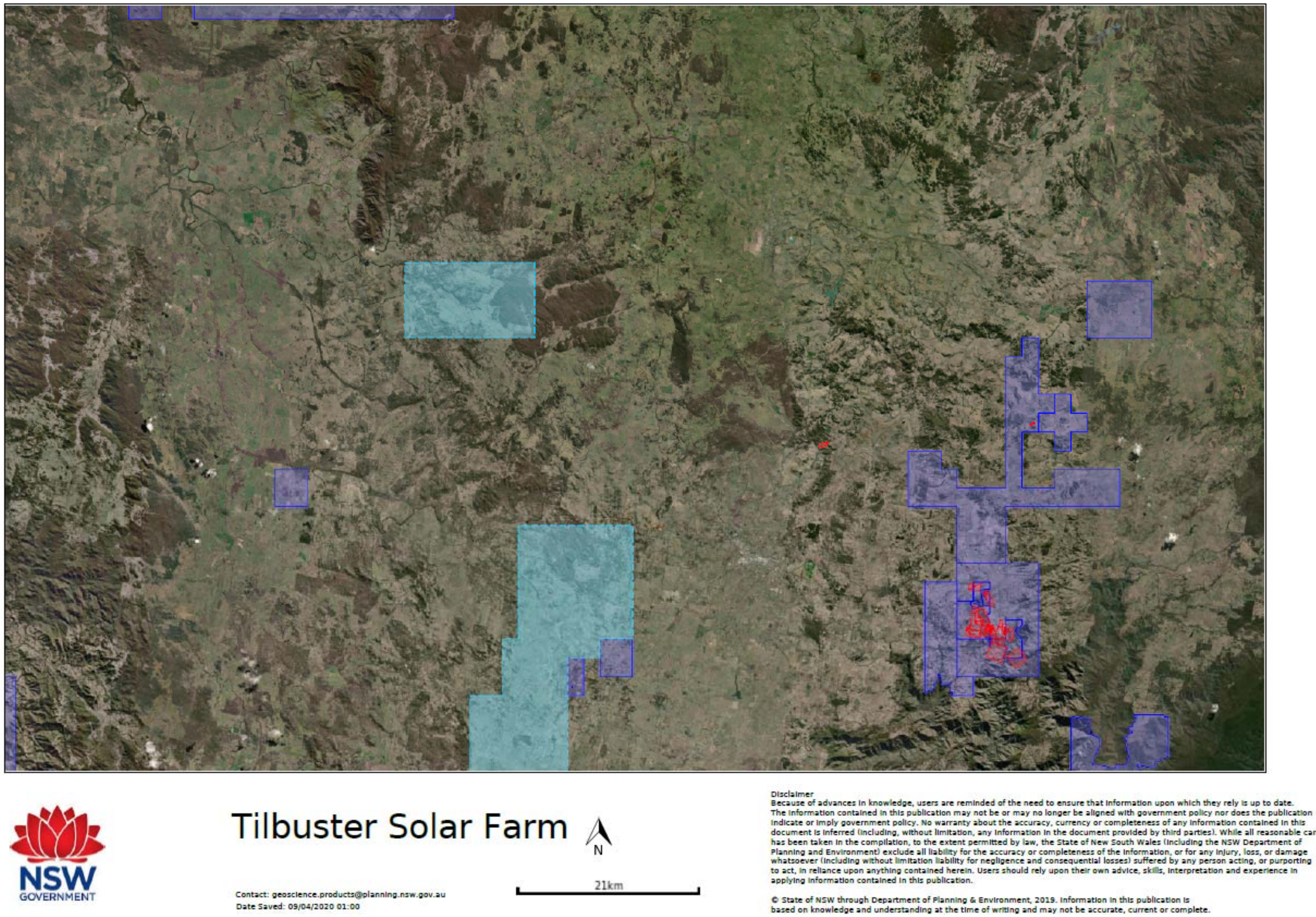

Figure 7-12 Exploration licences within the vicinity site

Residential

The Proposal Site is located approximately 7 km south of Black Mountain village and 13 km north – west of Armidale. Three residences are located within the Proposal Site, all of which are owned by the current landowner. 13 residences are located within 2 km of the Proposal Site. The closest non-associated receiver is 305 m from the Proposal Site on the eastern side of the New England.

Lifestyle blocks and residential estates do not occur on adjacent land and are not anticipated based on the site's location.

7.4.3. Potential impacts

Construction

The potential impacts of the Proposal during construction on surrounding land uses is considered to be minimal given the temporary nature of the construction stage and the high confidence in the ability to mitigate impacts. Potential impacts to surrounding land uses include the following:

Agriculture

The potential impacts of the Proposal on agriculture are detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

<u>Resource loss and fragmentation</u>

- Agricultural activities would temporarily cease upon commencement of construction in areas within the Proposal Site and along the access to the site.

<u>Biosecurity risks – pests diseases and weeds</u>

- The increased movement of vehicles, machinery and people within the Proposal Site, particularly during construction and decommissioning poses the largest risk to biosecurity. Weed seeds can be transported via the tyres and undercarriages of vehicles and clothing of staff resulting in a risk of wee spread to the Proposal Site. Limiting vehicles and machinery movements to formed access tracks during all phases, and implementing a wash down procedure for vehicles entering the Proposal Site would mitigate potential risk of seed dispersal.
- Preparation of a Weed Management Plan for the construction and decommissioning phases based on Armidale Regional Council and NSW DPI requirements would assist in the management of weeds.

Services

No impact is anticipated during construction on the existing 330 kV transmission line and 330 kV Armidale Substation. This would be ensured through consultation with TransGrid to ensure connection to the grid via the 330 kV transmission line does not disrupt operation and maintenance of TransGrid assets.

Minimal impact is anticipated to the local road network during construction; good sight lines and road conditions are present on the New England Highway.

Services for construction staff, including accommodation, recreation and other services are likely to be met by Armidale and surrounding towns. Existing fluctuations in demand due to the university terms and holiday periods may exacerbated by the proposed Tilbuster Solar Farm construction program and would require consideration with local service providers.

Aviation

There is unlikely to be any construction impacts on aviation or aerial spraying during construction of the solar farm. The proposed infrastructure is low-lying with the substation being the tallest infrastructure. The installation of this infrastructure would not impact on any flight paths or present a hazard to aircraft.

Mining and exploration

No impacts to mining and exploration is anticipated as there are no titles or applications relevant to the Proposal Site. The closest title is located approximately 8.7 km south – east of the Proposal Site and would not be impacted by construction of the solar farm.

Residential

Residences located near the site or along the access route may experience temporary noise, dust and traffic impacts during construction. There are a low number of receivers (Figure 8-1) and these impacts are considered manageable and are addressed in Sections 8.1 and 8.5.

Operation

The potential impacts of the Proposal during operation on surrounding land uses is considered to be manageable with implementation of mitigation measures provided in this EIS. Potential impacts include the following:

Agricultural activities

During operation, the Proposal Site would change from agricultural land use to power generation. The potential impacts of the Proposal on agricultural resources is detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

<u>Resource loss and fragmentation</u>

- The Proposal would result in the temporary loss of most of the production value of the Proposal Site for the life of the solar farm (approximately 30 years). This represents 0.005% of the agricultural holdings within the New England and North West region of NSW and does not significantly reduce the availability of land for primary production in the region. Grazing could continue but at reduced numbers, see below. Additionally, 577.4 ha of residual land owned by the associated landowner would be subdivided from the Proposal Site and available for agricultural use.
- Connection to the national grid does not require additional power lines as the Proposal would connect via an existing 330 kV transmission line that traverses Proposal Site. This reduces the potential for limiting ground clearance and impacting on safe movement of agricultural machinery.
- Access to the site is anticipated to be via existing road reserves and tracks. No resource fragmentation is anticipated.

<u>Impacts on farming operations and livestock</u>

- Some sheep grazing may continue to be undertaken within the Proposal Site to control grass and weed growth around the solar arrays. Grass fuel levels within the site would be managed to minimise bushfire risks (refer to Section 8.7). Adequate groundcover would be maintained to protect soil and water values (refer Section 8.1 and 7.3).
- The Proposal would not affect access or agricultural land uses on surrounding properties during the operation phase. The existing surrounding land uses are known, and the solar farm is not considered to be an incompatible land use with a potential to create land use conflicts.

- Best practice waste and wastewater management, fuel storage and re-fuelling and chemical handling would be stringently applied to prevent soil and water pollution (refer Section 8.1 and 7.3).
- Impacts on soils and erosion risk are assessed in Section 7.3, impacts on downstream water quality are assessed in Section 8.1 and impacts on local air quality are assessed in Section 8.9. These assessments conclude that the Proposal would not be likely to adversely affect land uses or activities on neighbouring properties or elsewhere in the locality, subject to the identified mitigation measures.

<u>Biosecurity risks – pests, diseases and weeds</u>

- Biosecurity risks associated with construction and decommissioning are also relevant during the operational phase, to a lesser degree. An operational weed management plan would be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the Proposal Site and the importation and dispersal of weeds due to vehicle movements and dispersal by people and animals. Additionally, weed control techniques including herbicide and grazing pressure would be a focus of the plan.
- Risk of increasing pest animals (cats, dogs, rabbits and foxes) at the Proposal Site during operation would be managed by ensuring waste from rubbish bins containing food are covered and regularly removed. Targeted pest management during the operational phase of the Proposal would control pest numbers. Resources and cover for pest species would be reduced grazing pressure and reduced plant matter.

Reserves

View shed mapping in Section 8.1 indicates only a very small area of Duval Nature Reserve will potentially have a view of the solar farm site. Given the distance, intervening screening and lack of public access ways, no impact is anticipated on either of the reserves.

Aviation

There is a perceived issue of glint or glare associated with PV solar panels. Glint is a quick reflection that occurs when the sun is reflected on a smooth surface. Glare is a longer reflection. Onsite infrastructure that may cause glint or glare depending on the sun angle, include:

- Solar panels.
- Steel array mounting – array mounting would be steel or aluminium.
- PCUs.
- Transmission line poles if steel is used.
- On-site substation.
- Temporary construction site buildings.

Recent studies have suggested that potential for glare from PV solar panels is relatively limited (Spaven Consulting, 2011). PV solar panels are designed to reflect as little sunlight as possible as the PV panels are designed to absorb solar energy in order to generate the maximum amount of electricity. It is documented that PV panels may reflect as little as 2% of the light they receive (FAA, 2010).

The panels would not generally create noticeable glare compared with an existing roof or building surfaces. Figure 7-13 compares the reflectivity of various common surfaces. Seen from above (such as from aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar PV plants have been installed on a number of airports around the world and in Australia including Karratha in WA and Darwin in NT.

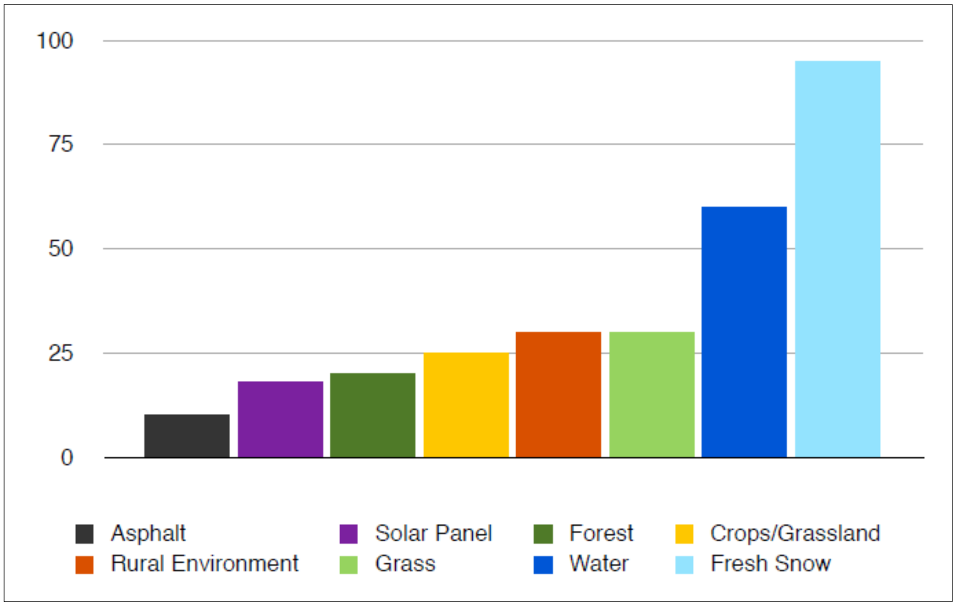

Figure 7-13 Comparative reflection analysis (Spaven Consulting, 2011)

Mining and exploration

No impacts to mining and exploration is anticipated as there are no titles or applications relevant to the Proposal Site. The closest title is located approximately 8.7 km south – east of the Proposal Site and would not be impacted by construction of the solar farm.

Decommissioning

The potential impacts of the Proposal during decommissioning on surrounding land uses is considered to be manageable with the implementation of the mitigation measures presented in this EIS. Potential impacts to surrounding land uses include:

Agricultural activities

Existing agricultural land uses, or future agricultural land uses on the Proposal Site or adjacent land are not anticipated to be impacted due to the highly reversible nature of the proposal.

The potential impacts of the Proposal on agricultural activities is detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

<u>Site rehabilitation</u>

A Rehabilitation Plan associated with decommissioning activities would be developed and implemented with the objectives of returning the land to its pre-solar capability or better, based on base line soil data collected prior to construction. All above ground infrastructure would be removed. All below ground infrastructure would be removed in areas currently suitable for sustained cropping. The plan would be informed by soil information derived from a soil survey using:

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

Aviation

There is unlikely to be any impacts on aviation or aerial spraying during decommissioning of the solar farm. The proposed infrastructure is low-lying with the substation being the tallest infrastructure. The removal of infrastructure would not impact on any flight paths or present a hazard to aircraft.

Residential

Residences located near the site may experience temporary noise, dust and traffic impacts during decommissioning. These impacts are considered manageable and are addressed in Sections 8.1 and 8.5. No impacts on the use of recreational areas would occur.

The Proposal is considered highly reversible given the relatively low impact on the soil surface. Following decommissioning, rehabilitation of the site would be undertaken to restore the site to its pre-solar condition. All above ground infrastructure would be removed upon decommissioning and any cabling greater than 500 mm below the ground would be left in place to minimise surface disturbance during decommissioning activities. Following decommissioning, alternate land uses including agriculture could resume.

Land use risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011) Solar farming is not prohibited on rural land zonings in the Armidale Dumaresq LGA (eg RU1 zone) and is therefore considered compatible with agricultural land uses. Notwithstanding this, the proposed solar farm is different to the surrounding agricultural land use activities. Therefore, this assessment aims to identify and rank any potential land use conflicts so that they may be adequately managed. Where expected conflicts are adequately managed, the rights of the existing and proposed land uses can be protected.

The risk ranking in Table 7-11 has been determined using the risk ranking matrix shown in Table 7-10, and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). The matrix ranks the risk of impacts according to the probability of occurrence and the consequence of the impact. Probability 'A' is described as 'almost certain' to probability 'E', which is described as 'rare'. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk (DPI, 2011).

Table 7-10 Risk ranking matrix (DPI, 2011)

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

Table 7-11 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Category and Ranking		Management Strategy	Revised Risk Ranking	
Agricultural land use					
Contaminated surface water runoff	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generated during the construction and decommissioning stages to be managed using water carts when required. Dust is not expected to generate a significant land use conflict during operation.	C5	4
Fire/ Bush fire	C1	22	Implementation of a Bush Fire Management Plan would significantly reduce the probability of solar farm operation starting a fire or a bush fire damaging the solar farm infrastructure.	D3	9
Visual amenity	B5	7	There is one dwelling (R2) in the immediate vicinity of the Proposal Site, with the exception of the associated landowner. The infrastructure occupies low relief and should not greatly modify skylines / horizons. R2 has been assessed as having a low impact due to the distance of the proposal.	B5	7
Noise	C3	13	Noise generated during construction and decommissioning stages would be minimised through	D4	5

Identified Potential Conflict	Risk Category and Ranking		Management Strategy	Revised Risk Ranking	
			the implementation of mitigation measures. Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict.		
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely however the impact would be temporary and able to be managed (refer to Section 8.6). Traffic is not expected to generate a land use conflict during operation.	C4	8
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation phases	D4	5

7.4.4. Safeguards and mitigation measures

Table 7-12 Safeguards and mitigation measures for compatibility with existing land uses

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	PC		
2	Consultation with adjacent landowners, to minimise impact of the Proposal on adjacent agricultural activities and access.	PC		
3	Consultation with DPIE (Crown Lands) would be ongoing and the following would be undertaken: Prior to construction, a license will be applied for to allow construction to commence within Crown roads on the Proposal Site.	PC		

ID	Safeguards and mitigation measures	C	O	D
4	Consultation with representatives from nearby major projects, including Salisbury Solar Farm, Oxley Solar Farm, New England Solar Farm, to ensure traffic and pressure on local services are managed adequately	PC/C		

7.5. HYDROLOGY AND FLOODING

7.5.1. Approach

A Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd to assess potential impacts of the Proposal on existing hydrological conditions of the site. The report has been provided as Appendix G and is summarised below.

7.5.2. Existing environment

The Armidale - Dumaresq Local Flood Plan covers preparation for response to and recovery from emergencies including flooding (NSW SES, 2013).

According to the Armidale - Dumaresq Council Flood Plan, the area is almost entirely contained within the Macleay River Basin. The Armidale Regional Council area is located in the New England Tablelands and Gorge sections of the upper Macleay River Valley. The primary tributaries are the Gara River, Commissioners Waters, Salisbury Waters and the Chandler River and its main tributaries.

The majority of flooding in the Dumaresq Council area is flash flooding from the Dumaresq Creek and its tributary streams, Martins Gully and Black Gully.

One of the highest floods recorded for the LGA occurred in 1949 during which 10 homes and two commercial premises were inundated. A flood occurring in May 1963 was estimated to be 0.3m below the height of a 1% AEP flood. In 1964, parts of Armidale were flooded from the Dumaresq Creek and was estimated to have a 5% AEP recurrence probability.

Floods do not significantly affect the rural community of the LGA. However, flooding does cause damage to several roads, which may be cut for short periods. The areas so affected include roads in the Tilbuster area, which may be cut by the Duval, Tilbuster or Puddledock creeks.

No existing flood studies of relevance to the Proposal Site are available.

The Proposal Site is traversed by Duval Creek, largely along its western flank, and contains numerous other minor unnamed tributaries of Duval Creek. Most of these are first, second or third order watercourses. All watercourses within the Proposal Site are ephemeral and would only contain flowing water during and shortly after rainfall events. There are 11 farm dams within the Proposal area which are currently used for stock water.

It is understood that the Proposal area has been used for agricultural cultivations, including grazing and occasional cropping, and is predominately cleared of understorey vegetation.

The Proposal Site typically falls from north-west to south-east with elevation ranging from 1150m Australian Height Datum (AHD) to 1050 AHD. On the northern and western flanks, the Proposal area is bound by relatively steep terrain which rises to an elevation of about 1300m AHD. These elevations are shown in Figure 7-14.

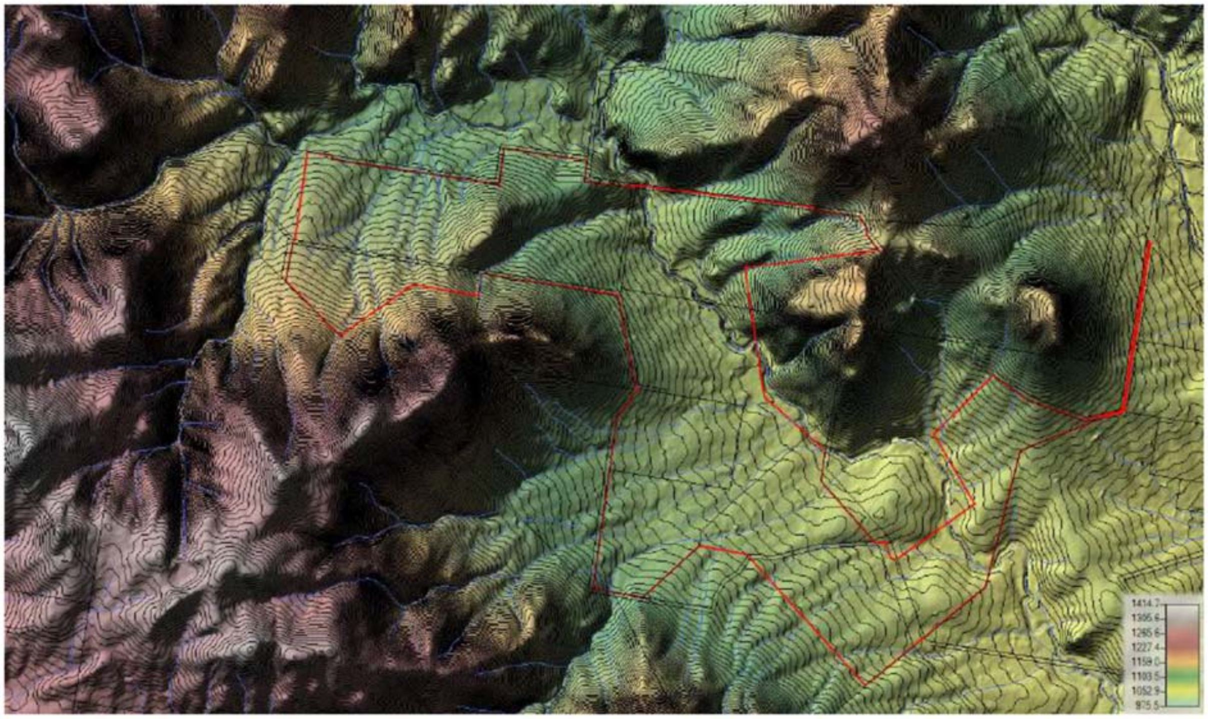

Figure 7-14 Terrain Analysis over Proposal Site (2m contour interval) (Footprint, 2020)

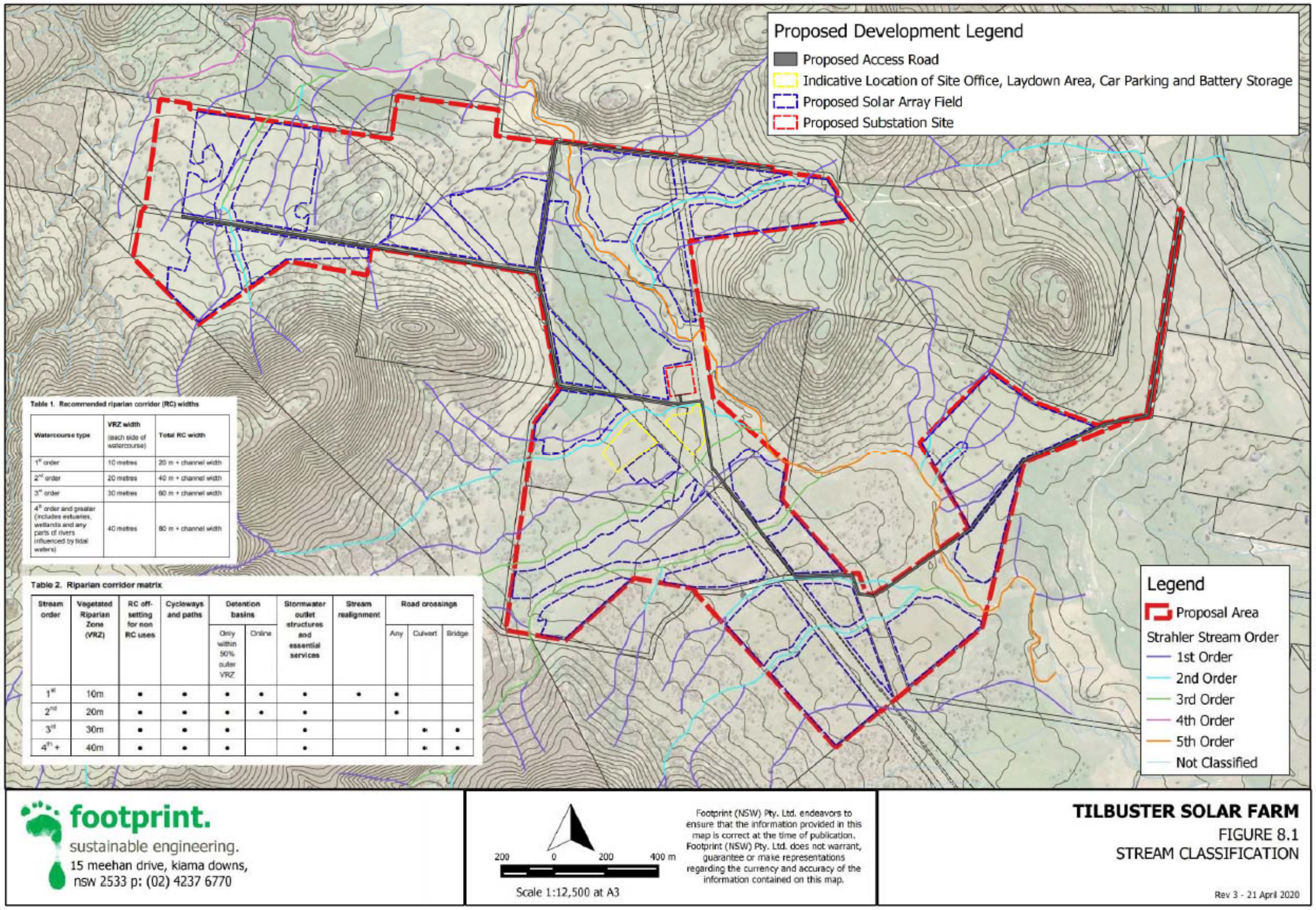

Table 1. Recommended riparian corridor (RC) widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Table 2. Riparian corridor matrix

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

Figure 7-15 Watercourses and stream orders within the Proposal Site (Footprint, 2020).

7.5.3. Hydrological and hydraulic modelling results

In a 1% AEP event, the hydrological and hydraulic modelling shows that significant flood depth (>1m) is expected to occur within Duval Creek with velocities of 3m/s and up to 4m/s where flood depth is highest. Within the unnamed tributaries of Duval Creek, flow depths can reach up to >1m, however predominately do not exceed 0.60m in the 1% AEP event and velocity is predominately 1m/s to 2m/s, except where flood depth is highest in which case velocity can exceed >4m/s (Figure 7-16 Figure 7-17).

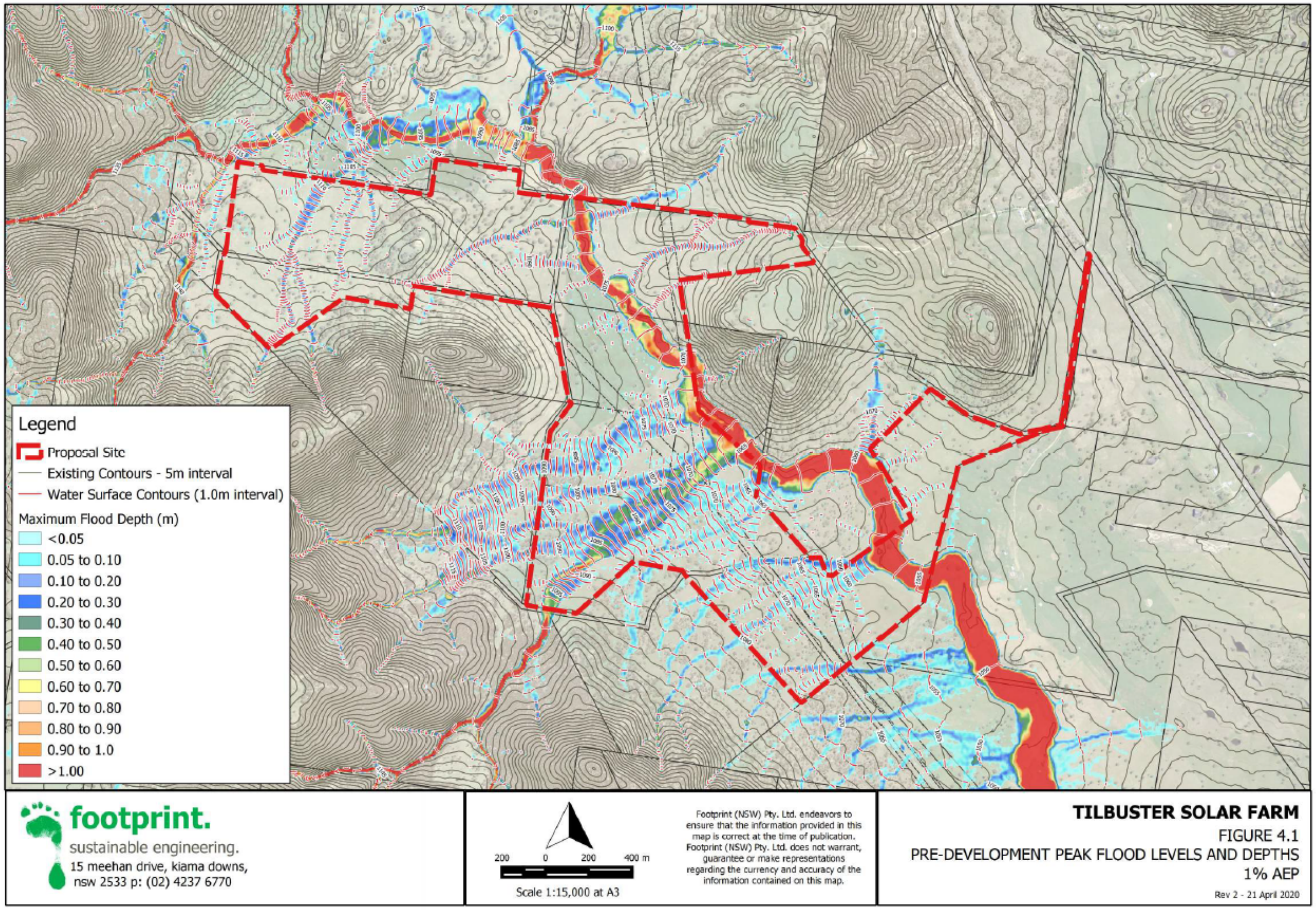

Figure 7-16 Existing 1% AEP peak flood levels (Footprint, 2020)

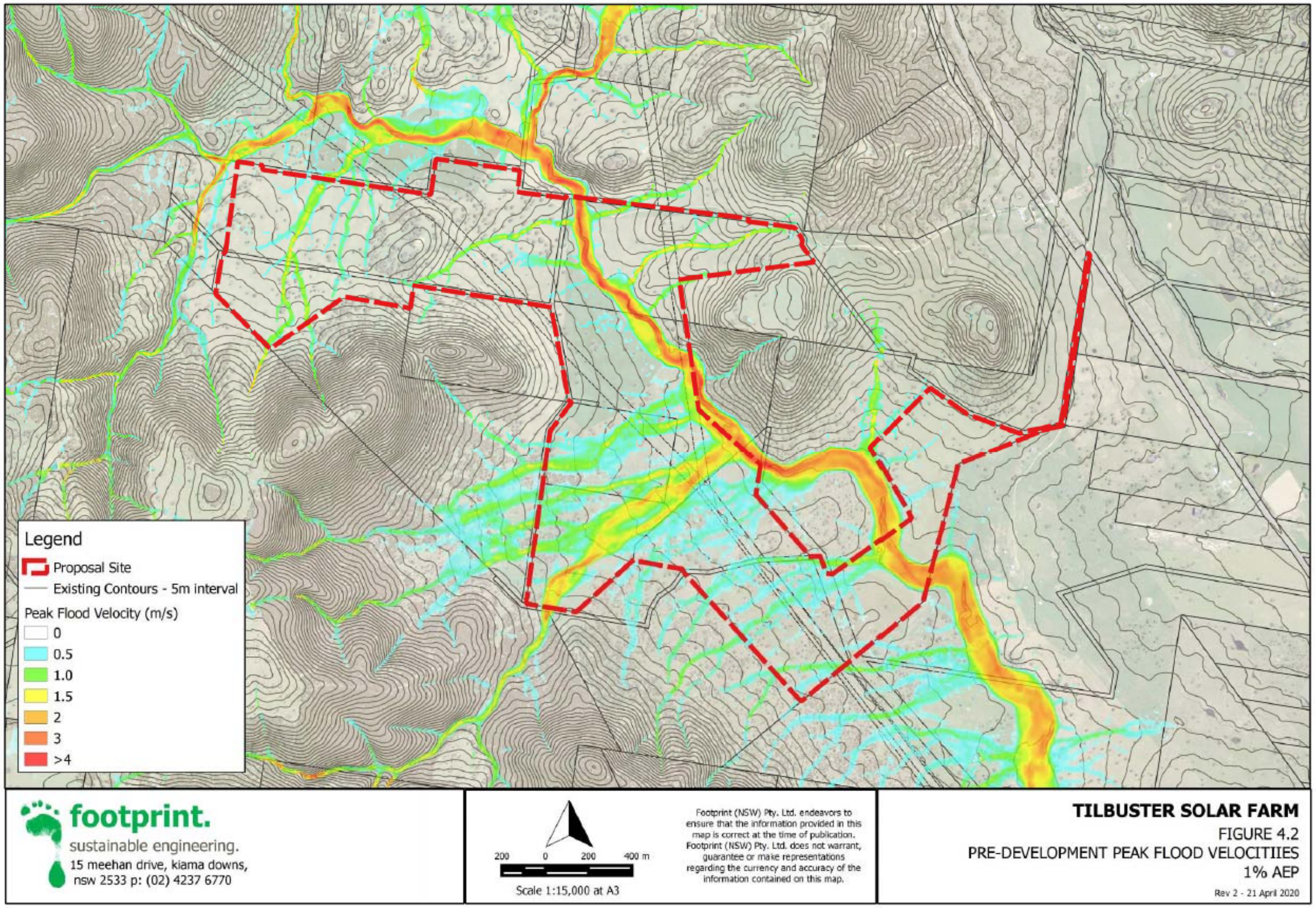

Figure 7-17 Existing 1% AEP Peak flood velocities (Footprint, 2020).

Hazard vulnerability

The flood hazard vulnerability over the Proposal Site is primarily classified as a H1 hazard vulnerability in the 1% AEP event (Figure 7-18), except for flooding within Duval Creek and the third order watercourses that discharges into Duval Creek. Duval Creek reached H6 classification and the third order watercourses that discharges into Duval Creek through the south-western corner of the Proposal Site, reached H5 classification in parts. As expected, hazard increases over the Proposal Site in the PMF event. The areas classified as H6 and H5 would therefore be unsuitable for development.

The results in Figure 7-19

Figure 7-19, Figure 7-20 and Figure 7-21 demonstrate that there is not predicted to be a significant impact on flood behaviour within the floodplain as a result of the proposed works, with flood levels, depths, velocities and hazards remaining relatively unchanged. The change in maximum flood level and peak velocity resulting from the proposed development are anticipated to remain unchanged, due primarily to the infrastructure being located outside of areas subject to flooding. Some minor increases in flood levels and corresponding decreases in velocity are shown to occur within the proposed substation and operation and maintenance precinct, however these changes are very localised and not anticipated to adversely affect adjoining properties.

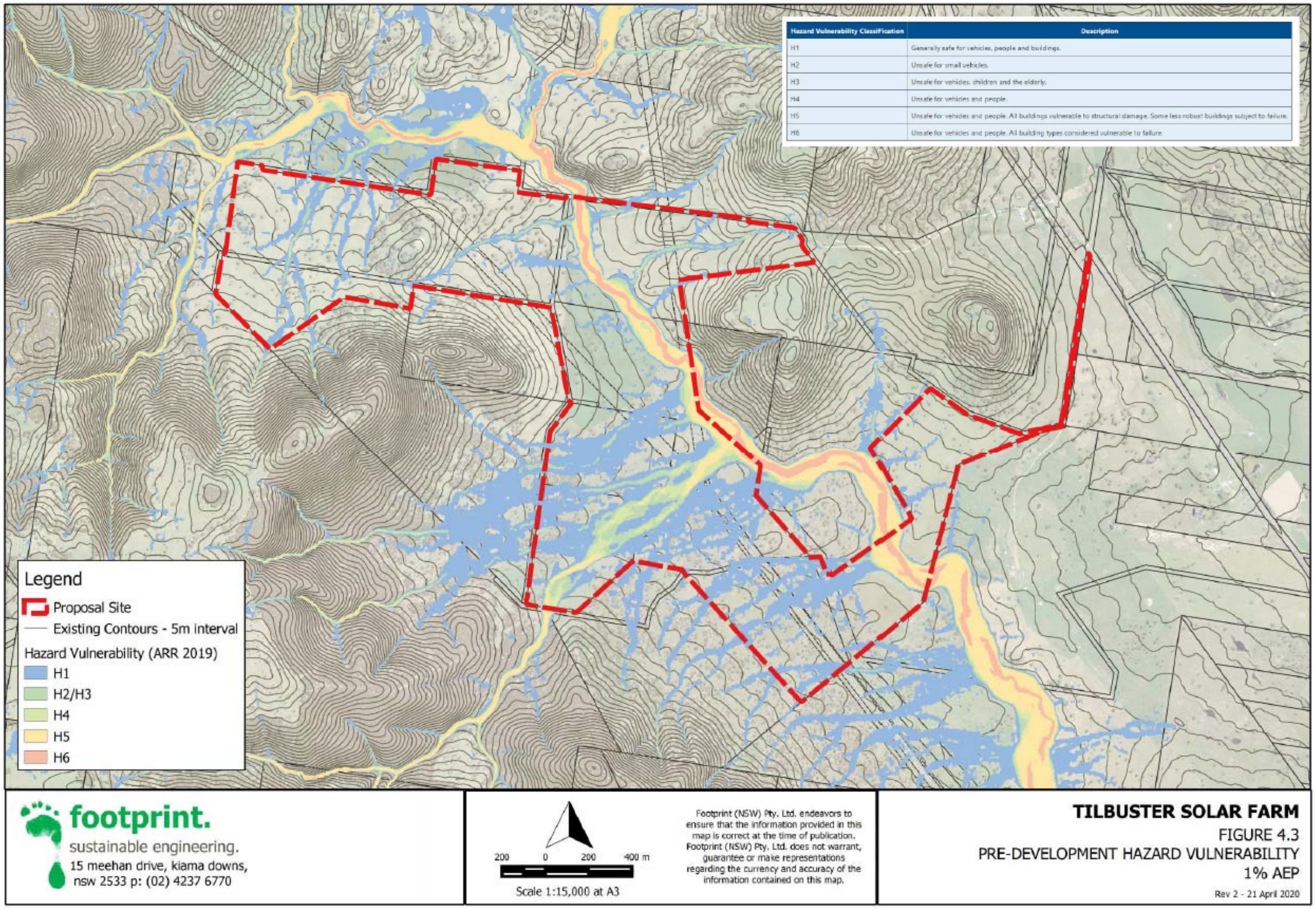

Figure 7-18 Existing 1% AEP flood hazard vulnerability (Footprint, 2020).

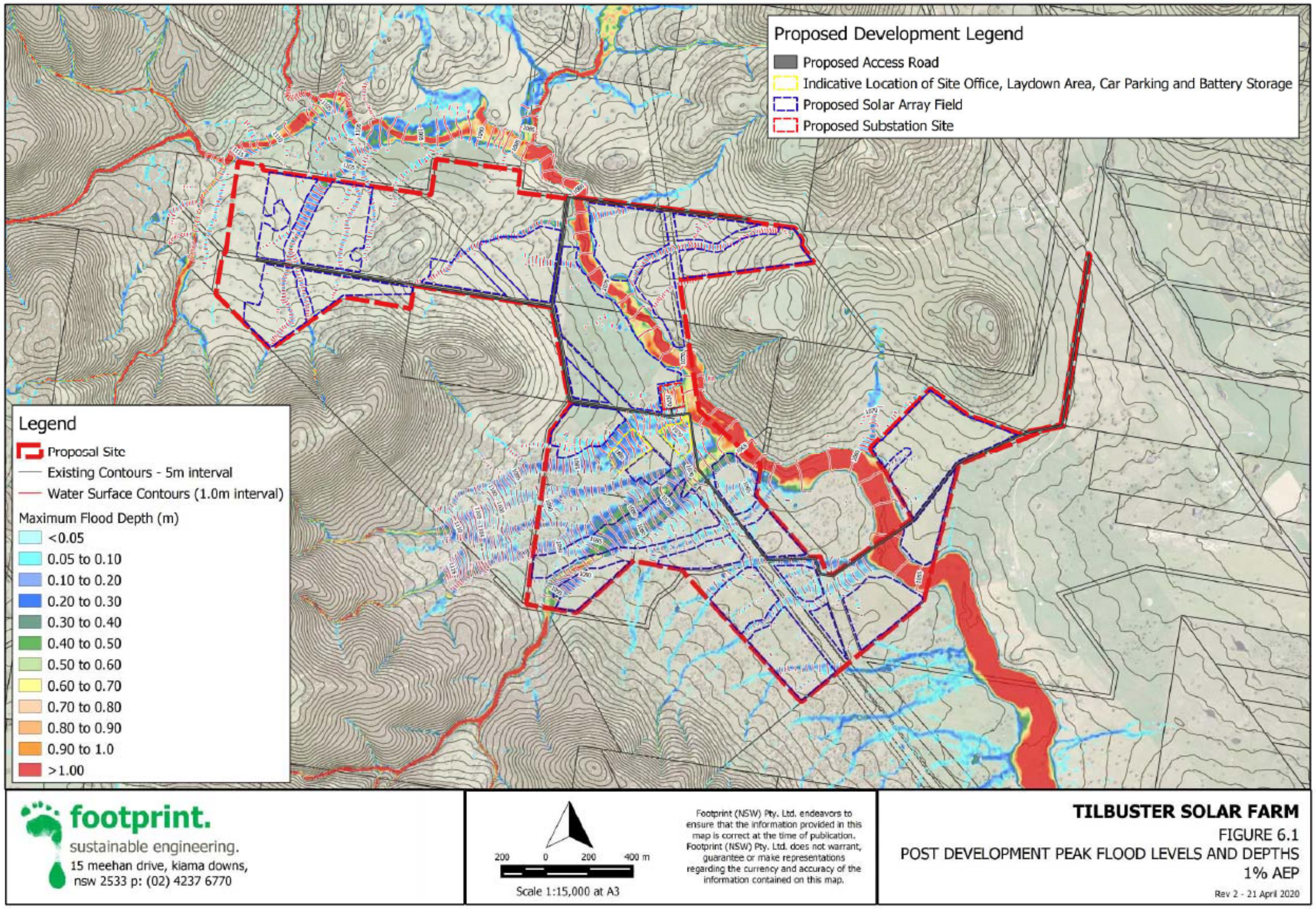

Figure 7-19 - Post development 1% peak flood levels and depths (Footprint, 2020).

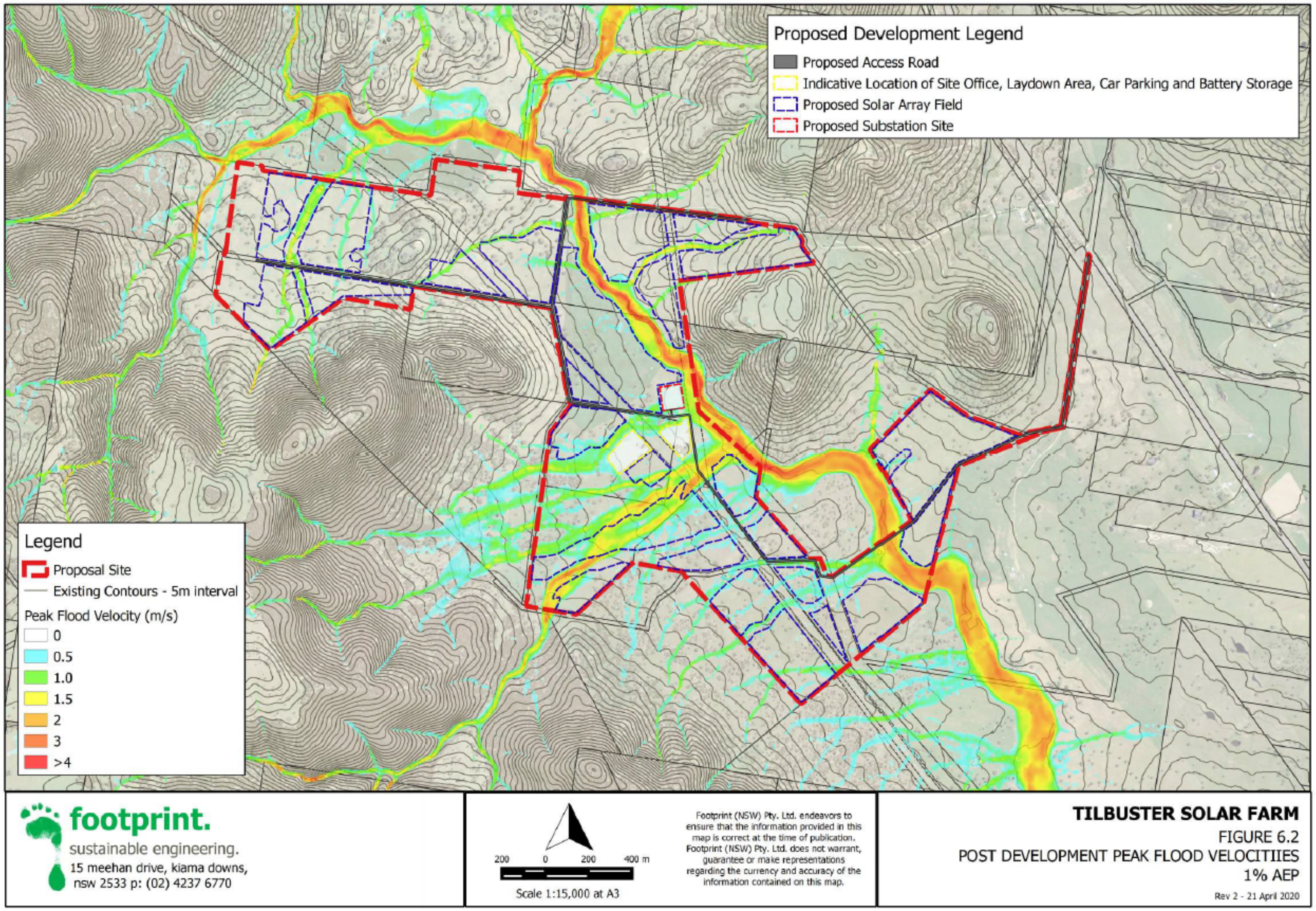

Figure 7-20 Post development 1% AEP peak flood velocities (Footprint, 2020).

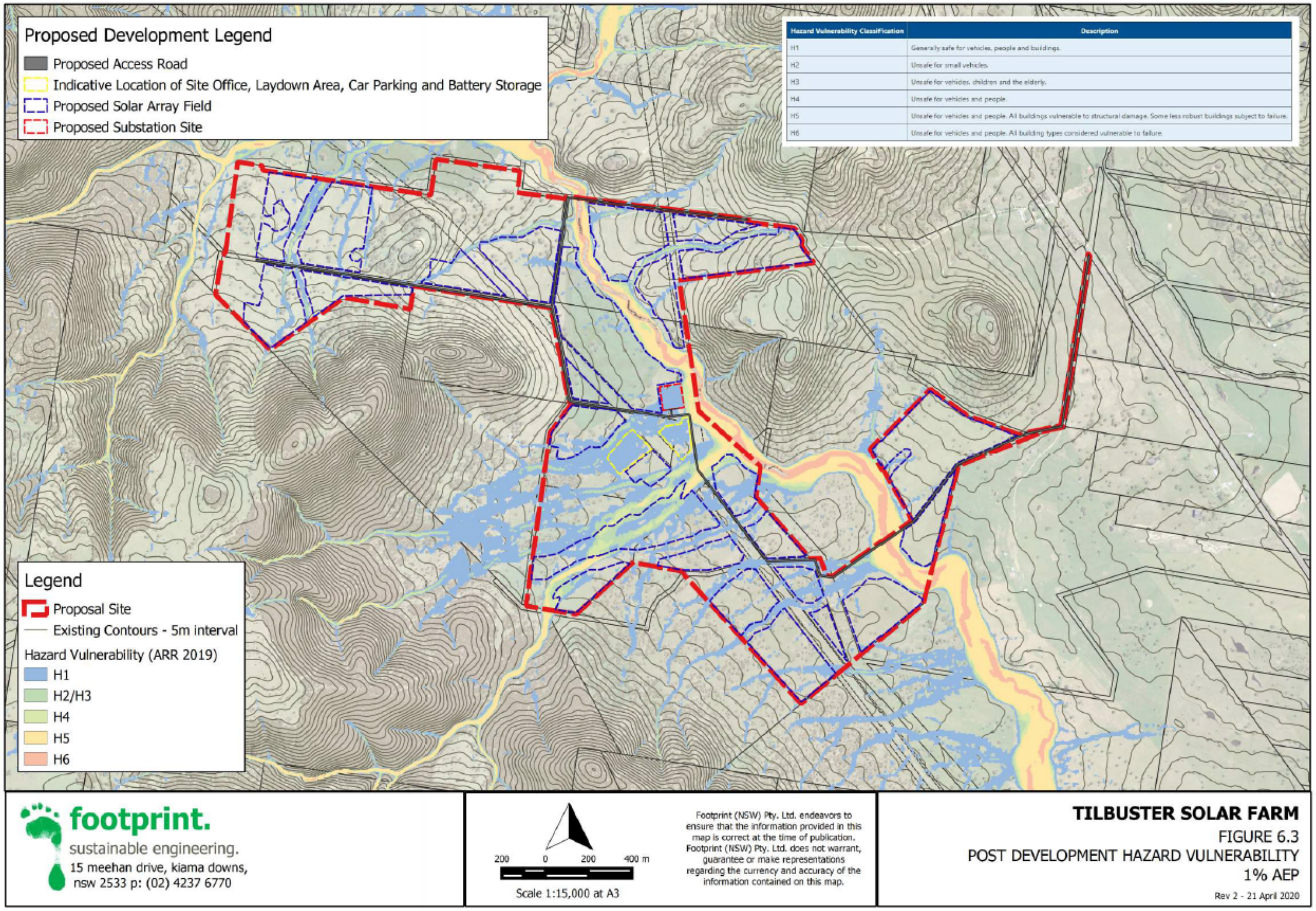

Figure 7-21 Post development 1% AEP hazard vulnerability (Footprint, 2020).

7.5.4. Potential impacts

Construction and decommissioning

Flood impacts can relate to the potential of a development to increase the risk of flood occurrence or severity, or the potential to create hazards in the event of a flood affecting the site.

Parts of the site may be at risk of temporary minor flooding during high rainfall events and high flows within the vicinity of Duval Creek and its tributaries. Temporary localised flooding has the potential to interfere with construction and poses a safety risk for workers onsite. The Proposal has potential to create the following hazards in the event of a localised flood:

- Electrical hazards to staff, emergency workers and assets due inundation of infrastructure.
- Pollution risks from leakage of stored pollutants (hydrocarbons, pesticides, solvents).
- Physical damage from the mobilisation of components in flood waters.

Buildings, equipment foundations and footings would be considered during detailed design in relation to the potential for flooding at the site. No components are considered susceptible to becoming mobile and entering waterways during construction. All potential pollutants stored on-site during construction would be stored in accordance with HAZMAT requirements and bunded.

The primary access point during construction and operation for light and heavy vehicles would be off the New England Highway, east of the site. It is considered Duval Creek would be impassable during significant flood events. Water crossings across the Proposal Site will be upgraded in accordance with Guidelines for Riparian Corridors on Waterfront Land (DPI Water, 2012).

A flood response plan would be developed to manage the safety of workers and equipment in the event of extended flooding in the region.

Maintaining grass cover across the site as far as practicable during construction, particularly within the existing waterways, would help maintain soil stability during floods, and would improve soil permeability over time.

Operation

The addition of the solar array and associated infrastructure would result in an increase in surface roughness over the site, from grazed/cropped pasture to a regular grid of steel piers. The change in floodplain roughness associated with the proposed development was assessed using the Modified Cowan Method for Floodplain Roughness and is shown in Table 7-13 . It demonstrates that the roughness is anticipated to slightly increase because of the proposed development.

It should be noted that only n_3 (effect of obstructions) has been modified to represent the change in roughness associated with the solar array piers, all other variables remain at pre-development values which are variable across the site and hence have remained at n_b, n_1 etc.

Table 7-13 Modified Cowan method for estimation of floodplain roughness (Footprint, 2020).

Roughness component	Existing (grazed pasture)	Proposed (solar array)
Floodplain material (n_b)	NA	NA
Degree of irregularity (n_1)	NA	NA

Roughness component	Existing (grazed pasture)	Proposed (solar array)
Variation in floodplain cross section (n_2)	NA	NA
Effect of obstructions (n_3)	0.000	0.003[1]
Amount of vegetation (n_4)	NA	NA
Total	**0.000**	**0.003**

It should be noted that the proposed development would include a network of access roads and these would be constructed from gravel and within the floodplain itself would be constructed at the existing surface level so as not to result in adverse impact on flood behaviour.

In accordance with the Modified Cowan Method of Floodplain roughness gravel has a similar floodplain roughness to that of the surrounding pre-development floodplain roughness. On this basis and considering the fact these tracks are likely to be less than 10m in width and therefore not well represented by the model, the marginal increase in floodplain roughness associated with the proposed road network was not included in the post development models.

Furthermore, watercourse crossings were not included in the models as fords or bridges, which minimise any hydraulic impact have been recommended (see Table 7-14).

The post development hydraulic model is therefore considered to be representative of the development as proposed and therefore reflective of the hydraulic impacts associated with the development.

Localised flooding during operation may pose the following risks:

- A safety risk for workers and assets, where electrical infrastructure becomes inundated.
- A pollution risk, where stored pollutants may be leaked to the environment.
- A local flooding risk should any components become mobile in flood waters.

Structural damage to buildings and structures (including solar arrays) could be expected in areas categorised as being within high hazard areas (H5 and above). Development in these areas is avoided (refer to Figure 7-21).

All infrastructure would be located above the 1% *Annual Exceedance Probability* (AEP) flood level plus 500mm freeboard so as not to impact on existing flood behaviour and to prevent infrastructure from being damaged. Infrastructure would be designed to withstand periods of local flooding. No components are considered susceptible to becoming mobile and entering waterways.

Access to the site will cross Duval Creek. It is considered Duval Creek would be impassable during significant flood events. As such, flood warning signs, flood level indicators, a flood refuge building and a Business Floodsafe Plan should be implemented.

The recommendations made above are incorporated into project commitments below.

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[1] Based on an obstruction of 2.5% of the available flow area (i.e. 150mm piers at 5-6m intervals)

7.5.5. Safeguards and mitigation measures

Table 7-14 Safeguards and mitigation measures for biodiversity impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	The design of buildings, equipment foundations and footings for electrical componentry and panel mounts would be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including: • The solar array mounting piers would be designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500mm freeboard, giving regard to the depth and velocity of floodwaters. • The tracking axis for solar tracking modules would be located above 1% AEP flood event plus 500mm freeboard. • The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, would be located above the 1% AEP flood level plus 500mm freeboard. • Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water. • The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater. • Security fencing would be designed so as to create two separate fenced compounds on either side of Duval Creek.	Design		
2	At the substation site, slight raising of the adjacent roadway (or similar type bunding) is recommended in order to divert upslope runoff around this critical piece of infrastructure.	Design		
3	If the proposed crossing structures over Duval Creek will be rendered impassable during significant flood events, the following would occur: i. Flood warning signs and flood level indicators would be placed on each approach to the proposed crossings. ii. A flood refuge building or structure be provided within the Proposal area on the eastern side of Duval Creek, such that in the event the proposed Duval Creek crossings are not trafficable any staff on-site have access to a weatherproof, flood free structure to seek temporary refuge. Such refuge area would be located a minimum of 500mm above the PMF level. iii. A Business Floodsafe Plan be prepared for the development to ensure the safety of employees during flood events in general accordance with the NSW SES “Business Floodsafe Toolkit and Plan”.	C	O	D
4	Any road crossings on watercourses within the Proposal Area would be of the type defined in Table 2 of the Hydrological and Hydraulic	Design		

ID	Safeguards and mitigation measures	C	O	D
	Analysis Report was prepared by Footprint NSW Pty Ltd in Appendix G. Any proposed crossings (vehicular or service) of existing watercourses on the subject site should be designed in accordance with the following guidelines, and in the case of vehicle crossing should preferably consist of bed level crossings constructed flush with the bed of the watercourse on first and second order watercourses to minimise any hydraulic impact: i. Guidelines for Watercourse Crossings on Waterfront Land (DPI, 2012) ii. Guidelines for Laying pipes and Cables in Watercourses on Waterfront Land (Office of Water, 2010)			
5	Within the floodplain access roads should be constructed as close to natural ground levels as possible so as not to form an obstruction to floodwaters. The surface treatment of roads should be designed giving regard to the velocity of floodwaters to minimise potential for scouring during flood events.	C		
6	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal . The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	C	O	D

8. ASSESSMENT OF ADDITIONAL ISSUES

8.1. VISUAL AMENITY AND LANDSCAPE CHARACTER

8.1.1. Approach

NGH completed a Visual Impact Assessment (VIA) of the Proposal in the following stages:

1. Background investigations, including Zone of Visual Influence (ZVI) modelling, identification of Landscape Character Units (LCU's) and identification of key viewpoints.
2. Field survey including reconnaissance, ground truthing and photography of key viewpoints.

3. Community consultation including understanding community values and documenting community perception.
4. Impact assessment of the potential visual impact during construction and operation of the proposal.
5. Development of a visual impact mitigation strategy, in consultation with near neighbours where a view would be visible from their residence.

The VIA is provided in full below.

Background information

Background investigations of existing literature and aerial photographs were undertaken to identify key landscape features within the locality that may be affected by the visual characteristics of the proposal.

Mapping and modelling were undertaken to:

- Identify LCUs within 7 km of the proposed solar farm. This was undertaken using aerial imagery and later validated during a field survey. LCUs are used to summarise differences in landscape amenity and the visual sensitivity of different areas.
- Define areas in which the infrastructure may be visible, using ZVI modelling. A map identifying the ZVI (or viewshed) of the proposed solar farm was produced. This method models proposed infrastructure heights against topographic information to determine areas in which views of infrastructure may be visible, and to what degree. The infrastructure was modelled as 2.1 m high for arrays and 6 m high for ancillary infrastructure (i.e. inverters). Topography was based on the best available resolution Digital Elevation Model (DEM) that could be sourced (elevation data processed in 5 m squares sourced from Elevation and Depth Foundation Spatial Data, NSW Government 2019). Viewers were considered at 1.6 m height. Modelling does not take into account screening that may be provided by existing vegetation or structures. The transmission line was not considered in the viewshed due to the height of the infrastructure and it not being a new visual feature in the landscape, transmission lines are a common feature within the study area.
- Identify key viewpoints such as major travel routes, public recreation areas, potential receivers (dwellings and other structures), and built up areas. This excluded areas deemed not to be visible from the ZVI modelling.
- Understand the feasibility of screening to mitigate visual impacts.

The ZVIs for the foreground (0 – 1 km), middle ground (1 – 2 km) and background (more than 2 km) are provided in Figure 8-1.

The results were used to select representative viewpoints to focus the field survey in areas where the Proposal would be most visible (Figure 8-1).

Field survey

With reference to the background information above, a field survey was undertaken to:

- Validate and document the existing LCUs in the study area.
- Provide photographs from representative viewpoints within the LCUs, including foreground, middle ground and background viewpoints.
- Understand the likely extent of visibility and sensitivity of the LCUs to views of the proposed solar farm.

The field survey consisted of driving along publicly accessible roads, investigating and documenting dominant visual character elements and potential views to the proposed infrastructure. Photographs were taken at representative locations. One resident was specifically targeted due to the potential for high visibility indicated by the ZVI modelling. Nearby roadside viewpoints have been tagged 'residential' where they occur near a residence.

Representative viewpoint locations are provided in Table 8-5 and shown in Figure 8-1.

The three residences associated in the Proposal are not represented by specific viewpoints. Impacts on the associated residences are not considered in this assessment.

Community consultation

Considering the broader community, a high percentage (77%) of Australian's believe that large scale solar farms could supply a significant source of Australia's energy requirements (ARENA, n.d.). The large scale solar energy sector is still at a relatively early stage of development in Australia. While most members of the community are aware of large scale solar energy, many do not know a great deal about their impacts (ARENA, n.d.) including visual impacts.

Community consultation specific to this assessment of visual impacts was required to:

- Understand how the community values existing visual amenity in the study area.
- Document the perceptions of the community to solar farms in general and the Proposal specifically.

Community consultation was undertaken as part of the environmental impact assessment process, in accordance with a Community Consultation Strategy. As part of the plan, respondents were surveyed on their views regarding solar farm development and local visual amenity. The feedback form questions are included in Appendix D, however no responses were received.

A project website was developed to provide information and updates. The website went live in November 2018 and is updated regularly. An online comments section was also made available for the public to leave feedback or comments, of which none were received.

An Open house community information session were held on 19 February 2020, inviting all interested parties to query and comment on the proposal. The open day was advertised through three local papers (the Armidale Express, Guyra Argus and Guyra Gazette. During the session, two attendees raised concerns in relation to the potential visual impacts of the solar farm.

Impact assessment

The impact assessment methodology used is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (Bureau of Land Management, n.d.). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the proposal.

Key steps undertaken to assess the visual impact are as follows:

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

The criteria for scenic quality, sensitivity, proximity, contrast and visual impact are included in the assessment, below.

Mitigation measures are considered warranted for 'high impact' receivers, for whom unmitigated impacts are considered greater than what is acceptable. For 'medium impact' receivers, the contrast is considered acceptable although mitigation is sometimes suggested. For low impact receivers, the contrast is deemed unlikely to be perceived.

8.1.2. Landscape character units (LCUs)

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

Five LCUs were identified within Tilbuster and surrounding areas:

- Rural (including agricultural lands, with low density dwellings and sheds).
- Village (Black Mountain village).
- Industrial (major roads, electrical and other built infrastructure).
- Commercial (Armidale town centre).
- Forest (surrounding conservation areas, reserves and recreational areas).

The scenic quality was rated in each LCU as follows:

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

The five LCUs identified are characterised in Table 8-1 in terms of their scenic quality.

Table 8-1 Key features of LCUs within Tilbuster and surrounds

Landscape Character Unit – Rural
The land within and immediately surrounding the Proposal Site is rural agricultural land mostly used for sheep grazing and cropping for feed. Land surrounding the Proposal Site is up to 1400 m above sea level (ASL) and is densely treed. The paddocks within the Proposal Site are flat to undulating and are positioned lower in the landscape with altitudes ranging from 1050 m to 1160 m ASL. The paddocks within the Proposal Site are generally comprised of native vegetation consisting of scattered trees and pasture. As a result of the current drought conditions and lack of irrigation, the landscape is beige to brown; the paddocks are mostly grazed and green pasture is absent in the landscape. Expansive views within the rural LCU are generally limited given the undulating relief and screening provided by vegetation. State Sealed roads including the New England Highway, secondary sealed roads including Thunderbolts Way and unsealed local roads including Sunnyside Road and Puddledock Road are the main vantage points to from which to view agricultural areas. Agricultural and grazed land can be viewed openly from road corridors. Patches of native and planted vegetation screen some views of agricultural land from roads. Residences within this landscape are sparsely distributed and commonly associated with additional landscape plantings and agricultural sheds and buildings. Low paddock fencing and overhead transmission lines represent a linear pattern over the more organic pattern of the terrain. In the flat areas, views are more expansive across the landscape, while in the undulating areas views can either be restricted or expansive depending on the viewer's location within dips or rises.

<u>Scenic quality is considered moderate.</u> Elements have subtle variety and contrast and feature naturally pleasing elements such as the mountain ranges of the Great Dividing Range to the west of the Proposal Site and scattered native vegetation remnants. Built elements including fencing, transmission lines and agricultural buildings are production – related.

This LCU is common in the study area, but has features and variety. The proposed solar farm is located within this LCU.

Landscape Character Unit – Village

Black Mountain is a small village approximately 7 km north of the Proposal Site with a population of 310 people and 131 private dwellings in 2016. Community facilities include a public primary school, Rural Fire Service, roadhouse (providing food and fuel) and a Baptist church. Black Mountain is surrounded by grazing land, horticulture and fodder cropping. The Main North Line Railway, which extends from Sydney to Wallangarra in Queensland crosses through Black Mountain village. Although the station is now closed, the building remains and is listed on the NSW State Heritage inventory.

The Black Mountain village built environment shows historic character including an old church and historic train station. Colours vary from off white, yellows, greys and browns. The church, school and private dwellings differ in materials and design with dominant colours being white, green and red. Other built forms include fences, water tanks, transmission lines and sheds. The presence of vehicles, yards and gardens results in a residential character. Views to the surrounding ranges are visible in some areas where vegetation does not screen the view.

Streets are sealed with no footpaths and formal curbing is only present within the vicinity of the public primary school. There are a small number of street plantings. The street layout is generally rectilinear.

The Proposal Site is not visible from Black Mountain, and as such is excluded from the assessment.

<u>Scenic quality is considered moderate.</u> These areas have variety in colour and form. They contribute to a unique historic character type framed by ranges in the distance. Built elements and the historic railway station contribute to the character type. The character is important in defining the history of land use in the local area.

This LCU is not common in the study area.

(Sourced: NSW Government Heritage Division)

(Sourced: NSW Government Heritage Division)

Landscape Character Unit – Industrial

Industrial areas within the vicinity of the Proposal Site include from the major New England Highway and two overhead transmission lines (132 kV and 330 kV). Common features include dual lane sealed road, road reserve, fencing, overhead transmission lines and regular small and large vehicles.

<u>Scenic quality is considered low,</u> with features matching the land use. Screening is present for the majority of surrounding roads, with broken views of surrounding rural land visible through existing native vegetation. The undulating landform also breaks up expansive views of surrounding rural land. This LCU is common in the study area, with the Proposal Site located along major roads and adjacent to the major overhead transmission lines.

This LCU is common in the study area.

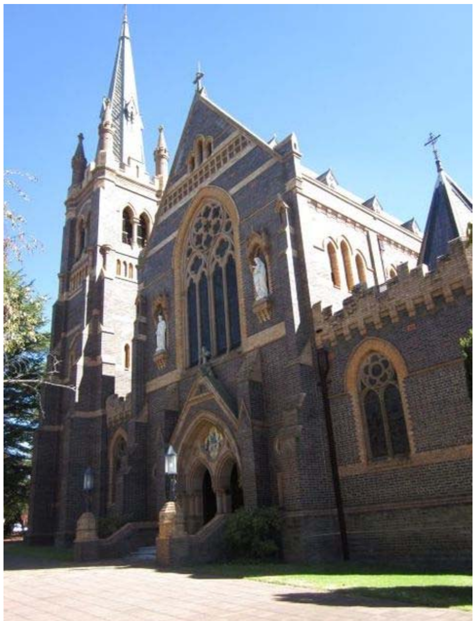
Landscape Character Unit – Commercial

Commercial landscape within the vicinity of the Proposal Site primarily includes the Armidale central business district. Armidale is located approximately 13 km south east of the Proposal Site and in 2016 had a population of 23,352 people. Armidale is the regional centre for residents of Tilbuster and facilities include New England University, TAFE, schools, hospitals, and an airport. The area is well known for its cathedral and heritage buildings.

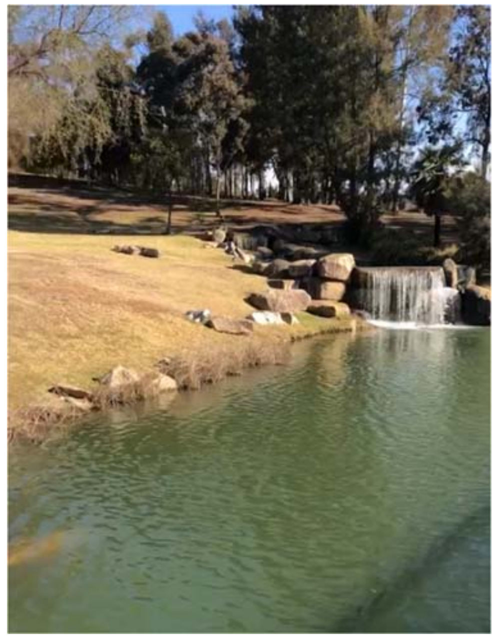
The Proposal Site is not visible from Armidale, and as such is excluded from the assessment.

Scenic quality is generally moderate. These areas have variety in colour and form. They contribute to a unique historic character type framed by ranges in the distance. Built elements including historic churches and cathedrals contribute to the character type. The character is important in defining the history of land use in the local area.

This LCU is not common in the study area.



(Sourced: NSW Government Heritage Division)



Landscape Character Unit – Forest

The vegetated ranges to the north, south and west of the Proposal Site provide a dominant visual element to the study area. The colour is from dusky green - blue to grey. This LCU is in contrast to the low open expanses of the agriculture landscape.

Duval Nature Reserve is approximately 4.4 km to the south of the Proposal Site. The reserve has limited recreational access and no recreational facilities as it requires access through the University of New England Newholme field laboratory.

Thunderbolt's Cave is located approximately 5.5 km north east of the Proposal Site. The carpark is accessed via New England Highway then Thunderbolts Cave Road. The carpark area has a picnic table and marks the beginning of the 'Robbers Run' Mountain Bike Trail leading to the cave and continuing south – west towards the New England Highway.

Scenic quality is generally moderate. Colour variation is low. Forms are generally uniform, lacking variety. Areas that appear untouched by settlement provide a pleasing visual contrast to the rural, industrial and commercial LCUs. Recreational infrastructure provides a scenic recreational space where groups may congregate.

This LCU is common in the study area.

Representative viewpoints

The BLM methodology requires identification of representative viewpoints in the study area. These may be travel routes such as roads, waterways and recreational tracks, residential areas, tourist facilities, houses and farmland.

The ZVI modelling (provided as Figure 8-1) assumes infrastructure heights being up to 4 m high for arrays and 6 m high for ancillary infrastructure (i.e. inverters). The modelling undertaken is based on the final infrastructure layout provided. The visibility was then modelled based on the number of points of the infrastructure block that can be seen. 100% means all points can be seen and equates to the highest visibility. The lowest score is 0%; none of the points of the infrastructure block can be seen.

Six representative viewpoints were identified using the ZVI mapping (Table 8-2 and Figure 8-1). The predicted sensitivity of each viewpoint can be determined, considering its proximity to the Proposal Site and factors such as use, scenic quality and regional significance.

Criteria for proximity are as follows:

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

Criteria for scenic quality are as follows:

- High sensitivity:
  - high use routes or areas.
  - routes or areas of national or state significance.
  - areas with high scenic quality.
- Moderate sensitivity:

- moderate use routes or areas.
- routes or areas of regional or local significance.
- areas with moderate scenic quality.

- Low sensitivity:
  - low use routes or areas.
  - routes or areas of low local significance.
  - areas with low scenic quality.

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

- Within the rural LCU, viewpoints were assessed to be of low sensitivity on low use roads. One viewpoint (7) has moderate sensitivity due to the proximity to the site and views across the site with forest LCU in the background.
- Within the industrial LCU, viewpoints were assessed as having low sensitivity. Any views from these areas would be fleeting due to vehicle speed, hard to discern, and fragmented by existing roadside vegetation and overhead transmission lines. Built structure is more commonly functional than aesthetic in these settings.
- No viewpoints were assessed for the following LCU's, due to their distance from the site and lack of public viewpoints toward the Proposal Site.
  - Village (Black Mountain)
  - Commercial (Armidale)

The sensitivity of each viewpoint is provided below.

Table 8-2 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	View location	Representative receivers	Proximity	Scenic quality	Sensitivity
1	Rural	Residential	Local traffic along Thorpes Lane and resident of Thorpes Lane	Background	Moderate	**Low**
2	Forest	Recreational	Users of Robbers Run mountain bike trail and Thunderbolts Cave.	Background	Moderate	**Low**
4	Industrial	Public Road	Traffic along New England Highway and residents of New England Highway (R5).	Foreground	Low	**Low**
5	Industrial	Public Road	Traffic along New England Highway and	Middle Ground	Low	**Low**

ID	LCU	View location	Representative receivers	Proximity	Scenic quality	Sensitivity
			residents of New England Highway (R3 and R6).			
6	Rural	Residential	Local traffic along Sunnyside Road	Background	Moderate	**Low**
7	Rural	Residential	Residential receiver (R2).	Middle Ground	Moderate	**Moderate**

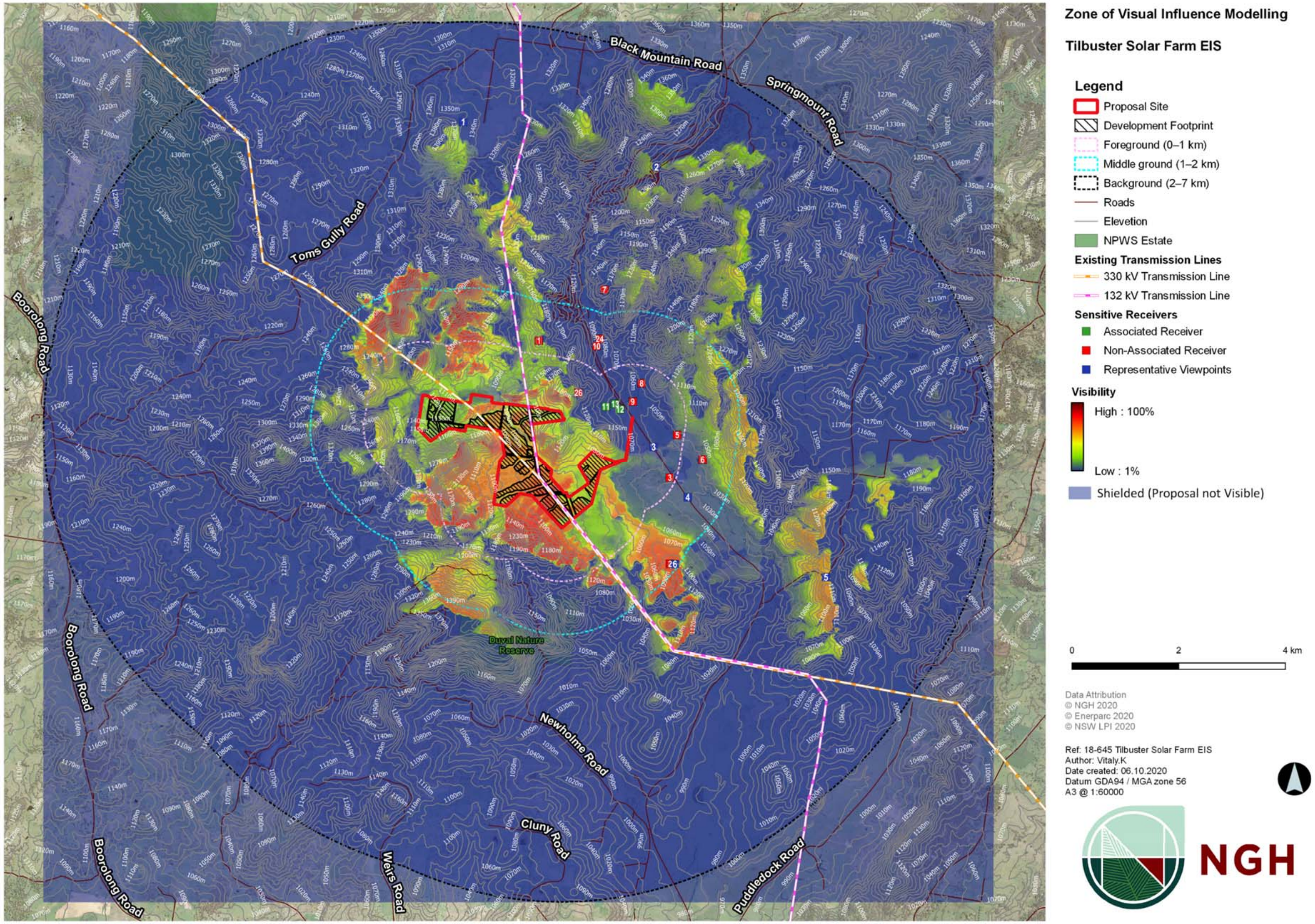


Figure 8-1 Zone of Visual Influence showing existing residential receivers and local roads and the low visibility of the Proposal Site to these.

8.1.3. Potential impacts

Evaluation criteria

Visual LMZs were assigned to each viewpoint. The zones were derived by combining scenic quality, viewer sensitivity and the distance to the Proposal Site. Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 8-3.

Table 8-3 Visual Landscape Management Zone decision matrix

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

Each zone has associated objectives to guide management of visual change and to help evaluate impacts of the proposed solar farm. These are shown in Table 8-4.

Table 8-4 Visual Landscape Management Zone management objectives

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

The ratings for the degree of contrast created by the proposed solar farm infrastructure for each viewpoint have the following definitions (Bureau of Land Management, n.d.).

- High contrast: the proposed solar farm would be dominant within the landscape and generally not overlooked by the observer, the visual change would not be absorbed.
- Medium contrast: the proposed solar farm would be moderately dominant and noticed, the visual change would be partially absorbed.
- Low contrast: the proposed solar farm would be seen but would not attract attention, the visual change would be well absorbed.
- Indistinct: contrast would not be seen or would not attract attention. The visual change would be imperceptible.

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

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

For high impact viewpoints, mitigation must be considered.

Table 8-5 below evaluates the representative viewpoints They are ordered in terms of highest visual impact rating. Table 8-7 provides a summary of visual impacts for all associated and non-associated receivers within 2km of the proposal site.

Photomontages

Photomontages were prepared for one viewpoint to represent one residence with visual impact concerns. This is considered to be the most effected receiver. Photomontages provide a realistic impression of the operational solar farm. As access to the residence was not possible, the photomontage was taken from a location close by considered to be representative of the potential view of solar farm infrastructure from that location.

A photomontage of the project shown within the existing context was prepared by Moir Landscape Architecture to assist in the impact assessment of the proposal. The Photomontage is based on a worst-case scenario of the Proposal without the inclusion of proposed mitigation measures (i.e. vegetative screening). Where infrastructure is discernible in the landscape, rendered images in red have been included to provide clarity.

Table 8-5 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures (i.e. vegetation screening).

The montage is included in Section 8.1.3 and shows a specific view from a particular residence. Evidence of consultation has been recorded in Section Table 6-6.

Visual impact assessment at representative viewpoints

Table 8-5 Visual impact at representative viewpoints with reference to the Tilbuster Solar Farm, in order of highest impact

VIEWPOINT 1		
Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	Residents of Black Mountain in location with most potential for impact.	Taken from the termination of Thorpes Lane and facing south towards the proposal. The viewpoint is representative of the rural views of the area. Dominant features include the unsealed road and grazing paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, existing vegetative screening and the undulating nature of the area. **No mitigation is required**
LCU	Rural	
Scenic Quality	Moderate	
Proximity	Background (<2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

VIEWPOINT 2

Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	Users of Robber Run and Thunderbolts Cave recreational area	Taken at the beginning of Robbers Run mountain bike trail on Thunderbolts Cave Road, and facing south - west towards the proposal. The viewpoint is representative of the forest views of the area. Dominant features include gravel tracks, cleared recreational areas and vegetation. Proposed infrastructure is not discernible by recreational users of Thunderbolts Cave, Robber Run mountain bike track or by motorists due to distance, existing vegetative screening and the undulating nature of the area. **No mitigation is required**
LCU	Forest	
Scenic Quality	Moderate	
Proximity	Background (<2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

VIEWPOINT 3

Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	R5 and users of New England Highway	Taken from New England Highway, and facing west towards the proposal. The viewpoint is representative of the industrial views of the area. Dominant features include the dual lane sealed road, grazing and cropping paddocks, fencing, transmission lines and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, existing vegetative screening and the undulating nature of the area. **No mitigation is required**
LCU	Industrial	
Scenic Quality	Low	
Proximity	Foreground (0 - 1 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

VIEWPOINT 4

Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	R3, R6 and users of New England Highway	Taken from New England Highway, and facing west towards the proposal. The viewpoint is representative of the industrial views of the area. Dominant features include the dual lane sealed road, grazing and cropping paddocks, fencing, transmission lines and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, existing vegetative screening and the undulating nature of the area. **No mitigation is required**
LCU	Industrial	
Scenic Quality	Low	
Proximity	Middle ground (1 - 2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

VIEWPOINT 5

Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	Residents of Sunnyside Road in in location with most potential for impact.	Taken from Sunnyside Road facing north - west towards the proposal. The viewpoint is representative of the rural views of the area. Dominant features include the unsealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, existing vegetative screening and the undulating nature of the area. **No mitigation is required**
LCU	Rural	
Scenic Quality	Moderate	
Proximity	Background (<2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Residual Visual Impact	LOW	

VIEWPOINT 6

Summary of Viewpoint		Viewpoint Description / Impact
Receiver/s represented	R2	Taken from R2 facing north - west towards the proposal. The viewpoint is representative of the rural views of the area. Dominant features include the grazing and cropping paddocks, fencing, and vegetation. Clear views of the proposed infrastructure will be noticeable from some areas within the front garden of this residence. **Refer to photomontage 1 and Appendix J.** **No mitigation is required.**
LCU	Rural	
Scenic Quality	Moderate	
Proximity	Middle ground (1 - 2 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Moderate	
Residual Visual Impact	LOW	

Table 8-6 Photomontages of representative viewpoint (red arrow indicates location of infrastructure).

Photomontage 1 (taken from approximately 630 m north west of Viewpoint 6, to represent R2)

Existing view

Proposed view

Table 8-7 associated and non-associated receivers within 2km of the proposal site.

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
Non-associated receivers						
R1	1250m north of proposal site boundary	1160m	**Solar farm infrastructure** Existing vegetation screening means this receiver will not have a view of solar farm infrastructure. **Glint and glare** This receiver would not experience glint or glare from any infrastructure due to existing vegetation screening.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R2	1850m south-east of proposal site boundary	1090m	**Solar farm infrastructure** This receiver will have a view of solar panels to the north – east. The closest panel infrastructure will be located 1859m north – east. Existing 330 kV and 132 kV transmission lines are visible from this receiver. **Glint and glare** Glint and glare from panels and fixed frames are possible for this receiver. If fixed panels are selected, panels would be tilted to the north, as such impacts would be from the fixed frames. Impacts are not	LOW	No mitigation is required.	LOW

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
			considered to be significant given the distance from the proposal. If single axis tracking panels are selected, rows would be configured in a north to south direction and the panels would track sun from the east to west, as such, impacts would be from frames and panels and would be variable depending on the time of day. Impacts are not considered to be significant given the temporary nature of the impact and distance from the proposal.			
R3 This receiver will not have a view of solar farm infrastructure.	900m east of proposal site boundary	1040m	**Solar farm infrastructure** Existing topography means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R5 This receiver will not have a view of solar farm infrastructure.	875m east of proposal site boundary	1050m	**Solar farm infrastructure** Existing topography means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
R6 This receiver will not have a view of solar farm infrastructure.	1425m east of proposal site boundary	1050m	**Solar farm infrastructure** Existing topography means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R8 This receiver will not have a view of solar farm infrastructure.	670m north of proposal site boundary	1060m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R9 This receiver will not have a view of solar farm infrastructure.	305m north east of proposal site boundary	1060m	**Solar farm infrastructure** Existing topography means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
R10 This receiver will not have a view of solar farm infrastructure.	1410m north of proposal site	1090m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R24 This receiver will not have a view of solar farm infrastructure.	1970m north east of proposal site boundary	1080m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R26 This receiver will not have a view of solar farm infrastructure.	495m north east of proposal site boundary	1160m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
Associated receivers						
R11	540m north of the proposal site boundary	1085m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R12	280m north of the proposal site boundary	1065m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare** Existing topography and vegetation would screen this receiver from glint or glare.	Shielded from proposal	No mitigation is required.	Shielded from proposal
R13	411m north of the proposal site boundary	1070m	**Solar farm infrastructure** Existing topography and vegetation means this receiver will not have a view of solar farm infrastructure. **Glint and glare**	Shielded from proposal	No mitigation is required.	Shielded from proposal

Receiver	Distance (m) and direction from proposal site	Elevation (AHD)	Potential impacts	Unmitigated impact	Mitigation Measures	Residual impact
			Existing topography and vegetation would screen this receiver from glint or glare.			

Construction impacts of infrastructure components

Visual impacts during the construction would vary over the12 month construction period. At the commencement of construction, heavy vehicles would enter the proposal site by the main entrance and deposit plant and building materials at the compound site. The receiver (R2) with views of the proposal site boundary may see excavators establish the APZ around the perimeter and the security fence erected. During establishment of the APZ and internal roads, some dust may be apparent, but this would be minimised by water trucks and crushed aggregate.

Once the perimeter fence and internal roads are established, the contractor would commence building the solar farm. Overstorey vegetation removal would be completed first, which R2 may see as a small cluster of vehicles including an excavator, chipper, and dump truck move across the site. Ground cover vegetation would be retained across most of the site, except where tracks or footings are required, ie substation and operations and maintenance building.

Dust from the construction of the solar farm would not be high, given the low level of soil disturbance required and by utilising water trucks as required.

Operational impacts of infrastructure components

An operational visual impact assessment was conducted considering the potential visual impacts arising from key infrastructure elements described in Table 8-7.

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible, resulting in negligible glare or reflection. The panels will not generally create noticeable glare compared with an existing roof or building surface. Seen from above (such as from an aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

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

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

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

High impact – mitigation required

The proposed solar farm would have no areas of high visual impact due to the screening provided by topography, distance, vegetation and the low number of residents near to the site. Mitigation measures are not required for these locations.

Medium impact – mitigation should be considered

The proposed solar farm would have no areas of moderate visual impact due to the screening provided by topography, distance, vegetation and the low number of residents near to the site. Mitigation measures are not required for these locations.

Low impact – no mitigation

One viewpoint was assessed as a moderate sensitivity, Viewpoint 6. As such, a photomontage was prepared for this viewpoint. Viewpoint 6 is representative of R2, a property located approximately 2 km south – east of the Proposal Site. Some vegetation screening exists in the form of boundary plantings, which provides some screening of the Proposal Site

Views will be that of the solar panels. The form of the infrastructure is low (up to 4 m) and in rectangular arrays, is not in keeping with the existing low-lying rectangular forms in this agricultural area. Infrastructure will however not be in direct contrast with the existing overhead transmission lines that run along the western boundary of R2.

R2 has been assessed as having a low impact due to the distance of the proposal.

The remaining five viewpoints were assessed to have a low visual impact. These viewpoints were assessed as such due to the undulating terrain, distance of infrastructure from the viewpoint, and existing vegetation between the site and receivers. Mitigation measures are not required for these locations.

Based on the consultation with the affected landowner to date, and the findings of the visual impact assessment, visual screening and the development of a draft Landscaping Plan are not considered to be required. There are no areas of high visual impact and the one area of potential medium visual impact is limited to a low number of receivers and the views would be temporary and short term.

8.1.4. Cumulative impacts

Adverse cumulative impacts occur when the infrastructure or activities at the solar farm site exacerbate the negative impacts of other infrastructure or activities occurring nearby.

Construction

During construction, the additional traffic and dust generation impacts pose the greatest potential for cumulative visual impacts. The visual impact of increased traffic movements to the site would be predominantly limited to construction. A Traffic Management Plan (TMP) will be developed to minimise vehicle movements as much as practicable during construction.

Operation

During operation, with the exception of infrequent maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles is all that will be required. Cumulative visual traffic impacts are considered negligible.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the existing and retained vegetative screening and undulating nature of the site that blocks out the majority of views. Specifically, screening to soften cumulative impacts has been recommended at one receiver.

8.1.5. Safeguard and mitigation measures

Table 8-8 Safeguards and mitigation measures for biodiversity impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical: • Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown. • Pole mounts will be non-reflective. • Security fencing posts and wire would be non-reflective.	Design		
2	During construction, dust would be controlled in response to visual cues.	C		
3	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).		O	
4	In the event that a Development Application for a residential dwelling on Lot 4 DP800611, the proponent would undertake consultation with the landowner in relation to potential visual impacts and provide fund towards establishing appropriate screening.	C		

8.2. NOISE AND VIBRATION

8.2.1. Approach

A Construction and Operational Noise and Vibration Assessment for the proposed Tilbuster Solar Farm was undertaken by Renzo Tonin and Associates. The full report is provided in Appendix H and is summarised below. It includes consideration of noise and vibration impacts from the construction and operation phases of the Proposal in accordance with SEARs.

8.2.2. Existing environment

The Proposal Site is located on the western side of the New England Highway, approximately six kilometres northwest of the Tilbuster township within the Armidale Regional Council LGA in NSW. The existing background and ambient noise is dominated by traffic along the New England Highway and agricultural activities such as operation of tractors, quad bikes and 4WD vehicles.

Identified receivers surrounding the Proposal Site are classified as rural under the NSW 'Noise Policy for Industry' (NPfI) (NSW EPA, 2017). Background noise levels were found to be typical of for a rural area. Receiver locations are shown in Figure 8-2. The closest non-associated receiver is located approximately 280 metres north of the project area at 12029 New England Highway (R11A).

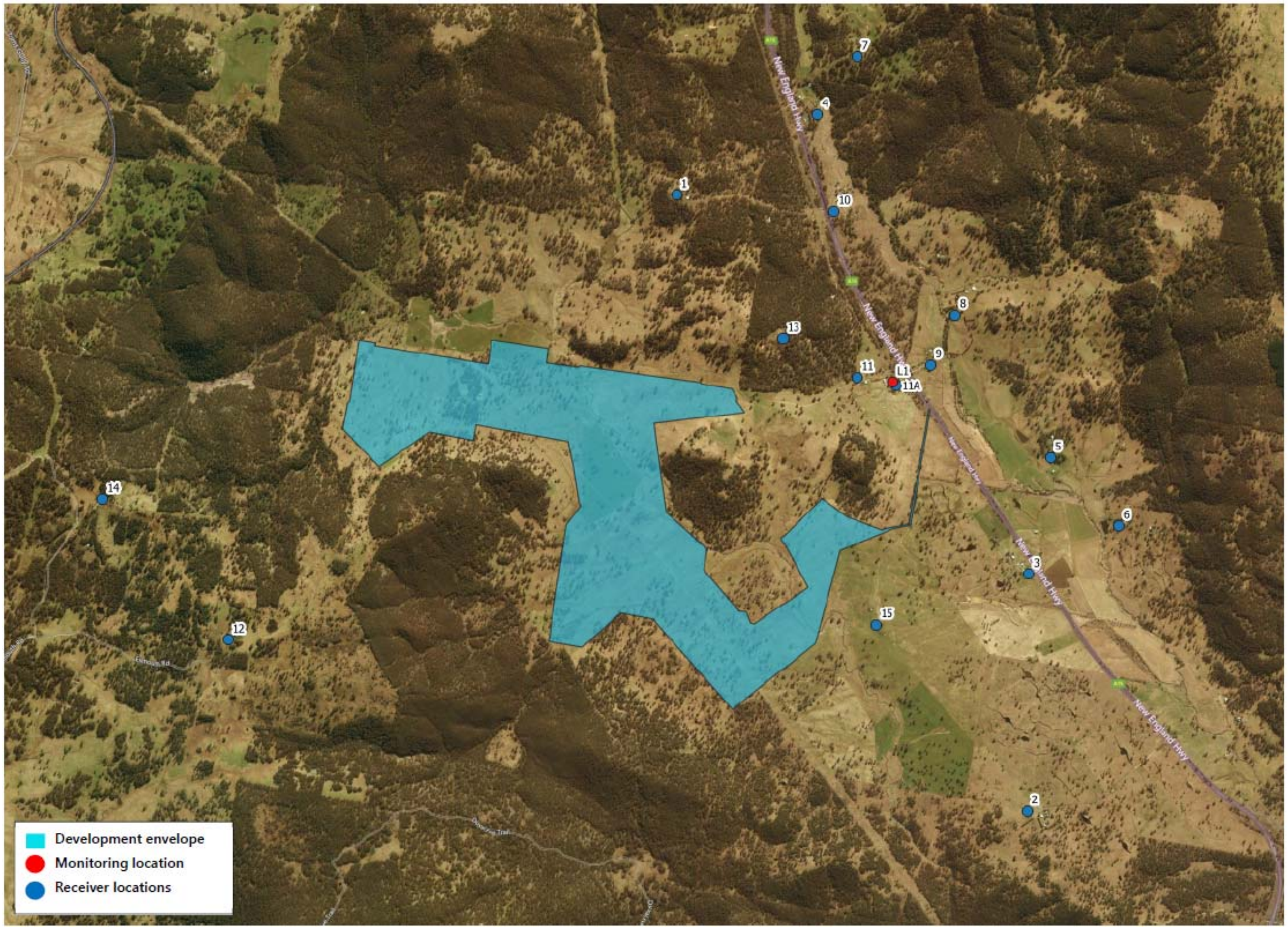


Figure 8-2 Residential receivers and noise monitoring locations adjacent to the Proposal Site (Renzo Tonin & Associates, 2020)

8.2.3. Noise monitoring

Criteria for the assessment of construction and operational noise are derived from the measure existing background noise levels. The NSW Policy for Industry (NPfI) (NSW EPA, 2017) outlines methods for determining the background noise level of an area. This assessment of the proposed works has used long-term noise monitoring.

Noise monitoring was undertaken at the closest sensitive receiver (L1). To quantify the existing ambient noise environment, long-term (unattended) noise monitoring was conducted at Location L1 between Tuesday 13th August and Tuesday 20th August 2019. The existing background and ambient noise levels determined from the monitoring are presented in Table 8-9.

Table 8-9 Measured existing background (L90) and ambient (Leq) noise levels, dB(A).

Monitoring location	L_{90} Background Noise Levels			L_{eq} Ambient noise level		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
L1 – 12029 New England Highway	35	23	17	55	43	43

The identified receivers surrounding the subject site are all classified as rural under Npfl guidelines. It was found that the background noise levels were typical for a rural area.

Based on Table 2.1 of the NPfI Guidelines, where background noise levels are less than the minimum assumed Rating Background Noise Levels (RBLs), the minimum assumed RBL's are adopted for all receiver locations. Therefore, the background noise levels relevant to the Proposal are as per the fourth column of Table 8-10 below.

Table 8-10 Rating Background Noise Level, dB(A).

Time of day	Measured Existing Background (L_{90}), dB(A)	Minimum Assumed RBLs, dB(A)[1]	Applicable Rating Background Level, dB(A)
Day	35	35	**35**
Evening	23	30	**30**
Night	17	30	**30**

[1] In accordance with Table 2.1 of the NSW NPfI.

8.2.4. Construction noise impact assessment

Criteria

The NSW 'Interim Construction Noise Guideline' (DECC, 2009) provides guidelines for assessing noise generated during the construction phase of developments. According to the guideline, a quantitative assessment of noise impacts is warranted when works are likely to impact an individual or sensitive land use for more than three weeks in total. The construction of the Tilbuster Solar Farm meets the requirements of a quantitative assessment.

Residential receivers

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers (Table 8-11). The Rating Background Level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period. Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified below.

Table 8-11 Noise management levels at residential receivers

Time of day	Management Level
Recommended standard hours: **Monday to Friday** **7 am to 6 pm** **Saturday 8 am to 1 pm** **No work on Sundays or public holidays**	Noise affected Rating Background Level + 10dB(A)
	Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected Rating Background Level + 5dB(A)

Table 8-12 identifies the adopted construction Noise Management Levels (NMLs) for the nearest noise sensitive residential receivers for the Tilbuster Solar Farm Proposal. The NMLs for the receiver locations are derived from the RBLs represented by the background noise levels measured at the monitoring location (Table 8-9) and NSW ICNG (DECC, 2009) criteria. During standard construction hours, a highly affected noise criteria of 75 dB(A) applies for all receivers.

Table 8-12 Construction noise management levels at residential receivers

Location description	Day L_{A90} background noise level (RBL)	Day noise management $L_{A90\ (15min)}$
All residential receivers	35[2]	45

Construction noise sources

Noise impact predictions take into account the typical noise levels of construction equipment likely to be used for the construction phase. The equipment and their sound power levels to be used within the Proposal Site are in Table 8-13.

Table 8-13 Typical construction equipment sound power levels within Proposal Site.

Equipment used	Laeq Sound power levels (dBA) per single item	No. Items required
Small Pile Driving Rig	6	114
Crane	2	110
Drum roller	2	109
Padfoot roller	2	109
Wheeled loader	2	109
Dump Truck	4	108
30T Excavator	8	107
Grader	4	107
Chain trencher	2	104
Water truck	4	104
Telehandler	4	98

[2] Construction works occur during the daytime period only; hence, only the day period is assessed.

Equipment used	Laeq Sound power levels (dBA) per single item	No. Items required
Forklift	4	90

Construction noise assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2020 MR 1) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations;
- Height of sources and receivers;
- Separation distances between sources and receivers;
- Ground type between sources and receivers (soft); and
- Attenuation from barriers (natural and purpose built).

Table 8-14 presents the noise levels likely to be experienced at the nearby affected receiver locations during the construction works within the Proposal Site. The predicted levels are considered a worst-case scenario with up to three nosiest plants operating concurrently.

Table 8-14 Predicted Laeq 15 min construction noise levels at receiver locations for works with the Proposal Site.

Receiver location (refer to Figure 8-2)	Noise management level[1]	Predicted construction noise Level, $L_{Aeq\ (15\ min)}$ [2]	Compliance with criteria? (Yes/No)
Residential receivers			
R1	45	<20-23	Yes
R2		<20-27	Yes
R3		<20-32	Yes
R4		<20	Yes
R5		<20-36	Yes
R6		<20-31	Yes
R7		<20-21	Yes
R8		<20-39	Yes
R9		<20-45	Yes
R10		<20-23	Yes
R11		<20-40	Yes
R11A		<20-45	Yes
R12		<20	Yes
R13		<20-33	Yes
R14		<20	Yes
R15		<20-44	Yes

1. Noise management for standard day time construction works (i.e. Monday to Friday 7am to 6pm and Saturday 8am to 1pm).
2. Up to 3 (noisiest) plant operating concurrently.

Based on the construction noise levels presented in the table above, the predicted construction noise levels at all receivers are within the construction noise management levels during standard construction hours. It is noted that construction noise levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A).

8.2.5. Operational noise assessment

Background noise monitoring

The background noise data collected to assess construction noise was also used to assess operational noise.

Criteria

The NSW *Noise Policy* for Industry (NPfI) (NSW EPA, 2017) specifies noise criteria relating to intrusive noise impacts and noise level amenity. The assessment criteria under the NPfI for the Tilbuster Solar Farm is outlined in Table 8-15.

Table 8-15 Proposal specific criteria

Assessment Criteria	Proposal Specific Criteria
Intrusive	Rating background level + 5dBA
Amenity	$L_{Aeq\ period}$ recommended amenity noise levels – 5dBA $L_{Aeq\ period}$ + 3dBA

The operational proposal-specific noise criteria for the solar farm based on the NPfI criteria and guidelines is shown in Table 8-16 and Table 8-17.

Table 8-16 Intrusiveness noise criteria

Receiver	Period	RBL, dB(A)	Laeq (15 minute) (dBA)
All residential receivers [1]	Day	35	35+5 = 40
	Evening	30	30+5=35
	Night	30	30+5=35

Notes: Intrusiveness criteria is only applicable for residential receivers.

Table 8-17 Applicable amenity noise criteria

Type of Receiver	Indicative noise amenity area	Time of day	Recommended noise level	
			L_{Aeq} Period	$L_{Aeq\ 15\ min}$
Residence	Rural	Day [1]	50-5=45	45+3=48
		Evening [2]	45-5=40	40+3=43
		Night [3]	40-5=35	35+3=38

Notes: 1. Day is defined as 7.00am to 6.00pm, Evening 6.33pm to 10.00pm; Night 10.00pm to 7.00am

2. On Sundays and Public Holidays, Day 8.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 8.00am

3. The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

In accordance with the Npfl guidelines, the Proposal noise trigger levels are the lowest (i.e. more stringent) value for the Proposal intrusiveness noise levels and Proposal amenity noise levels. These have been determined and reproduced in Table 8-18 below.

Table 8-18 Proposal Noise Trigger Levels, dB(A).

Receiver location (refer to Figure 8-2).	$L_{Aeq\ 15\ min}$ Proposal Noise Triggers[1]		
	Day	**Evening**	**Night**
Residential receivers			
All residential receivers (R1 to R15)	40	35	35

Notes:
1. Monday-Saturday, Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
2. On Sundays and Public Holidays, Daytime 8.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 8.00 am.
3. The Laeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
4. Proposal Noise Trigger Levels only apply when premises are in use.

Operational noise sources

The proposed solar farm considers two options for the configuration of the PV panels:

1. Fixed configuration, where the panels would be placed on fixed frames running in rows from east to west and tilted to the north; or

2. Single axis tracking, where the panels would be in rows configured in a north to south direction and the panels would track the sun from east to west throughout the day.

For this noise assessment only the single axis tracking has been considered. The single axis tracking system involves the panels being driven by motors to track the arc of the sun to maximise the solar effect. Hence, the tracking motors are a potential source of mechanical noise and therefore, has been included for a more conservative assessment.

The potential sources of noise during operation of the solar plant considered for the assessment included:

- Mechanical noise from the tracking system of the solar panels, from a total of 302 tracking motors (ATI DuraTrack Tracker or equivalent) that will drive 6,306 tracker tables, each holding approximately 84 solar modules, and are to be evenly distributed across the solar farm area.
- Operation of up to 30 PCUs (SMA MV Power Station) with each PCU containing two (2) 3000kW inverters and one (1) transformer, which will be evenly distributed across the solar farm area.
- A new substation located in the middle of the site. The dominant noise source from the new substation will be from two (2) 100MVA transformers (generic brand). There will also be 20 battery storage systems (Autarsys Nucleons) located in this area.
- Five staff members onsite daily with the use of a light vehicle.

The predicted power levels of these operation activities are shown in Table 8-19.

Table 8-19 Typical operational plant and equipment & sound power levels.

Plant Item	Plant Description	LAeq Sound Power Levels, dB(A) re. 1pW
1	ATI DuraTrack tracker motor (302 in total)	81 (each)[1]
2	SMA MV Power Station 3000 kW inverter (60 in total)	88 (each)[1]
3	SMA MV Power Station Transformer (30 in total)	83 (each)[1]
4	Horizon Power ONAF 100 MVA transformer (2 in total)	96 (each)[1]
5	Energy storage units (20 in total)	87 (each)[2]
6	Light vehicle (5 in total)	88 (each)[1]

- Notes:
- 1. Based on sound power level data from past projects and/or RT&A's acoustic database
- 2. Based on sound power level data provided by the client

For the assessment of the solar farm, the noise from the inverters and transformers are considered to be tonal in nature. Therefore, a 5dB(A) penalty has been applied to the predicted noise contributions from the inverters and transformers.

Operational noise assessment

In order to determine the noise impacts of the operating solar farm, a computer model incorporating all significant noise sources, receiver locations, topographical features of the intervening area, and potential noise control treatments surrounding the study area. The modelling calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

Additionally, in accordance with the NPfI noise predictions were prepared for each of the following meteorological conditions:

- Calm and isothermal conditions (acoustically neutral) – no wind and no temperature inversion.
- Slight to gentle breeze –3m/s wind velocity at 10m from ground level between each noise source and each noise receiver (as per INP default wind conditions). Wind direction was based on wind travelling from the source to the receiver.
- Moderate temperature inversion – applicable for noise predictions during night-time periods only.

Table 8-20 present the predicted noise levels for the 'worst case scenario' based on concurrent operation all plant and equipment shown in Table 8-19.

Table 8-20 Predicted cumulative Laeq 15min operational noise levels at residential receiver locations, dB(A).

Receiver location (refer to Figure 8-2).	Proposal noise triggers			Predicted operational noise levels, Laeq (15 min)			Comply? (Yes/No)
	Day	**Evening**	**Night**	**Calm and isothermal conditions**	**Slight to gentle breeze**	**Moderate temperature inversion[1]**	
R1	40	35	35	<20	<20	<20	Yes
R2				<20	22	22	Yes
R3				<20	<20	<20	Yes
R4				<20	<20	<20	Yes
R5				<20	<20	<20	Yes
R6				<20	<20	<20	Yes
R7				<20	<20	<20	Yes
R8				<20	<20	<20	Yes
R9				<20	<20	<20	Yes
R10				<20	<20	<20	Yes
R11				<20	<20	<20	Yes
R11A				<20	<20	<20	Yes
R12				<20	<20	<20	Yes
R13				<20	<20	<20	Yes
R14				<20	<20	<20	Yes
R15				26	31	31	Yes

Notes: 1. Criteria for night-time period only

Based on the predicted noise levels presented in the table above, operational noise levels from the proposed solar farm and the upgraded substation at the nearest receivers each comply under all scenarios and meteorological conditions.

8.2.6. Sleep Disturbance Assessment

To assess the likelihood of sleep disturbance, the potential of maximum noise level events from premises during the night-time period has been considered in this assessment. In accordance with the NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- LAeq,15min 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- LAFmax 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

Where there are noise events found to exceed the initial screening level, further analysis is undertaken to identify:

- The likely number of events that might occur during the night assessment period,
- The extent to which the maximum noise level exceeds the rating background noise level.

During the night-time period, only mechanical plant will be operating, including the tracking motors, inverters and the substations. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the LAmax noise levels experienced at the identified receivers will be similar to the predicted LAeq,15min noise levels shown in Table 8-14. Hence, it is expected that both the LAeq,15min and LAFmax will be well below the nominated sleep disturbance criteria of 40dB(A) and 52dB(A), respectively.

8.2.7. Vibrational assessment

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's 'Assessing Vibration; a technical guideline' (DEC, 2006). The guideline provides criteria which are based on British Standard BS 6472-1992 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

Based on the proposed plant items presented in Table 8-19, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 8-21 below. The assessment is relevant to the identified receiver locations.

Table 8-21 Potential vibration impacts for identified receivers

Receiver location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts	Vibration monitoring
R1	1,250m	Residential	Very low risk of adverse comments	Not required
R2	1,880m	Residential	Very low risk of adverse comments	Not required
R3	900m	Residential	Very low risk of adverse comments	Not required

Receiver location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts	Vibration monitoring
R4	1,970m	Residential	Very low risk of adverse comments	Not required
R5	875m	Residential	Very low risk of adverse comments	Not required
R6	1,425m	Residential	Very low risk of adverse comments	Not required
R7	2,430m	Residential	Very low risk of adverse comments	Not required
R8	670m	Residential	Very low risk of adverse comments	Not required
R9	305m	Residential	Very low risk of adverse comments	Not required
R10	1,410m	Residential	Very low risk of adverse comments	Not required
R11	540m	Residential	Very low risk of adverse comments	Not required
R11A	280m	Residential	Very low risk of adverse comments	Not required
R12	1,590m	Residential	Very low risk of adverse comments	Not required
R13	495m	Residential	Very low risk of adverse comments	Not required
R14	1,810m	Residential	Very low risk of adverse comments	Not required

Receiver location	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts	Vibration monitoring
R15	380m	Residential	Very low risk of adverse comments	Not required

The potential for adverse comment to vibration impacts was determined to be very low.

8.2.8. Road traffic noise assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

Vehicle access to the subject site will be via the New England Highway. Based on information provided by the client, the peak vehicle movements during the construction stage of the project are presented in the following table. Furthermore, vehicle movements will only occur during the daytime period when construction works occur.

Based on functionality, the New England Highway is categorised as an arterial road. For existing residences affected by additional traffic on existing arterial roads generated by land use developments, the following RNP road traffic noise criteria apply.

Table 8-22 RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Proposal /Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15 hour)}$ 60 (external)	$L_{Aeq,(9 hour)}$ 55 (external)

Table 8-23 Summary of estimated construction traffic volumes during peak (excluding one off delivery and pick up).

Vehicle type	Trips per day
Cars/light vehicles	58
Shuttle bus	8
MRV/HRV	22
AV/B-Double	14
Total	**102**

Results of the road traffic noise predictions are presented in Table 8-24. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels due to existing general traffic flows as existing traffic volumes along the New England Highway are unknown.

Table 8-24 Predicted road traffic noise contribution levels along public roads, dB(A).

Receiver	Criteria	Truck traffic movements	Speed (km/h)	Distance to Road	Predicted Noise Level	Comply? (Yes/No)
Residences on the New England Highway	$L_{Aeq,\ (15\ hour)}$ 60	As per Table 8-23	100	20m	50	Yes

From Table 8-24, it can be seen that road traffic noise level contributions from the vehicle movements associated with the construction works are at least 10dB(A) below the applicable noise criterion based on dwellings being 20m from the road. Given that residences are located within a rural environment, distances between the road and the dwellings would likely be significantly greater than 20m.

Furthermore, as the predicted levels are 10dB(A) less than the traffic noise criterion, it is not expected that the traffic noise contribution from the construction vehicles would result in an exceedance of the traffic noise criterion and/or increase the existing traffic noise levels by more than 2dB.

8.2.9. Safeguards and mitigation measures

Table 8-25 Safeguards and mitigation measures for noise and vibration impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A Noise Management Plan would be developed as part of the CEMP. The plan would include, but not be limited to:	C		

ID	Safeguards and mitigation measures	C	O	D
	• Use less noisy plant and equipment where feasible and reasonable. • Plant and equipment to be properly maintained. • Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. • Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel. • Avoid any unnecessary noise when carrying out manual operations and when operating plant. • Any equipment not in use for extended periods during construction work should be switched off. • Complaints procedure deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. • Establish good relations with people living in the vicinity of the site at the beginning of Proposal and maintain. Keep people informed, deal with complaints seriously and expeditiously. The community liaison member of staff should be adequately experienced.			

8.3. WATER USE AND WATER QUALITY

8.3.1. Existing environment

Surface water

The Proposal Site is located in the Northern Tablelands Local Land Services region within the 50,000 km^2 Northern Rivers Catchment of which the major rivers are the Tweed, Brunswick, Richmond, Clarence, Bellinger, Nambucca, Macleay and Hastings. The dominant surface water feature within the locality is the Macleay River, located approximately 42 km south east of the Proposal Site and joins the Gara River. The Gara River system feeds into the Guyra Dam storage area. The closest internationally important wetland (Ramsar) to the Proposal Site is the Little Llangothlin Nature Reserve, which is approximately 32 km north-north east. The closest nationally important wetland (DIWA) to the Proposal Site is the Dumaresq Dam (New England Wetland), which is approximately 6 km south west.

The existing surface water environment within the Proposal Site is characterised by 11 dams, one named watercourse (Duval Creek) and approximately 18 unnamed tributaries. The dams are located mostly along the drainage lines that traverse the site (Figure 8-3). All watercourses are described as ephemeral and would only contain flowing water during significant rainfall events. A site inspection was undertaken on 14 August 2019 during drought conditions. No flowing water was observed on any of the site visits, although some small areas of pooling were noted (Figure 8-5).

Most of the smaller watercourses on the Proposal Site are unnamed 1st, 2nd and 3rd order streams that are tributaries of Duval Creek, which is a 5th order stream under the Strahler Stream Classification System (Figure 7-15). Tributaries of Sams Gully (a tributary of Duval Creek located north of the Proposal Site) also traverse the Proposal Site in the west. Duval Creek flows north-west to south-east and discharges into Tilbuster Ponds approximately 6.5 km south east of the Proposal Site. Although only pools of water were observed during the site inspection, Duval Creek has defined channels with potential to flow during rainfall events (Figure 8-4).

Total catchment areas (and sub-catchments) contributing to the main watercourse were estimated by Footprint (2020) using Digital Elevation Models (DEM). The total catchment area contributing to Duval Creek at the southern boundary of the Proposal Site was estimated to be approximately 2765 ha (Footprint, 2020). The overall catchment was dissected into 25 sub catchments and ranged in size from 3.30 to 211.31 ha, with an average size of approximately 100 ha.

Water quality onsite for all the waterways would be influenced by the surrounding agriculture activities, in particular: stock access, informal waterway crossings and runoff of chemicals (e.g. fertilisers and herbicides) and animal waste.

Figure 8-3 Typical farm dam within the Proposal Site

Figure 8-4 Current condition of Duval Creek (south-east portion of site)

Figure 8-5 Pooling of water within Duval Creek (south-east boundary)

Groundwater and water entitlements

The NSW DPI database of groundwater lists 1 bore located at the Proposal Site and 4 bores within 2 km of the Proposal Site (Figure 8-6).

The Proposal Site is not located in an area mapped as having groundwater vulnerability.

The Proposal Site is located within Macleay River Catchment and is subject to the Water Sharing Plan for the Unregulated and Alluvial Water Sources.

Groundwater Dependant Ecosystems

Groundwater Dependent Ecosystems (GDEs) include ecosystems which may rely on the surface expression of groundwater (including surface water ecosystems that may have a groundwater component) and ecosystems which may rely on the subsurface presence of groundwater (including vegetation ecosystems).

The Groundwater Dependent Ecosystems Atlas (BOM, 2018) maps potential GDE's within the vicinity of the Proposal Site (Figure 8-7). Terrestrial Groundwater Dependent Ecosystems occur within and surrounding the Proposal Site.

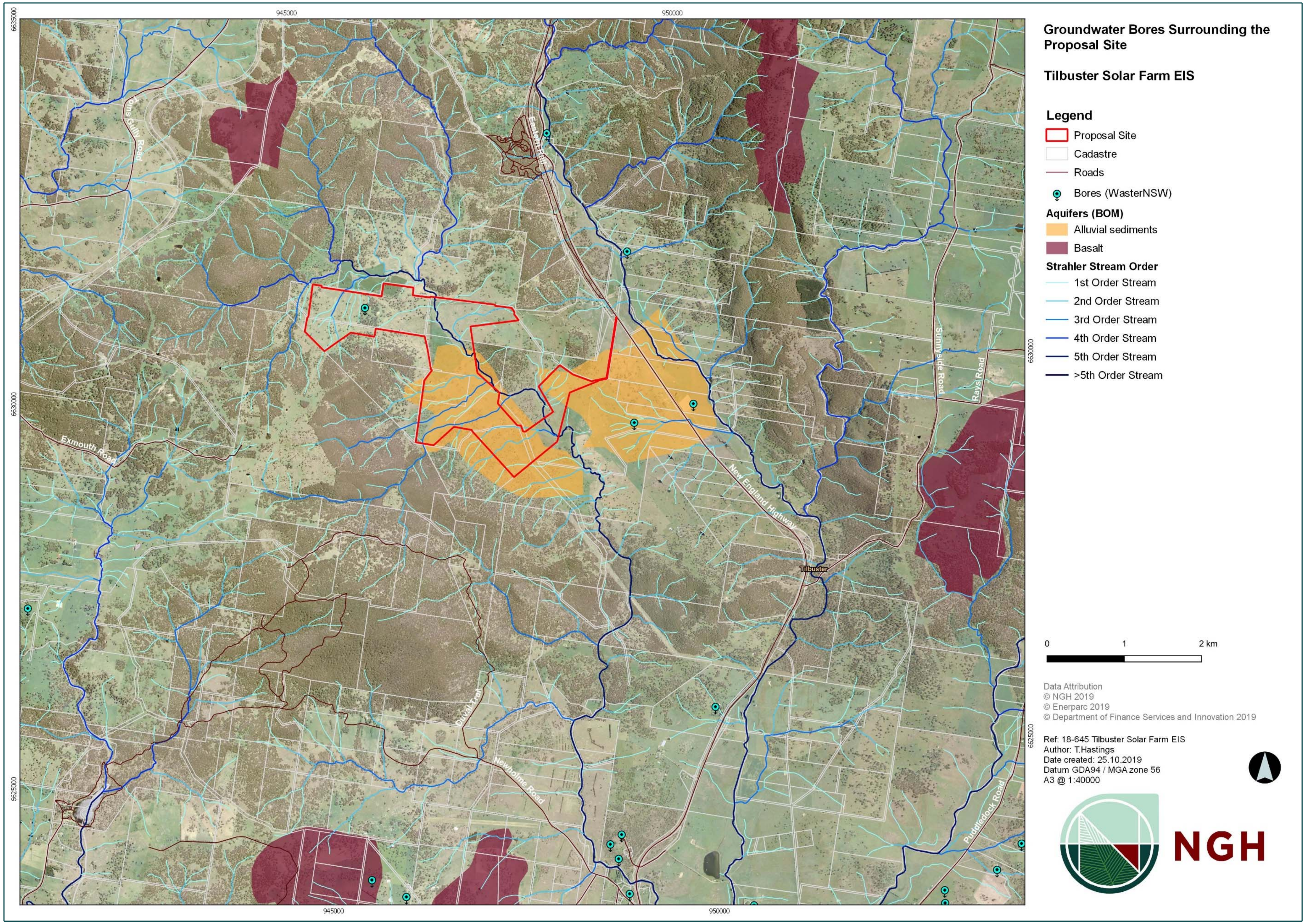


Figure 8-6 Groundwater bores surrounding the Proposal Site

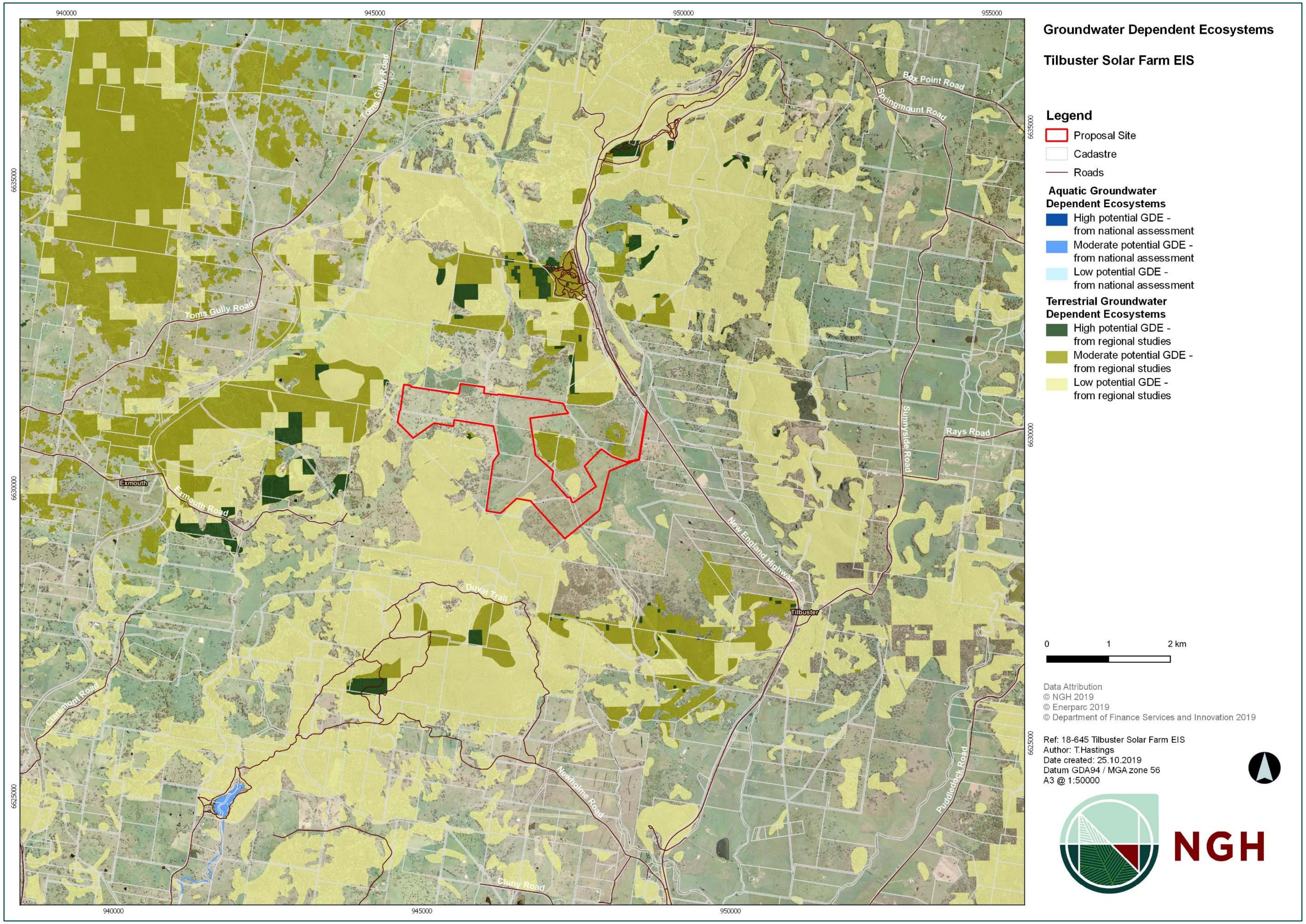


Figure 8-7 Groundwater Dependent Ecosystems in proximity to the Proposal Site

8.3.2. Potential impacts

Construction and decommissioning

Surface water

Construction activities that disturb soil may lead to sediment or other pollutant laden runoff, mobilising and entering local waterways. Activities that may contribute to this include:

- Excavation for the construction of internal roads and associated drainage, parking areas, footings for onsite substation, inverters and maintenance building and footings for temporary staff amenities and offices. This may result in erosion and subsequent sedimentation.
- Construction of 11 waterway crossings for internal access roads. The crossings would be located at Duval Creek.
- Trenching for installation of underground cables.
- Construction of laydown areas and access tracks resulting in soil compaction, consequently reducing soil permeability, increasing surface water runoff and the potential for concentrated flows.

During construction, ground cover would be retained and protected as much as possible, by rationalising laydown areas and tracks and use steel piles that are driven or screwed into the ground rather than excavated footings.

Construction may slightly alter surface water drainage patterns, this would be managed by ensuring flow is directed to existing locations. Surface water would still drain via the ephemeral drainage lines which flow into Duval Creek and Sams Gully. The main watercourse (Duval Creek) would not be altered by the Proposal with the exception for the construction of crossings for the internal access roads and for the installation of underground cables. The design and construction of the waterway crossings would need to consider the requirements of the following publications:

- Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (Fairfull, S. and Witheridge, G, 2003)
- Policy and Guidelines for Fish Friendly Waterway Crossings (DPI, 2003)
- Guidelines for Watercourse Crossings on Waterfront Land (DPI, 2012)
- Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land (Office of Water, 2010)

Given the waterway is categorised as a 5th order stream under the Strahler System, a 40 m buffer would apply, and crossings would need to be in the form of bridges or culverts. In order to minimise hydraulic impact on 1st and 2nd order watercourses, vehicular crossings should consist of bed level crossings constructed flush with the bed of the watercourse.

Solar panels would be installed over some sections of the drainage lines categorised as 1st order streams within the Proposal Site. This is not likely to change the hydrology of the site or present any risk to bank stability (Footprint 2020). The drainage lines are considered to be areas of overland flow with no defined bed or banks, and are moderately grassed.

The construction phase would include the following water pollution risks:

- A hydrocarbon spill risk from use and re-fuelling of construction vehicles and machinery.
- On-site concreting for building and equipment foundations.
- Wash off from curing asphalt pavement and road seal.
- Storage and use of paints, cleaning solvents and other chemicals.
- Pesticide and herbicide storage and use.

- Fertilisers used for revegetation.
- Runoff from waste materials.

Sediment and chemical pollutants which enter the drainage lines present on the site have the potential to flow into Duval Creek and be further transferred into the Macleay River.

Activities with the potential for adverse water quality impacts would be managed through the development of site specific erosion and sediment control plans and spill control plans, as detailed in Sections 7.3 and 8.11. Impacts to local water quality can also be minimised by ensuring erosion and sediment control plans include measures to ensure *Managing Urban Stormwater: Soils and Construction, Volume 1* (Landcom) criteria are met prior to discharge of water offsite.

Groundwater and groundwater dependent ecosystems

No groundwater is anticipated to be intercepted, and no groundwater would be extracted. The maximum depth of infrastructure would be pile driven or screwed mounting structures up to a depth of 2 m. Impacts to groundwater are considered unlikely to occur. Consequently, impacts to Terrestrial GDE's that are known to occur within the Proposal Site would not occur as a result of impact to groundwater supplies. No groundwater is anticipated to be intercepted and no groundwater would be extracted.

Water use and wastewater

Water use during the construction phase would be minimal and used predominantly for dust suppression on unsealed tracks and for the construction of new roads. The requirement for water is dependent on weather conditions, and is anticipated to be up to 7 ML in total. Approximately 0.3 ML of potable water would be required for employees and contractors (Table 8-26).

Table 8-26 Water requirements for construction of the proposal

Water quality	Total construction water requirement (ML)	Sources	Availability
Potable (drinking)	0.3 ML (for about 12 months)	Bottled water	Available as required – commercial supply
Non-potable	7 ML (for about 12 months)	Runoff Onsite dams Rainwater tanks New standpipe	Available as required

The development footprint is approximately 310 ha, of which 178 ha would incorporate solar panels. It is likely that the runoff due to rainfall from the site will be similar despite the addition of solar panels, however additional flows may occur from access roads and hardstands.

Based on data collected at Armidale airport weather station between 1994 and 2020, the area has an average annual rainfall of 742.9 mm per annum (BOM, 2020). The average annual runoff is about 5% dependent on the year, the timing, intensity and duration of rainfall events. Based on 5% runoff, approximately 66.1 ML is generated by the development footprint over the construction period on average. The harvestable right is 10% of runoff. Based on 10% of 66.1 ML, the harvestable right is approximately 6.61 ML. This represents 66% of the total water required for the construction phase.

The indicative layout for solar farm infrastructure requires approximately eight of the 11 existing dams within the proposal footprint to be filled in prior to construction. The dams to be filled in would be dewatered, and the water would be used for construction or transferred to another dam onsite. The remaining dams may be cleaned or enlarged as required to retain the overall harvestable right volume for the proposal site. During construction, grey construction water will be stored and treated in temporary sediment basins. This grey water will be beneficially reused onsite and displace proposal demand for clean and potable water.

Gara River is about 16 km east of the proposal. This section of the Gara River is also referred to as the Gara River Water Source and has 8 WALs available. As the river is only 16 km to the east of the proposal, an opportunity exists to establish a standpipe and draw water from the river when flows are sufficient. 1,065 ML of unregulated water was made available in 2019/2020, of which none was used. The water required for construction represents 0.7% of the volume available for that financial year. Using a proportion of this water would also supplement the proposal's water needs. The impact of drawing the 7 ML over the 12 month construction period is considered acceptable because ample remaining water is available in the system based on previous year’s figures.

Commissioners Waters is about 16 km south east of the proposal. This section of the Commissioners Waters is also referred to as the Commissioners Waters Water Source and has 45 WALs available. As the river is only 16 km to the east of the proposal, an opportunity exists to establish a standpipe and draw water from the river when flows are sufficient. 2,247 ML of unregulated water was made available in 2019/2020, of this volume, 52.9 ML was used, or 2.4% of the water available. The water required for construction represents 0.3% of the volume available for that financial year. Using a proportion of this water would also supplement the proposal's water needs. The impact of drawing the 7 ML over the 12 month construction period is considered acceptable because ample remaining water is available in the system based on previous year’s figures.

A Water Access Licence (WAL) will be obtained prior to the extraction of any water sources which form part of the Gara River Water Source or the Commissioners Waters Water Source for the purpose of the proposal.

The combined water sources would be available to supply the construction requirement of the solar farm many times over. The proposal's use of water over the construction period is not anticipated to create shortfall of water supply in the local area or impact other local users of water.

An appropriate wastewater management system for the site would be developed and installed in accordance with Armidale Regional Council requirements to manage sewerage and liquid wastes associated with temporary staff facilities.

Operation

Surface water

The Proposal layout has been developed taking into consideration the Hydraulic and Hydrological Analysis undertaken by Footprint 2020 (Section 7.5). As such, during operation, there is minimal potential for any impacts to surface water quality to occur. Construction of internal roads would include suitable drainage mechanisms to minimise the risk of polluted water leaving the site or entering the waterways. As part of construction, the site would be revegetated with grass cover with the exception of internal roads, parking areas and areas around the substation. As such, water quality impacts during operation would be low and not considered substantially different to the existing potential water quality impacts occurring from onsite activities including cropping, and use of vehicles and machinery.

There is potential for water quality onsite to be improved through revegetation of areas that are eroded with low levels of vegetation. Additionally, improvements to water quality may occur due to waterway crossings being constructed in accordance with waterfront land and water crossing guidelines.

Groundwater and Groundwater Dependent Ecosystems

No operational activities would affect groundwater at the Proposal Site. No groundwater is proposed to be sourced during the operation of the solar farm.

Water use and wastewater

It is estimated that up to 100 KL would be required per annum during operation. If insufficient water is collected on site from rainwater tanks and dams, water would be obtained commercially.

Water would be sourced from farm dams or trucked in from established standpipes drawing water from the Gara River Water Source, or Commissioners Waters Water Source if required. A license under the WM Act is not required to draw water from onsite dams, and a water use approval is not required for SSD.

An appropriate wastewater management system (eg septic system or composting system) for the site office would be developed and installed in accordance with Armidale Regional Council requirements to manage sewerage and liquid wastes associated with staff facilities.

8.3.3. Safeguards and mitigation measures

Table 8-27 Safeguards and mitigation measures for water quality and water use impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Design waterway crossings and services crossing in accordance with the publications: • *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). • *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). • *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012). • *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (NSW DPI, 2012).	C	O	D
2	All fuels, chemicals, and liquids would be stored at least 50 m from any waterways or drainage lines, not on sloping land and would be stored in an impervious bunded area.	C	O	D
3	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
4	The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
5	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D
6	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
7	Ensure appropriate drainage controls are incorporated into the design to minimise the area of disturbance, runoff and pollutant generation.	Design		
8	If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	C	O	D

ID	Safeguards and mitigation measures	C	O	D
9	Re-use of stormwater should be considered wherever possible.		O	
10	Inspect stormwater control measures at least quarterly, and before and after rainfall of more than 10 mm in 24 hours.	C	O	

8.4. HISTORIC HERITAGE

8.4.1. Approach

A desktop study and site inspection were undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a focus on the Proposal Site and surrounding landscape. The following resources were used as part of this assessment:

- The NSW State Heritage Inventory (SHI), including items on the State Heritage Register and items listed by state agencies and local Government, to identify any items currently listed within or adjacent to the Proposal Site.
- The Australian Heritage Database, including items on the National and Commonwealth Heritage Lists, to identify any items that are currently listed within or adjacent to the Proposal Site.
- Heritage schedule of Armidale Dumaresq LEP, for locally listed heritage items, that are within or adjacent to the Proposal Site.

8.4.2. Results

A summary of the results of the heritage searches are illustrated in Table 8-28 and discussed below.

Table 8-28 Summary of heritage listed items in the Armidale Dumaresq LGA.

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
NSW State Heritage Register	18
NSW State Agency Heritage Register (section 170)	339
Armidale Dumaresq LEP	248

Australian Heritage Database

The Australian Heritage Database search was undertaken on the 6 December 2019 using a search of the Armidale Dumaresq LGA. The search resulted in no items on the National Heritage List, World Heritage List, or Commonwealth Heritage List within the LGA or in relation to the Proposal Site.

NSW State Heritage Register

A search of the NSW Heritage Register on 6 December 2019 for the Armidale Dumaresq LGA identified 18 items under the NSW Heritage Act. None of the items listed in the State Heritage Search were located within 3 km of the development site.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register for the Armidale Dumaresq LGA indicated 339 listings. These items are listed by State Agencies under s.170 of the *Heritage Act 1977*. None of the items are located within 2 km of the Proposal Site+.

Armidale Dumaresq Local Environmental Plan 2012

A search of the Armidale Dumaresq LEP indicated 248 local heritage items, two heritage conservation areas, and three archaeological sites listed in the LGA. There is one locally listed heritage item (Pinch Flat I189) located more than 300 m north east outside the Proposal Site. No items are located in within the proposed development site.

Unlisted Heritage Items

Although no listed items were identified within the Proposal Site, it is acknowledged that there may be unlisted items of historic significance on the Proposal Site. Therefore, potential historic heritage was considered as part of the heritage site inspection undertaken for the area.

Site inspection

During the field survey undertaken to identify the Aboriginal cultural heritage constraints relevant to the proposal, potential historic cultural heritage constraints were considered. While several miscellaneous structures were inspected, they were considered to be in a dilapidated condition with no identifiable heritage features evident. These structures were likely constructed by the landowner as temporary feeding, shelter or storage for the livestock present within the property. No items of potential historical heritage significance were identified during the site inspection of Tilbuster Solar Farm.

Summary of Results

The results of the heritage searches listed above indicate that no known historic items or places occur within the Proposal Site.

8.4.3. Potential impacts

The Proposal is not considered likely to have a significant impact on heritage values in accordance with the *NSW Heritage Act 1977*, the EP&A Act, and the EPBC Act.

A protocol for unexpected finds would be developed for the construction phase, as detailed in Section 8.4.4.

Given the pastoral and agricultural dominated landscape of the area, and the distance of any registered historic heritage from the Proposal Site, it is unlikely the proposed works would have any impact on items of historic heritage.

The Proposal is considered unlikely to have any significant impact to any non-Indigenous heritage items.

8.4.4. Safeguards and mitigation measures

In the event of an item of heritage significance being uncovered, works should cease in the vicinity of the find and the site manager contacted immediately. Works should not recommence until an investigation has been completed by suitably qualified person in accordance with NSW Heritage Branch guidelines.

Table 8-29 Safeguards and mitigation measures for biodiversity impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Should an item of historic heritage be identified, the Heritage Division (EES) would be contacted prior to further work being carried out in the vicinity.	C	O	D

8.5. SOCIAL AND ECONOMIC IMPACTS

8.5.1. Existing environment

The Proposal Site is located within the Armidale Regional LGA in the Northern Tablelands of NSW. The region covers about 8,621 km^2 and includes several historic towns and large agricultural land holdings. Table 8-30 outlines localities that are within close proximity and are relevant to the Proposal Site.

Table 8-30 Localities close to the Proposal Site and with relevance to the proposal

Location	Distance from Proposal Site	Relevance to proposed solar farm
Armidale	13 km south	The closest regional centre for residents of Tilbuster and proposed construction work force.
Black Mountain	7 km north	Black Mountain is the closest village to the Proposal Site.
Guyra	17 km north	Guyra is the closest township to the Proposal Site.
Hillgrove	30 km south-east	5 km south east of the closest approved solar farm to the Proposal Site.

Industry profile

The New England North West Regional Plan 2036 (DPIE, 2017) describes the region as "… one of NSW's strongest regional economies and one of the State's top agricultural producing regions …". According to the plan the top five industries by economic contribution were:

1. Agriculture, forestry and fishing, $1.3 billion and 15% of the total gross regional product
2. Education and training, $686 million and 8% of the total gross regional product

3. Healthcare and social assistance, $677 million and 8% of the total gross regional product
4. Public administration and safety $481 million and 5% of the total gross regional product
5. Manufacturing, $481 million and 5% of the total gross regional product

The top 3 contributors to agribusiness in 2017-18 within New England and North West region were:

1. Cotton, contributing $884 million.
2. Cattle and calves, contributing $679 million.
3. Wheat, contributing $215 million.

The plan also presents strong economic opportunities for the Armidale Regional Council in emerging industries across:

- Renewable energy including wind and solar energy;
- Green technology providing sustainable alternatives to environmental challenges; and

The Australian Bureau of Agricultural and Resource Economics and Sciences (DAWE, 2020) showed the gross value of agricultural production in the New England and North West Region in 2017-18 was $2.6 billion (20% of NSW).

Socio-economic profile

The socio-economic profile of the Armidale Regional LGA are presented in Table 8-31.

Table 8-31 Socio-economic profile of the Armidale Regional LGA (ABS, 2016)

Statistic	Armidale	Black Mountain	Guyra	Hillgrove
Population	23,352	310	2,027	176
Median age	34	42	42	45
Gender split	52.3% Female 47.7% Male	46.8% Female 53.2% Male	51.7% Female 48.3% Male	46.8% Female 53.2% Male
Main industry	Higher education	Sheep farming	Vegetable growing	Beef cattle farming
Unemployment rate	8.3%	5.2%	5.7%	9.4%
Highest age group employed	45-54	45-54	45-54	45-54
Aboriginal/Torres Strait Islander	7.2%	1.6%	7.1%	4.1%
Socio-Economic Indexes for Areas (SEIFA)	965	Unavailable	921	Unavailable

Economic strategy

A draft Economic Development Strategy has been developed by the Armidale Regional Council with the aim of:

> *'… enhancing the vibrancy, diversity and sustainability of the Armidale Region's economy and its influence on the liveability of the local government area as a whole"* (Armidale Regional Council, 2017).

A set of key themes and strategic objectives are identified by the Armidale Regional Council as essential in influencing economic development. The proposed Tilbuster Solar Farm would contribute to a number of these, specifically:

- Theme 1: A Region of Choice for Smart and Sustainable Agri-business
  Capitalise on the Armidale Region's competitive strengths in technology-driven agri-business in livestock and horticulture by establishing an agri-tech 'cluster' focusing on the benefits that flow from networked businesses, institutions and agencies sharing information, ideas, infrastructure and services.
- Theme 2: A Globally-connected 'Knowledge Region'
  Capitalise Establish the Armidale Region as a location of choice for 'knowledge workers', entrepreneurs and major innovative businesses seeking a sophisticated, family-friendly city-region lifestyle.
- Theme 3: A Skilled Workforce and Dynamic Regional Business Sector
  Collaborate with industry, the education and training sector and other tiers of government to enhance the Armidale Region's skills base and to support the growth of the region's innovative, productive and prosperous micro, small-to-medium and large businesses.

Establishing large scale solar in the region would strengthen the economy by diversifying industry which is currently dominated by agriculture. This is in line with the *New England North West Regional Plan 2036* which identifies renewable energy as a more sustainable energy source for the region. Additionally, the plan states that growth in solar energy will promote local jobs in smaller communities and development opportunities for future industries.

Community attitudes to renewable energy

Generally, solar energy development in Australia has enjoyed community support. OEH commissioned community research regarding attitudes to renewable energy in 2014 found that 89% of people support the use of renewable energy in the form of solar farms in NSW. Furthermore, 78% of respondents supported having a solar farm within 1-2 km of where they lived. Among the reasons for this were benefits to the environment and local economy. A significant amount (83%) of respondents believed that NSW should produce more of its energy from renewables over the following 5 years (OEH, 2015)

In research carried out by Ipsos for the Australian Renewable Energy Agency (ARENA, n.d.) 48% of respondents agreed that the local economy is positively impacted by large scale solar facilities and 68% agreed that establishing more large scale solar facilities would reduce Australia's carbon emissions. Making funding available for large scale solar facilities was viewed as a priority over non-renewable energy by 60% of respondents.

However, as more proposals become concentrated in suitable regions and particularly Renewable Energy Zones (those with good irradiance, electricity connections, generally flat and away from dense population centres), concern over local character loss and local agricultural impacts can be seen to emerge. The outcomes of the ARENA research resulted in five key themes that are important in establishing a social license to operate (SLO). These are noted below and are addressed in the following EIS sections:

1. Reliability and efficiency (Section 4.2).
2. Visual Impacts (Section 8.1).
3. Environmental Impacts (Sections 7.1, 7.2, 7.3, 7.3.1, 7.5, 8.1, 8.4, 8.7, 8.9 & 8.10).
4. Economic and employment impacts (Sections 2.2 and 8.5).
5. Health impacts (Sections 8.1, 8.6, 8.8 & 8.9).

8.5.2. Potential impacts

Construction

The Tilbuster Solar Farm would assist in providing direct economic stimulus to the region, utilising up to 125 staff during peak construction. Many of these would be drawn from the local area, hence increasing employment opportunities. Additional workers, moving to the area temporarily during construction, may support local economic activity directly. Service industries such as the accommodation, retail and tourism industries would be stimulated.

Conversely, the temporary influx may place pressures on local services such as schools, health services and accommodation. Additional traffic may be noticeable and could present an adverse effect on local tourism if coinciding with local festivals for example. Additional hazards accompany construction traffic (refer to Section 8.6). Mitigation strategies to address these impacts centre on consultation with the community, so that benefits can be maximised, and conflicts resolved where possible.

The solar farm would change the character of the site from agriculture to electricity generation. This change in land use can be viewed as either positive or negative within a community and can vary depending on the values of each individual, views among the community vary substantially. The development may be viewed as an opportunity for jobs and economic stimulus within the region and a sign of protecting the environment through the generation of renewable energy. Alternatively, some community members are hesitant of changes to the rural landscape and would consider the development to be in conflict with the existing environment and scenic values.

The site would be visible to the public during construction, for traffic travelling along the New England Highway and glimpsed from some connecting local roads. Thirteen residences are located within 2 km of the Proposal Site, but the most significant visual impact when viewed from the public domain is from locations along Goolma Road and Cobbora Road where the Proposal is in close proximity to the boundary. Visual, noise and traffic impacts and mitigation have been discussed in previous sections.

Accommodation and services

The construction period may place temporary strain on local service, including accommodation, retail outlets and health services. Armidale would likely be the main town centre providing accommodation for construction staff. The Proposal commits to hiring locally (to reduce accommodation and service pressures) and liaising with local representatives to coordinate accommodation services. It is expected approximately 50% of the workforce (approximately 125 workers) would be from the local community.

Armidale is located approximately 15 mins south of the site. In 2016, there were 8,160 private dwellings in Armidale, including 1,056 unoccupied private dwellings. Online rental websites indicate 88 properties available to rent (Domain, 2019) Armidale has multiple accommodation options, including 5-star accommodation, self-contained apartments, guesthouses, hotels and motels.

Traffic

Given the region is a hub for tourism, construction traffic has the potential to have adverse effects on road users visiting the area. Additionally, the residents of Tilbuster and surrounding localities may be impacted by the increase in traffic during the construction period, which may exacerbate existing traffic. A Traffic Impact Assessment has been undertaken and is discussed in Section 8.6.

During construction, the Proposal Site would be visible to traffic travelling along New England Highway to the east of the site. Construction has potential to increase the levels of dust in the locality temporarily. Excavation would be minimal however the traffic on unsealed tracks is likely to increase local dust levels, particularly in dry conditions. Dust would be supressed during construction through the use of water applications and covering of loads. No night lighting, with the exception of limited security lighting, is anticipated.

Operation and decommissioning

The development of rural land uses compatible with agricultural activities, such as solar power generation, have potential to provide increased economic security to rural economies through the following means:

- Generating employment opportunities
- Supporting sustainable economic growth
- Contributing to diversification of local industry
- Facilitating investment opportunities

There is a limited amount of information specifically regarding the effect of rural solar plants on local land values. The key driver of land value is and has been historically, the agricultural productivity of the area. The highly reversible nature of the Proposal aims to ensure that existing land capability is restored during decommissioning (refer to Section 7.4). Amenity values, such as views, rural lifestyle and proximity to Armidale, could also be considered to enhance land value. While visual impacts would occur during operations (and would be minimised via specific areas of vegetation screening), they would similarly be reversible during decommissioning.

Adverse socio-economic impacts are anticipated to be minimal during operation and decommissioning. During operation, maintenance staff and associated activities would be consistent but limited. The additional accommodation, traffic and use of services are not likely to be noticeable. Where possible, maintenance staff would be sourced from the local area.

Less staff are likely to be required for decommissioning than during construction. The economic benefits during this stage would be similar to construction, introducing local opportunities for employment, accommodation and services. Additionally, local recycling of infrastructure components would potentially occur during the decommissioning stage.

8.5.3. Safeguards and mitigation measures

Table 8-32 Safeguards and mitigation measures for Community and Socio-economic impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
2	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
3	Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D

ID	Safeguards and mitigation measures	C	O	D
4	The Community Consultation Strategy would be implemented to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the Proposal and Proposal benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.). • Protocols to respond to any complaints received.	C		D

8.6. TRAFFIC TRANSPORT AND SAFETY

Amber (2020) prepared a Traffic Impact Assessment for the proposed construction and operation of the Tilbuster Solar Farm. The report is summarised below and provided in full in Appendix I.

8.6.1. Existing environment

Existing road network

New England Highway is a State Arterial Road under the care and management of Transport NSW. It runs in a northwest-southeast alignment from Newcastle to Muswellbrook, before running in a northern alignment to its termination at the Queensland Border. Within the vicinity of the site, it typically accommodates one lane of traffic in each direction and has a sealed width of approximately 7 metres, with gravel shoulders provided on both sides of the road. It has a speed limit of 100 km/hr. It has extensive sight lines in either direction from the proposed access point.

Access

Construction and operational access would be along an existing unnamed access road along the New England Highway (Figure 8-10 and Figure 8-11). This access is currently an unsealed road approximately 4 – 5 m in width (Figure 8-12 and Figure 8-13) and provides access to one other non-associated landowner.

Haulage

The bulk of the imported and manufactured components of the solar farm would be sourced overseas and arrive at port Botany in Sydney. Materials would be transported by road from port via the Pacific Motorway, Hunter Expressway and New England Highway to the Proposal Site.

It is expected that the haulage route for heavy and over-dimensional vehicles, during construction would be from Armidale then north to the site via New England Highway. The larger transformers would likely be delivered by low loaders on up to four occasions. The proposed haulage route is an approved 19m B-double route on the RMS Restricted Access Vehicles Map. The haulage route is shown in Figure 8-9.

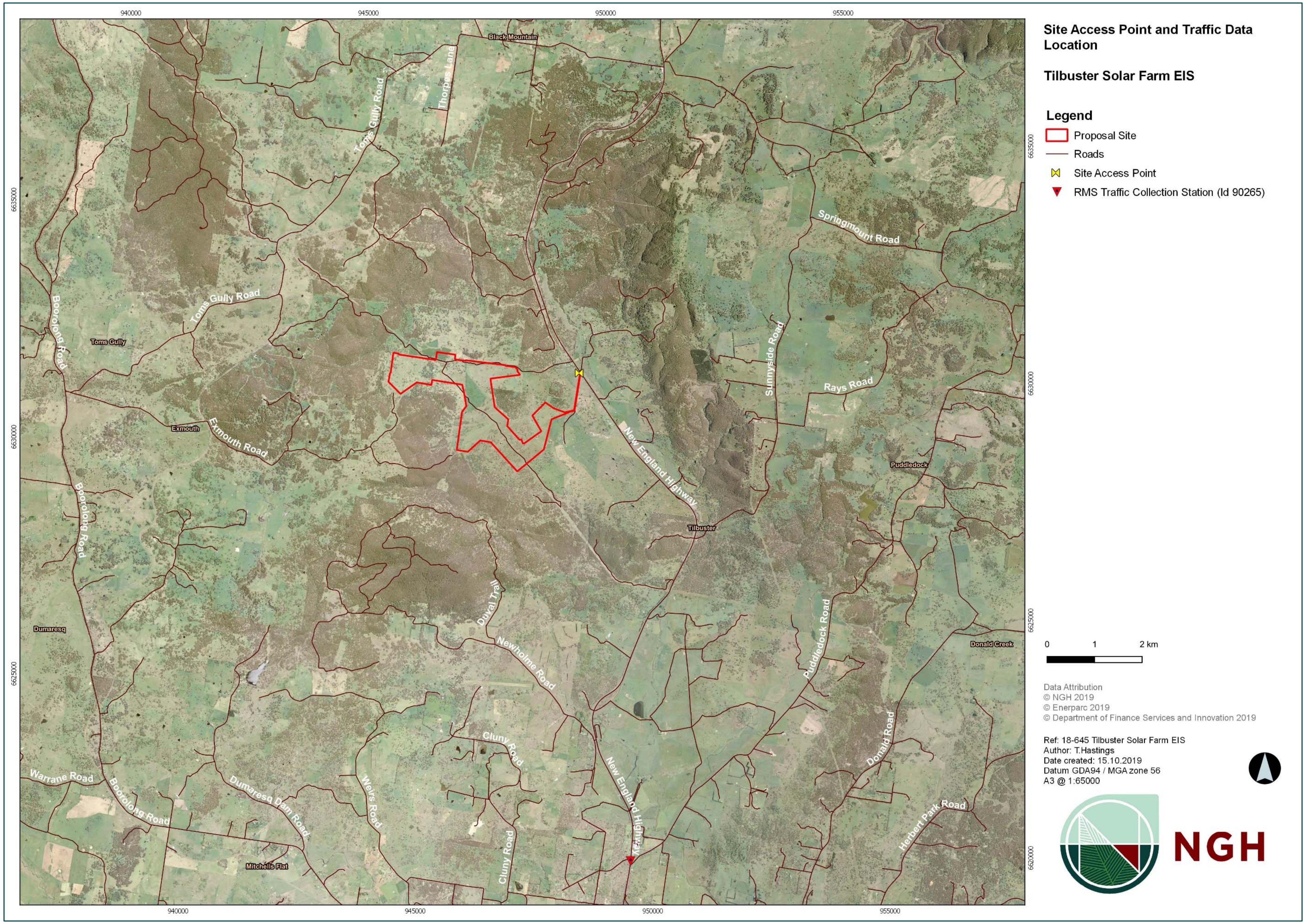


Figure 8-8 Site Access Point and Traffic Data Location.

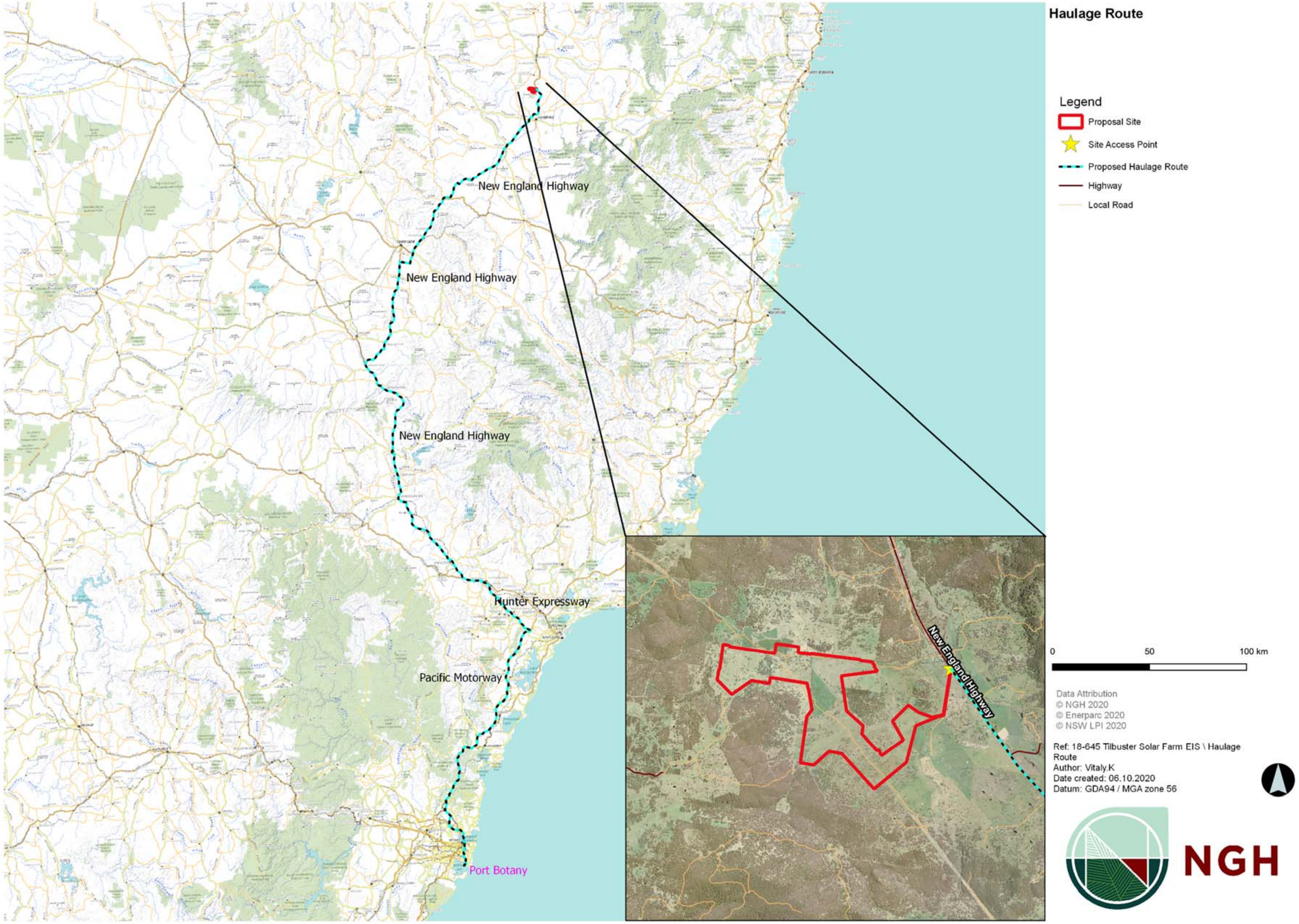


Figure 8-9 Haulage route from Port Botany to Proposal Site

Figure 8-10 New England Highway looking south from the Proposal Site access point.

Figure 8-11 New England Highway looking north from the Proposal Site access point.

Figure 8-12 The proposed access road looking east towards New England Highway.

Figure 8-13 The proposed access road looking west towards the Proposal Site.

Existing vehicle volumes

Traffic volume data for New England Highway was obtained from the RMS traffic volume viewer. The closest available data was located 10km south of the Proposal Site (Figure 8-8), just north of Puddledock Road (Station Id 92065), where the 2013 data recorded an average daily traffic count of 2,143 vehicles per day. The traffic count data indicates that 17% of all traffic is heavy vehicles. Applying a 1% growth factor to the 2013 traffic count, New England Highway is estimated to currently be accommodating 2,298 vehicles per day.

8.6.2. Potential impacts

Construction impacts

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

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

Increased vehicle numbers

As discussed in Section 4.6, construction of the solar farm is expected to take approximately 12 months, with the peak construction period expected to take 3-4 months. Construction activities would be undertaken during standard daytime construction hours (7:00am to 6:00pm Monday to Friday, and 8:00am to 1:00pm on Saturdays). Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

A maximum 125 employees will be required during the peak construction period (approximately 3-4 months duration). It is understood that 4 shuttle buses will be provided that can accommodate approximately 85 staff. The remaining 40 staff will access the site using private vehicles. Assuming a conservative vehicle occupancy rate of 1.35 for workers, the site is expected to generate 33 light/shuttle bus vehicle movements during each of the peak periods.

Approximately 18 trucks will access the site per day during peak construction periods including 7 AV/B-double and 11 MRV/HRV. The delivery trucks will predominantly be Medium and Heavy Rigid Trucks six of which would be water tankers. Articulated Vehicles up 19m will occasionally be used to transport larger plant such as the PV panels.

During peak construction, the site could generate up to 36 heavy and 66 light vehicle movements per day. Table 8-33 summarises the estimated traffic movements generated during the peak construction period of the solar farm.

Table 8-33 Estimated traffic volumes during peak construction for the Tilbuster Solar Farm

Type of vehicle	Vehicle movements per day
Light vehicle (car/4WD)	58
Shuttle bus	8

Type of vehicle	Vehicle movements per day
MRV/HRV	22
AV/B-double	14
Total	**102**

Accordingly, the site is expected to generate approximately 102 vehicle movements per day during peak periods. The peak hour for the solar farm will occur at the start and end of the day when staff are transported to/from the site. During the morning peak all vehicle movements will be towards the site and in the evening peak all vehicle movements will be away from the site. Heavy vehicle movements will be distributed throughout the day and will be split evenly between inbound and outbound movements. All traffic will use the New England Highway and proposed access road to access the solar farm.

New England Highway is estimated to currently accommodate 2,298 vehicles per day based on the 2013 traffic volume count data. Assuming 10% of these trips are generated during peak periods, the peak hour traffic volume is 230 vehicles per hour. Therefore, during the peak hours New England Highway would accommodate approximately 263 vehicles per hour with the solar farm construction traffic, which is well within the capacity of the road network. Outside of these times, the increase in traffic of 3-4 vehicle movements per hour would result in a negligible change to the traffic environment.

While a detailed haulage program has not yet been developed, it is expected that the project's components would be delivered by road from Sydney, via the New England Highway. The proposed route brings traffic through outskirts of Armidale, bypassing a large number of residences smaller and local roads. The roads would have sufficient capacity to accommodate the haulage of components required for the construction of the solar farm.

Accordingly, the road network is able to accommodate the traffic generated by the solar farm during the construction period.

Increased collision risk

The increased collision risk relates primarily to traffic entering and exiting the site from New England Highway. This relates to both oncoming traffic and traffic following vehicles that are turning on and off New England Highway. Slow moving vehicles may also present a risk to through traffic, requiring signage to warn motorists of the construction timeframes.

Traffic accessing the site will do so via the single access point to/from New England Highway. The following provides a breakdown of the access distribution for each of the vehicle classifications outlined within Table 8-33:

- Light Vehicles: It is anticipated that most staff will be local to the New England region (in any direction). For the purposes of this assessment it is estimated that 75% of staff will be travelling from the south and the remaining 25% will travel from the north.
- Shuttle Bus: It has been assumed that all shuttle buses will travel to/from the south.
- MRV/HRV: These vehicles will predominantly be water trucks and vehicles transporting materials such as concrete and fencing supplies. These materials will be sourced within the surrounding area and as such, it has been assumed that 75% of these vehicles will be travelling from the south and the remaining 25% will travel from the north.
- AV: Plant will be transported via Sydney to/from the south.

Austroads Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings specifies the turning treatments required at intersections. The peak hour turning volumes will be generated by staff accessing the site in the morning. Based on the traffic distribution described above the site will generate 26 left turn movements from the south, and 7 right turn movements from the north. Based on these volumes and New England Highway having a Major Road Traffic Volume of 230 vehicles per hour, the intersection would require an Auxiliary Left Turn Lane (AUL) and a Basic Right Turn (BAR) turn treatment.

In accordance with the Austroads Guideline, a BAR would be required. However, it is proposed only a Basic Left Turn (BAL) for the left turn treatment would be required. The justification for the adoption of the reduced turning treatment includes:

- The 26 vehicles turning left into the site will only occur once throughout the day during the morning peak. The movements will only be generated by light vehicles associated with staff accessing the site. Left turn movements during other times of the day will be larger vehicles, which will generate approximately 1-2 vehicle movements per hour.
- The solar farm construction is expected to take approximately 12 months, with the peak construction period expected to take 3-4 months. During operation, the site is expected to generate a total of 6 vehicle movements per day, or approximately 3 left turn movements per day.
- The site is located within the middle of a long straight and has excellent sight distance for vehicles travelling along New England Highway to see turning vehicles.
- The access will be realigned to be perpendicular to New England Highway to ensure easy vehicle access and clear sight lines for vehicles exiting the site. The access has also been widened and will be sealed for the initial section to allow easy entry for both light and heavy vehicles.
- A Construction Traffic Management Plan (CTMP) will be prepared prior to construction of the site. It is recommended that the CTMP consider the use of signage to enforce a lower travel speed at the site access and/or advise drivers of turning vehicles on New England Highway. It is also recommended that the CTMP include measures to inform staff of the reduced left turn treatment and to encourage suitable safety initiatives.

The proposed design for the site access is provided in Figure 8-14, based on an AV design vehicle, which is the largest vehicle expected to access the site. A swept path assessment has also been prepared for the access design using the software package ‘AutoTurn’. The swept path assessment is in Figure 8-15 showing that the vehicle is able to access the site in a suitable manner.

Accordingly, the proposed intersection turning treatment has been appropriately designed and in accordance with the Austroads dimensional requirements.

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections specifies the Safe Intersection Sight Distance (SISD) as the minimum sight distance which should be provided along the major road at any intersection. Table 3.1 of the guide specifies the SISD required for various design speeds. Given New England Highway has a speed limit of 100km/hr, a design speed of 110km/hr has been adopted, which requires a SISD of 285 metres. The available sight distance at the access greatly exceeds the Austroads requirements.

The majority of the construction traffic would be standard vehicles used by onsite workers, limited overmass or oversize haulage vehicles. As such there are opportunities to rationalise traffic movements, such as through the provision of shuttle buses for workers. This objective would be a requirement of the Traffic Management Plan to be developed for the Proposal .

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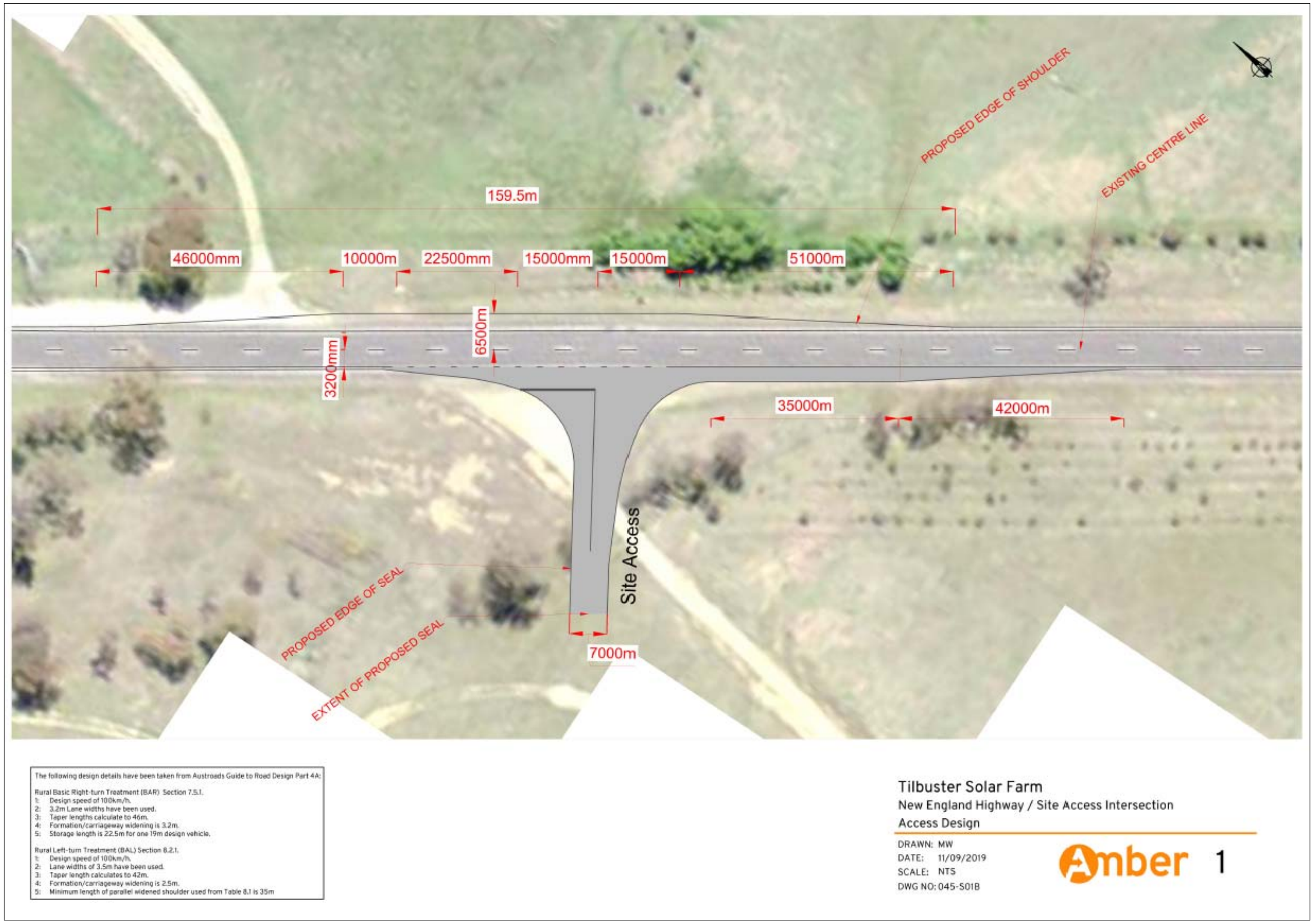

Figure 8-14 The proposed New England Highway intersection BAR and BAL treatments (Amber 2020)

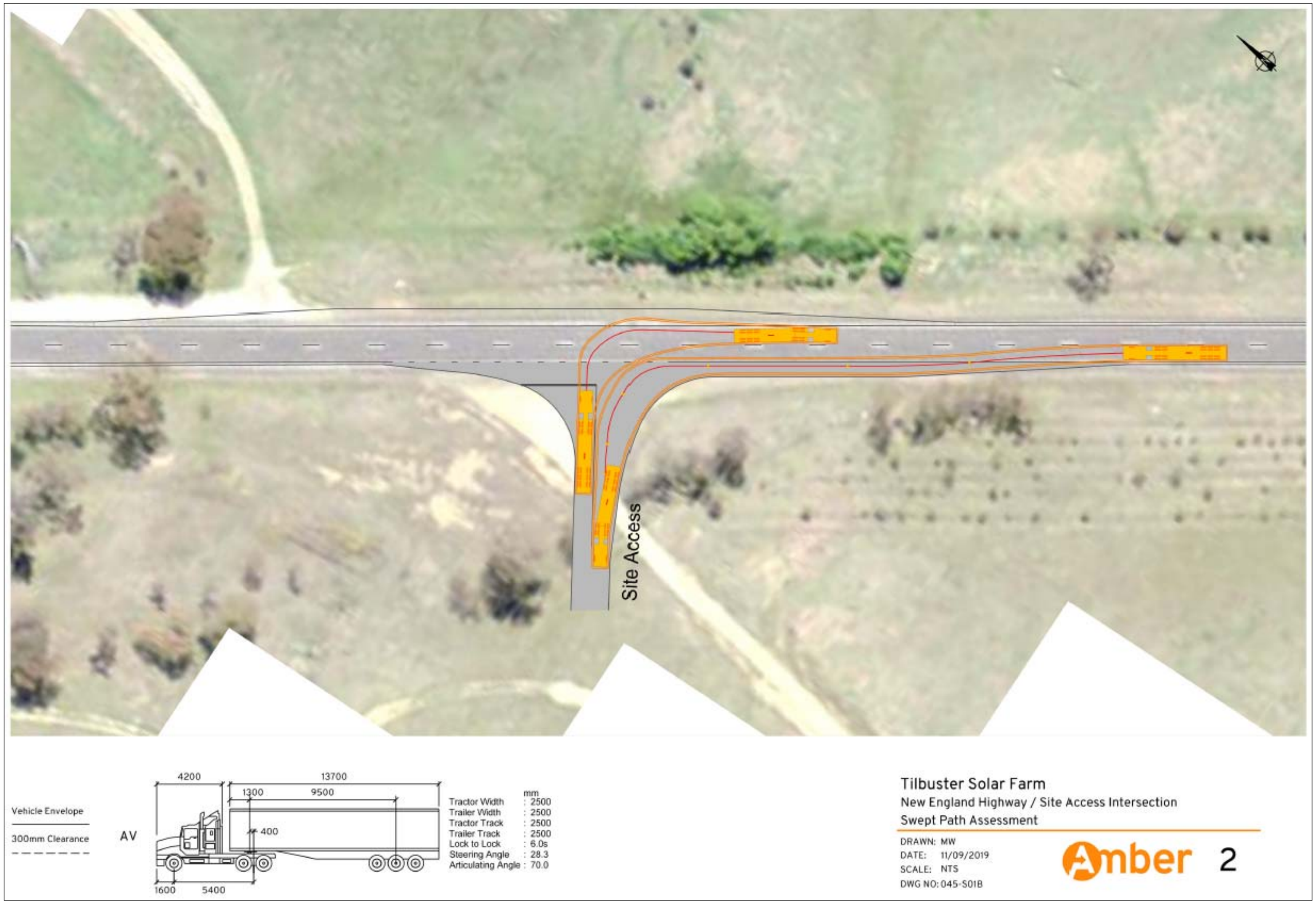

Figure 8-15 Swept-path analysis for turning vehicles from New England Highway (Amber 2019)

Damage to road infrastructure

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. For the New England Highway, the impact is expected to be negligible due to the existing capacity of the road network. However, the impact of turning traffic at the intersection of the Proposal Site would likely require monitoring to ensure that the road is maintained in an adequate condition. Any damage as a consequence of the Proposal would be rectified.

Internal access roads would be constructed or upgraded as required to accommodate the Proposal volumes and loads of traffic. The tracks would be compacted but unsealed gravel.

Associated noise and dust

The increase in traffic during construction may increase noise and dust in the local area, particularly on the unsealed access road. Impacts from dust generated from the proposed activity, including that associated with increased traffic is considered in Section 8.9. During construction, water would be used to minimise dust generation along access tracks.

The *NSW Road Noise Policy* (DECCW, 2011) have been used to evaluate impacts from road traffic noise. This policy outlines a range of measures required to minimise road traffic noise and its impacts, including noise generated by developments that generate additional traffic on existing roads. A road traffic noise assessment is included in Appendix H and Section 8.6 of this EIS.

Disruption to existing services

Increased traffic during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along New England Highway. The use of buses to transport workers to and from site would reduce the amount of disruption to traffic along the highway.

Cumulative construction traffic impacts

It is noted that the following major projects are occurring in the surrounding area:

- Oxley Solar Farm, proposed by Oxley Solar Development would be located approximately 20km south-south-east of the Proposal Site. The EIS and DA are currently being prepared.
- New England Solar Farm, proposed by UPC Renewables would be located approximately 26km south of the Proposal Site. Development Consent has been granted and construction is anticipated to commence in Q3 2020.
- Salisbury Solar Farm, proposed by MirrusWind and Energy would be located approximately 41km south of the Proposal Site. SEARS have been issued by DPIE.

Each of the above projects will generate peak hour movements associated with staff, similar to the proposed solar farm. However, given their locations these traffic movements are likely to be generated from towns south of the site such as Armidale and Uralla. As such, the peak hour traffic generated by these projects is unlikely to be located on the same sections of the road network as the proposed solar farm and the cumulative impact of the projects will have a minimal impact on the road network. Given the minimal increase in truck traffic generated by the site, the cumulative impact on the road network outside of peak times is also expected to be minimal.

Operation

During operation (approximately 30 years), the solar farm is expected to generate a maximum of 6 light vehicle movements per day. Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure.

Operational staff would be confined to designated parking areas and access roads/tracks within the Proposal area.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access or be above the background noise levels. Additional risks to road safety from operational traffic would be minimal.

Decommissioning

Decommissioning impacts are likely to follow a similar pattern as construction, as components are dismantled and removed. It is considered that the construction traffic generated during decommissioning would consist of less daily vehicular movements than the construction of the plant.

8.6.3. Safeguards and mitigation measures

Table 8-34 Safeguards and mitigation measures for traffic, transport and safety impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Direction of traffic flow (both heavy and light). • Loads, weights and length of haulage and construction related vehicles and the number of movements of such vehicles. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.). • All heavy vehicle movements to/from the access point are to be managed to ensure that only one inbound or outbound vehicle is travelling along the access route in the vicinity of the site at a time. • Heavy vehicle movements into and out of the Proposal Site will be controlled via traffic management means, including a traffic controller, temporary lowered speed limit and additional road signage alerting vehicles of truck movements in the area.	C	O	D
2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan will be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan would include, but not be limited to: • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction.	C		D

ID	Safeguards and mitigation measures	C	O	D
	• Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the project, especially at the access site along New England Highway. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. • A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the Code. • Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads to minimise dust generation through increased traffic use. • Following construction, a post condition survey of the relevant sections of the existing road network to be undertaken to ensure it is of similar condition to that prior to construction.			
3	Obtain a Section 138 Consent from the relevant council/agency to perform works within the road reserve.	C		
4	The proponent would consult with Armidale Regional Council and TfNSW regarding the proposed upgrade of the unnamed road for site access. The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.		Design	
5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	C		D
6	The proponent would engage an appropriately qualified person to prepare a Road Dilapidation Report for all road routes to be used during the construction (and decommissioning) activities, in consultation with the relevant road authority. This report is to address all road related infrastructure. Reports must be prepared prior to commencement and after completion of construction (and decommissioning). Any damage resulting from the construction (or decommissioning) traffic, except that resulting from normal wear and tear, must be repaired at the Proponent's cost. Such work shall be undertaken at a time agreed upon between the Proponent and relevant road authorities.	PC		D
7	Prior to the commencement of construction on-site, the Proponent would undertake all works to upgrade relevant state roads, their associated road reserve and any public infrastructure in that road reserve to a standard suitable for use by heavy	PC		D

ID	Safeguards and mitigation measures	C	O	D
	vehicles to meet any reasonable requirements that may be specified by TfNSW. The design, specifications and construction of these works must be completed and certified by an appropriately qualified person to a standard to accommodate the traffic generating requirements of the project. On Classified Roads the geometric road design and pavement design must be to the satisfaction of the TfNSW.			
8	For works on the State road network the developer is required to enter a Works Authorisation Deed (WAD) with TfNSW before finalising the design or undertaking any construction work within or connecting to the road reserve. The WAD documentation is to be submitted for each specific change to the state road network for assessment and approval by TfNSW prior to commencement of any works within the road reserve.	PC		

8.7. BUSH FIRE

Bush fire presents a threat to human life and assets and can adversely impact ecological values. Bush fire risk can be evaluated and managed by considering environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines, BESS and other electrical components).

This project is a State Significant Development, exempt from requiring a bush fire safety authority (BFSA) under section 4.41(f) *Environmental Planning and Assessment Act 1979.* Section 5.16(3) requires "the Planning Secretary is to consult relevant public authorities and have regard to the need for the requirements to assess any key issues raised by those public authorities", which includes consulting with the Rural Fire Service (RFS) in regard to bush fires.

8.7.1. Existing environment

The Proposal Site is currently agricultural land comprising several large paddocks which are gently undulating and mostly cleared of native vegetation. One major watercourse, Duval Creek, traverses the Proposal Site. Duval creek is a 5th order stream consisting of dry gullies with no permanent running water. There is little in the way of riparian vegetation. The surrounding landscape includes both cleared agricultural land and native tree cover. Adjacent woodland extends into Duval Nature Reserve, which is 1.4 km to the south of the Proposal Site.

Bush Fire Prone Land mapping applied to the Proposal Site, revealed that vegetation categories 1 and vegetation buffer apply to parts of the site (Figure 8-16). Vegetation category 1 is considered to be the highest risk for bush fire, has the highest combustibility and likelihood of forming fully developed fires (NSW RFS, 2015a). The treed parts of the site and surrounding land are Vegetation category 1, and a 100 m vegetation buffer has been applied and labelled vegetation buffer (Figure 8-16). The woodland extending into Duval Nature Reserve are similarly classified as Vegetation category 1 bush fire-prone land and mapped with a 100 m vegetation buffer.

The New England Bush Fire Risk Management Plan (NSW RFS, 2015b) identifies the Proposal Site as being within the New England Bush Fire Management Committee (NEBFMC) area. Section 1.3.4 of the plan states that there are on average 95 bush fires per year, 12 of which are considered major fires. The fires are typically ignited by escaped private burns, lightning strikes, and arson. The area has a cool climate with rainfall throughout summer, and a bush fire season running from August to March.

Resources available for fire-fighting include three farm dams that will be retained on the Proposal Site, and there are additional dams on properties surrounding the site. Duval Creek transect the Proposal Site and is a 5^{th} order ephemeral stream. The nearest Rural Fire Service is at Armidale, approximately 21 km from the site.

Eight occupied residences are located within one kilometre of the Proposal and five additional residences are located within 2 km. Most of these appear to have associated farm sheds, watering points, silos and other equipment.

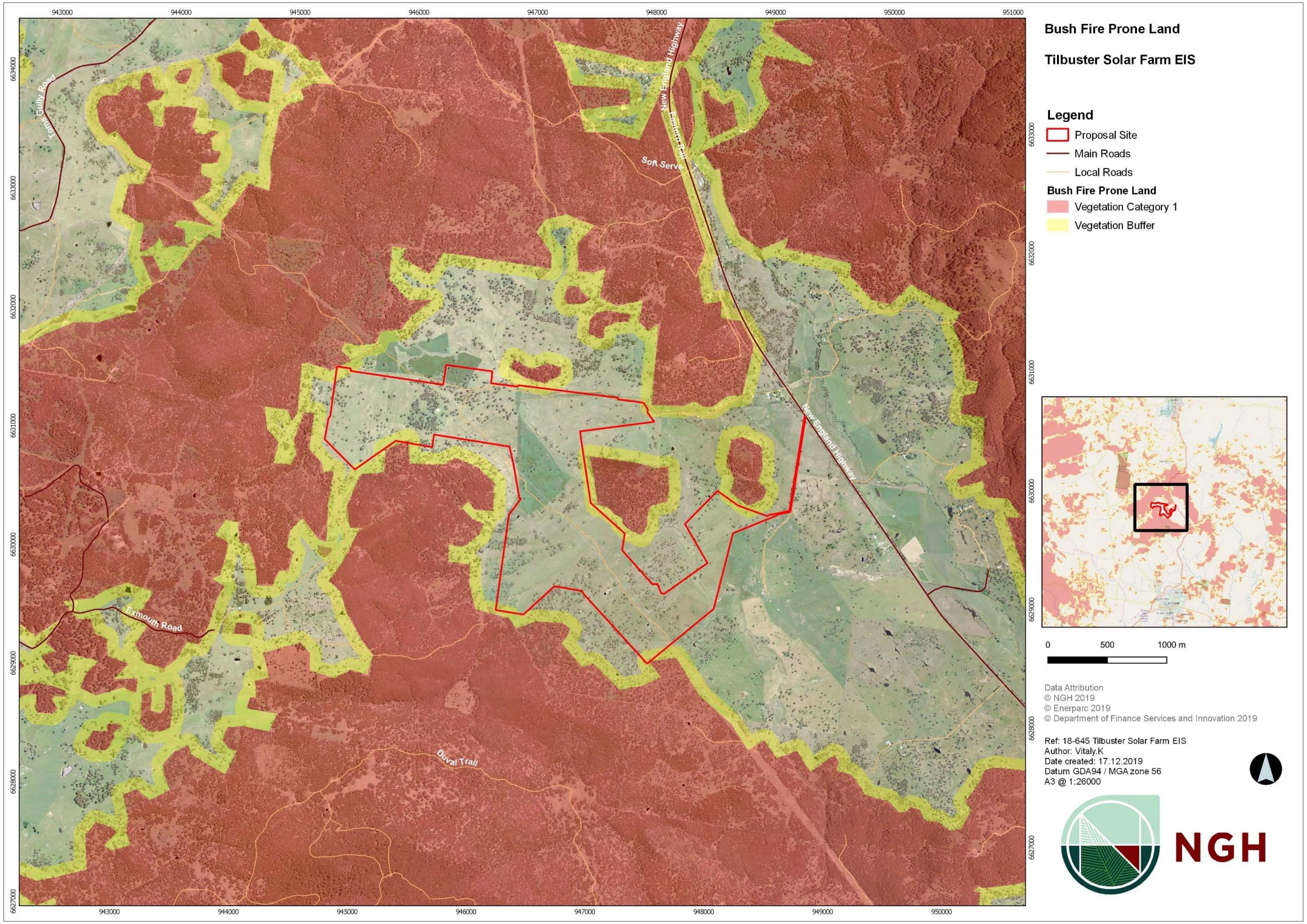

Figure 8-16 Bush fire prone land mapping

8.7.2. Potential impacts

Construction and decommissioning

The potential for increased bush fire risk may coincide with the construction and decommissioning stages of the proposal. Ignition sources during these stages include:

- Earthworks and slashing machinery causing sparks.
- Hot works activities such as welding, soldering, grinding and use of a blow torch.
- Sparks and contact ignition from vehicles in long combustible vegetation.
- Smoking and careless disposal of cigarettes.
- Use of petrol-powered tools.
- Operating plant fitted with power hydraulics on land containing combustible material.
- Electrical faults during testing and commissioning.
- Storage of chemicals and hazardous materials.

The Development Footprint proposed within the Proposal Site is predominantly on flat land in a low fuel environment. As such, bush fire risks during construction and decommissioning are considered to be low and would be managed through the mitigation measures recommended in this EIS.

Operation

The operational stage of the Proposal has the following associated bush fire risks:

- Powerline failure or contact with vegetation within clearances.
- Overheating in the substation or energy storage facility.
- Grass fire ignition from vehicles and maintenance machinery.
- Poor groundcover management and associated high fuel loads.

The key risk identified and discussed below is the operation of Lithium-ion batteries.

<u>LITHIUM-ION BATTERIES</u>

The Proposal would include an up to 40 MWh capacity of Battery Energy Storage System (BESS). All energy storage systems carry risks associated with the uncontrolled release of energy. While Lithium Ion (Li-ion) batteries offer significant advantages over competing commercialised storage technologies in terms of energy density, efficiency and charging times, these advantages also elevate the risk of fire. The Li-ion based BESS unit would be designed with proper disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate the fire risk to the required level of safety.

Operating strategies spanning proper planning, risk assessment, storage methods, maintenance protocols, and response protocols are the other important factors in mitigating Li-ion fire risks (Butler, 2013).

Fire risks

Li-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Li-ion systems can span -10 to 50 degrees Celsius (°C) but the cells inside the containers are kept within a smaller range, 10 to 30 °C, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come in contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350- 400 °C (Recharge, 2013) Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated.

There is potential for a fire event in the BESS which could initiate a bush fire in the surrounding grazed grasslands. Prevention measures to reduce the likelihood of a fire starting and effective mitigation measures to contain the fire reduces risk.

Fire causes

Battery overheating may be caused by a range of factors including electrical shorting, rapid discharge, overcharging, manufacturers defect, poor design and mechanical damage (Butler, 2013) Li-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault (Department of Commerce (WA), 2017). The main failure modes for these BESS are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum, A and Long, T, 2016).

A large majority of incidents involving Li-ion batteries have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge, 2013).

Risk and incident management

Factors listed in Department of Commerce (2017) to avoid and mitigate battery fire impacts include:

- Adherence to Building codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations.
- Adherence to Manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature.
- Adequate ventilation.
- Containment of electrolyte spills.
- Adequately fire-rated walls are used to avoid or delay the spread of fire.
- Adequate access/egress for installation and maintenance.
- Adequate mechanical protection.

Battery location and spatial design are also important safety factors.

Fire containment and suppression systems need to be employed to deal with a potential battery fire event, applying the Suppression through Cooling, Isolation, and Containment (SCIC) approach (Butler, 2013). However, while most current systems have automated and manually triggered fire suppression systems, the technology is new and there is limited knowledge about the usefulness of the suppression systems in the event of fire (Blum and Long, 2016).

Li-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler, 2013). The Proposal would manage the fire risks associated with the BSU by:

- Maintaining an APZ around each BSU.
- Locating the BSU as far as practicable from any sensitive receptors (residences) or large stands of vegetation.
- Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems.
- Installing reliable integrated fire detection and fire suppression systems (inert gas).

- Ensuring the BESS containers are not vulnerable to external heat effects in the event of a bush fire.
- Designing appropriate separation and isolation between individual BESS containers and between batteries and other infrastructure, including gravel surfacing around the facility.
- Compliance with all relevant guidelines and standards.
- Preparation of a specific Battery Fire Response Plan, under the general Fire Response Plan, in consultation with fire authorities, fire suppression experts, and in reference to relevant standards and guidelines.
- Facilitation (including funding) of first responder training in the management of LIB fires at the site for local brigades.

Though the specific battery manufacturer and model has not yet been determined, it is anticipated that each battery module within the implemented solution would have its temperature and voltage monitored.

The fire suppression system within the BESS unit would comprise the storage and release of inert gas within each BESS container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

There would be spare aircon units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all aircon units fail, the auto shutdown of the batteries would prevent overheating.

Standards and guidelines

The installation of Li-ion batteries has been identified as in need of relevant standards and Standards Australia has developed a new standard (AS/NZS 5139) for smaller scale battery installations. The Clean Energy Council provides requirements for accredited installers, the Australian Energy Storage Council has produced a Guide for Energy Storage Systems, and the WA Department of Commerce has released a guide for electrical contractors in relation to BESS systems (Department of Commerce, 2017).

8.7.3. Safeguards and mitigation measures

Bush fire risks during construction and decommissioning are considered to be low and would be managed through standard mitigation strategies. During operation of the solar farm, specific fire risks strategies would be adopted including:

- Adequate setbacks, access and firefighting facilities maintained onsite.
- Control of grass fuels including maintenance of groundcover beneath panels.
- Proper design and maintenance of equipment.
- Application of best practice and technical standards.

These form commitments of the proposal, as set out below.

Table 8-35 Mitigation measures for bush fire

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Copper conductors would be used where necessary to electrically bond the metal structures to earth to protect personnel and equipment in the event of lightning strikes and electrical faults.	Design		
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: The storage and handling of flammable and combustible liquids.	C	O	D

ID	Safeguards and mitigation measures	C	O	D
3	Develop a Bush Fire Management Plan to include but not be limited to: • Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting). • Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements. • Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies. • Document all firefighting resources maintained at the site with an inspection and maintenance schedule. • Monitoring and management of vegetation fuel loads. • A communications strategy incorporating use of mobile phones, radio use (type, channels and call-signs), Fire Danger Warning signs located at the entrance to the site compounds, emergency services agency contacts. In developing the Bush Fire Management Plan, NSW RFS would be consulted on the volume and location of water supplies, fire-fighting equipment maintained on-site, fire truck connectivity requirements, proposed APZ and access arrangements, communications, vegetation fuel levels and hazard reduction measures.	C	O	D
4	An APZ of minimum 10 m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4 m wide gravel access track. Average grass height within the APZ would be maintained at or below 5 cm on average throughout the October-March fire season. Average grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 cm throughout the fire season.	C	O	
5	The overhead powerlines at the site would be managed by maintaining appropriate vegetation clearance limits to minimise potential ignition risks, in accordance with the ISSC 3 Guideline for Managing Vegetation Near Power Lines.		O	
6	Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment would include fire extinguishers, a 1000 L water cart retained on site on a precautionary basis, particularly during any blasting and welding operations. Equipment lists would be detailed in Work Method Statements.	C		
7	The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
8	Following commissioning of the solar farm, the local RFS and Fire and Rescue brigades would be invited to an information and orientation day covering access, infrastructure, firefighting resources on-site, fire control strategies and risks/hazards at the site.		O	
9	The perimeter access track would comply with the requirements for Fire Trails in the PBP guidelines. All access and egress tracks on the site would be maintained and kept free of parked vehicles to enable rapid response for firefighting crews and to avoid entrapment of staff in the case of bush fire emergencies. Access tracks would be constructed as through roads as far as practicable. Dead end tracks would be signposted and include provision for turning firetrucks.	C	O	D

ID	Safeguards and mitigation measures	C	O	D
10	A Hot Works Permit system would be applied to ensure that adequate safety measures are in place. Fire extinguishers would be present during all hot works. Where practicable hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D
11	Machinery capable of causing an ignition would not be used during bush fire danger weather, including Total Fire Ban days.	C	O	D
12	Prior to operation of the solar farm, an Emergency Response Plan (ERP) would be prepared in consultation with the RFS and Fire and Rescue NSW. This plan must include but not be limited to: • Specifically addresses foreseeable on site and off site fire events and other emergency incidents. • Risk control measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. • Two copies of the ERP are stored in a prominent 'Emergency Information Cabinet' which is located in a position directly adjacent to the site's main entry point/s. • Once constructed and prior to operation, the operator of the facility would contact the relevant local emergency management committee (LEMC).		O	
13	Fire risks associated with the lithium-ion energy storage facility would include: • Locating the Energy Storage Facility as far as practicable from any sensitive receptors or large stands of vegetation. • Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems. • Installing reliable integrated fire detection and fire suppression systems (inert gas). • Ensuring the battery containers are not vulnerable to external heat effects in the event of a bush fire. • Designing appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility. • Compliance with all relevant guidelines and standards. • Preparation of a specific Battery Fire Response Plan, under the general Bush fire Management Plan, in consultation with fire authorities, fire suppression experts and in reference to relevant standards and guidelines. • Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades.		O	
14	A Fire Safety Study (FSS) will be undertaken and developed in accordance with the requirements of Hazardous Industry Planning Advisory Paper No. 2 (HIPAP No.2) and consultation with FRNSW prior to commencement of construction. The FSS will consider the limited operational capacity of local fire agencies and the need for the facility to achieve an adequate level of on-site fire and life safety dependence.	PC		

8.8. ELECTRIC AND MAGNETIC FIELDS

8.8.1. Existing environment

Electromagnetic fields (EMFs) consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, such as the Earth's magnetic field and discharges during thunderstorms (WHO, 2012)

Electric fields are produced by voltage and magnetic fields are produced by current. When electricity flows, EMFs exist close to the wires that carry electricity and close to operating electrical devices and appliances (WHO, 2007). Electric and magnetic field strength reduces rapidly with distance from the source, and while electric fields are insulated by air and insulation material, magnetic fields are not.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, n.d.). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project, established by the World Health Organisation, has thus far concluded that there are no substantive health consequences from exposure to ELF electric fields at the low levels generally encountered by the public (WHO, 2007), such as those that would be produced by electricity generation at the proposed solar plant and along the transmission line.

Whether exposure to ELF magnetic fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, n.d.) advises that 'the scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

Australia does not currently have a standard regulating exposure to ELF electric or magnetic fields. The International Commission on Non-Ionizing Radiation Protection (ICNPR) published *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz)* in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that would provide protection against known adverse health effects. To prevent health-relevant interactions with Low Frequency fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached.

The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions would also be met (in the body) (ICNIRP, 2016). Reference levels for occupational and general public exposure are shown in Table 8-36.

Table 8-36 ICNIRP reference levels for electric and magnetic fields (ICNIRP, 2010). Values are for 50 Hz.

Exposure characteristics	Electric fields	Magnetic fields
Occupational	ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
	field actually required: 24.2 kV/m	field actually required: 3.03 mT
General public	ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 μT

Exposure characteristics	Electric fields	Magnetic fields
	field actually required: 9.9 kV/m	field actually required: 606 µT

The Proposal includes five main types of infrastructure that could create EMFs:

1. Solar arrays (up to 1.5 kV DC).
2. Power conversion stations (up to 8 MW capacity).
3. Underground cables.
4. 132 kV – 330 kV overhead or underground transmission lines.
5. 330 kV solar substation.
6. Transformers and substation.
7. Energy storage facility.

Typical and maximum EMF levels for these types of infrastructure are discussed below. Strength attenuates with distance from the infrastructure and electric field levels for underground infrastructure are lessened by the shielding that the fill provides.

Solar arrays

Research into electric and magnetic fields undertaken at utility scale PV installations in California[3] indicated that magnetic fields were significantly less for solar arrays than for household applications ((Chang, G.J. and Jennings, C., 1994). Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

The Proposal would require installation of DC wiring between panels and the inverters. This cabling would be underground or above ground on cable trays and would conduct around 1500 V. The potential for electromagnetic interference as a result of the solar array cabling is considered to be negligible.

Power Conversion Stations

Up to 155 PCSs would be installed across the site. The stations would have a total output between 2 and 8 MW. The PCSs would have an AC power frequency range between 47 and 63 Hz and fall into the Extremely Low Frequency (ELF) range of 0-300 Hz. Within this range, EMFs are not considered to be hazardous to human health. In addition, the PCSs would be located within the fenced solar plant site with no public access and would operate only during the day reducing the total time that EMFs are generated by the infrastructure.

Underground cabling

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal and restricted to the Proposal Site.

Overhead powerlines

Figure 8-17 displays the typical electric fields emitted from different voltage overhead powerlines. The Proposal Site has existing 132 kV and 330 kV powerlines that traverse the central part of the site. Most cabling installed for the Proposal would be buried and located along the access tracks. A short section of overhead

[3] Note the U.S.A electricity supply operates at 60 Hz frequency.

electrical cabling would be used to connect the substation to the existing TransGrid 330 kV powerline. The existing and proposed overhead powerlines are less than the recommended 5k V/m and 10 kV/m limits.

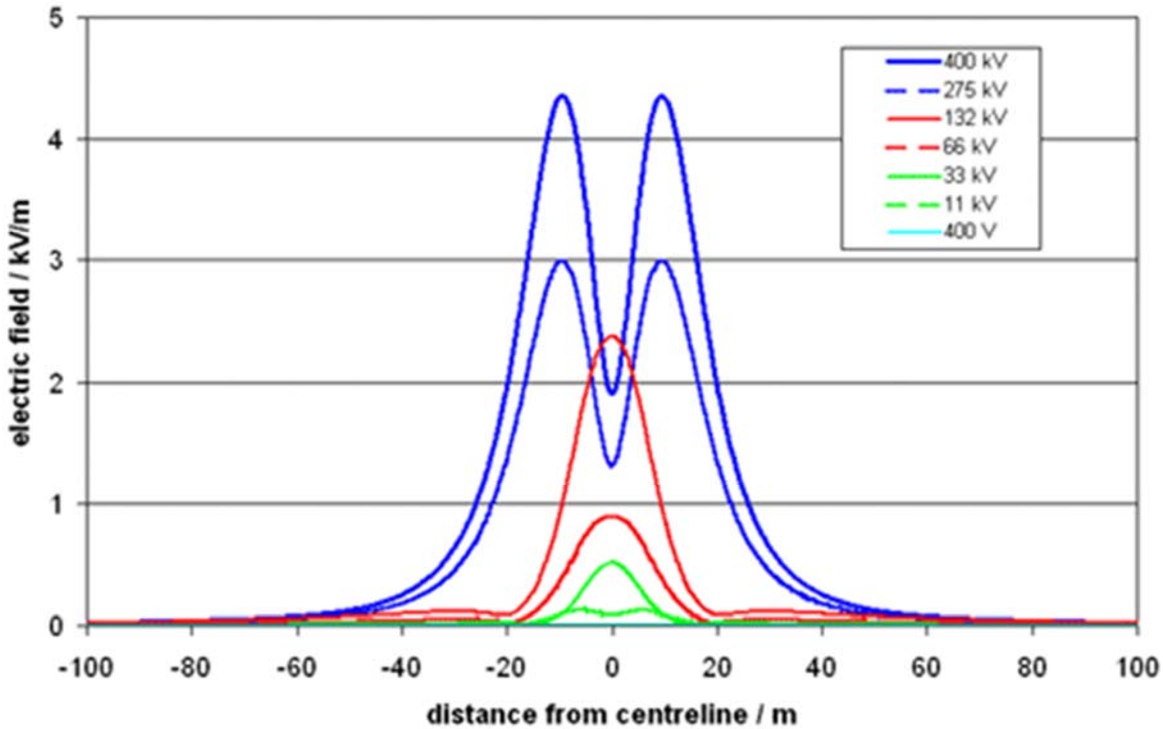

Figure 8-17 Typical electric fields from overhead powerlines (EMFs.info, 2017)

Substation

For the substation and transformers, the magnetic fields at distances of 5-10 m are generally indistinguishable from typical background levels in a home. The fenced exclusion area around the substation components is sufficient to reduce EMF to negligible levels. Works undertaken to facilitate the connection of the transmission line would require mitigation measures to ensure reduced exposure.

Energy Storage Facility

Lithium-ion batteries are not associated with high levels of EMF and the EMF produced by the proposed ESF would be well below ICNIRP reference levels.

8.8.2. Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the Proposal . The maximum magnetic field of the proposed transmission line is well under the 200 µT and 1000 µT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the proposed 330 kV underground transmission line. Exposure to EMFs during the construction of the transmission line and connection to substation would be short term, therefore the effects are likely to be negligible.

Operation

During operation, EMF sources would include overhead or underground transmission lines, underground cabling, and the solar array incorporating inverters.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts minimised also.

The site is surrounded by agricultural land. Public access would be restricted by site fencing around the site and existing substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar plant are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

Using the Principle of Prudent Avoidance to design and site infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the Proposal .

8.8.3. Safeguards and mitigation measures

Table 8-37 Mitigation measures for EMF hazards

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
2	All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
3	Design of electrical infrastructure would minimise EMFs.	C		

8.9. AIR QUALITY AND CLIMATE

8.9.1. Existing environment

Air quality

Air quality for the Armidale Regional LGA is generally expected to be good and typical of that found in a rural setting of NSW. Existing sources of air pollution within the LGA would include:

- Vehicle emissions – expected to be low for the site considering the low traffic amounts in the vicinity of the site and low intensity of land use and low density of settlement.
- Dust during dry periods – expected to be higher in dry and windy weather, generated from traffic on unsealed roads and bare areas of ground.
- Agricultural activities, particularly stubble burning and harvests. Cropping is limited in the immediate area.

During colder months, there may be a small increase in air contaminants due to smoke emissions from the operation of solid fuel heating. Locally this would be negligible given the low density of settlement.

A search of the National Pollutant Inventory (Australian Government, 2019) identified two facilities within the Armidale-Dumaresq Regional LGA that are required to record emissions. These were:

- Elgas Armidale, main activities import, handling, and distribution of liquid petroleum gas, located approximately 14.5 km south of the site; and
- Viva Energy Armidale Airport, main activities aircraft refuelling, located approximately 16.5 km south of the site.

The site is not located within the 200 km radius of the *Dark Sky Region* and is approximately 270 km north-east of the Siding Spring Observatory. The Dark Sky Region is centred upon the site of this observatory, which is considered Australia's most important visible-light observatory. The Dark Sky Region Guidelines have been prepared to ensure the night sky is free of light pollution and increased levels of atmospheric dust which may impact on the observatory.

The proposed solar farm is located on land zoned as RU1 Primary Production. The land surrounding the Proposal Site is predominately agricultural and is used for sheep grazing. Crown roads traverse the site in an east-west direction in the western portion of the site, and in a north-south direction through the centre of the site. No residences are located within the Proposal Site. Thirteen residences are within 2 km of the Proposal Site. The closest non-associated receiver is 305 m north east from the proposal site. As such, the Proposal is located in a low-density area. Traffic on the surrounding roads of the Proposal Site would be limited to private transport, with heavy vehicles being used in the harvest season or cattle transport.

Climate

The Proposal Site is located within the New England Tableland (NET) Bioregion. The NET is dominated by temperate to cool climate characterised by warm summers and uniform rainfall generally during the summer (BOM, n.d.). The closest climate data for the Proposal Site is the Armidale Airport weather station (site number 056238). Table 8-38 outlines the available data for this weather station from the Bureau of Meteorology (BOM):

Table 8-38 Armidale Airport weather station (site number 056238)

Aspect	Annual Mean	Mean Minimum Range	Mean Maximum Range
Temperature[4]	19.6°C maximum 7.5 °C minimum	13.5 °C (January) to 1.3 °C (July)	26.3 °C (January) to 12.2 °C (July).

[4] Based on data collected between 1994 – 2019.

Aspect	Annual Mean	Mean Minimum Range	Mean Maximum Range
Rainfall[5]	763.2 mm	34.7 mm (April)	98.0 mm (November)
Wind[6]	NA	15.6 km per hour (9am, May) 17.6 km per hour (3pm, April)	19.9 km per hour (9am, September) 21.2 km per hour (3pm, August)

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases in the atmosphere. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall declines in south eastern Australia and more extreme weather events including intense rainfall, severe drought and harsher fires (CSIRO, 2018). 2017 was Australia's third-warmest year on record, and in much of south eastern Australia, rainfall was below average. At the global level, 2016 was the hottest year on record, and the third hottest year in a row (Steffan W, Alexander D, and Rice, M., 2016). The annual mean air temperature in Australia is projected to increase by 2.8-5.1°C by 2090 (above the 1986-2005 period) (CSIRO, 2018).

In 2014, the NSW OEH published climate change projection snapshot reports for the NSW and ACT governments as part of the NSW and ACT Regional Climate Modelling (NARCliM) project. The study focused on projections for two future 20-year time periods: 2020-2039 as the near future and 2060-2079 as the far future. The snapshot included the analysis of over 100 climate variables, including temperature, rainfall and wind.

The projected climatic changes by 2030 (near future) for the New England North West region of NSW, which the Proposal Site is located in, included the following:

- Maximum temperatures are projected to increase by 0.4 to 1.0 °C.
- Minimum temperatures are projected to increase by 0.5 to 1.0 °C.
- The number of hot days would increase and cold night decrease.
- Rainfall is projected to decrease in winter and increase in autumn.
- The risk of fire is projected to increase during summer, spring and winter.

Rural and regional communities are disproportionately affected by the impacts of climate change, through worsening extreme weather events and impacts to capacity, productivity and resilience in some rural industries (Climate Council, 2016) A significant proportion of Australian exports are agricultural products that are sensitive to global warming impacts (AGO, 2003). Some incremental adaptations in agricultural enterprises would be straightforward, but the more transformational adaptive changes may be risky and expensive, especially for individual farmers (Climate Council, 2016).

[5] Based on data collected between 1994 – 2019.

[6] Based on data collected between 1994 – 2010.

8.9.2. Criteria

It is noted that the POEO Act regulates pollution including air pollution. It requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4 $mg/m/m^2$ are also specified.

8.9.3. Potential impacts

Construction and decommissioning

Air quality

Air quality can be affected by dust and emissions generated during the construction works. The sources of dust and emissions at the Proposal Site during construction would include:

- Excavation and earthworks, such as ground-breaking, levelling (cutting and filling), piling works, trenching, etc. – generally, the impacts would be in discrete areas and located well away from receivers.
- Vehicle movements over unsealed surfaces including internal and external access tracks. Up to 6.8 km of track would be installed. There are currently a limited number of unsealed informal tracks onsite.
- Dust from uncovered stockpiled powdery materials or truckloads.
- Emissions (e.g. NOx, SOx and CO) and particulates from vehicles, diesel generators, heavy plant and other mechanical equipment.
- Stored VOCs and other volatile hazardous materials such as paints, fuels and solvents. These would be limited.

Dust and air emissions can be a nuisance to nearby receivers including residences, farm workers and motorists. There are 13 residences are within 2 km of the Proposal Site. The closest receiver is 305 m north east from the site.

The degree of impact can be influenced by weather and climate. Work carried out during long periods of dry weather and high winds have a greater potential to generate dust which can impact air quality (refer to Table 8-41). Construction work during summer months may require greater dust suppression measures to manage any increased impacts.

The construction phase is expected to be approximately 9 months in duration with a peak period lasting 2 months. The air quality impacts from construction works on the Proposal Site, are considered to be negligible due the proposed minor earthworks and the distance from receivers. Mitigation strategies include a formal community consultation and engagement system, and complaints mechanisms, whereby the sources of any complaints are promptly identified and addressed, and appropriate application of a suite of dust and emission reduction measures.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase. Traffic requirements would be similar in type but of shorter duration than that required for the construction phase.

Climate and climate change

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. Haulage traffic and plant and equipment would generate emissions, however, the short duration of the work and the scale of the solar farm proposed suggests this contribution would be negligible in a local or regional context.

Operation

Air quality

Operational and maintenance process of the solar farm would generate very low emissions of pollutants. Specifically, the source of these pollutants is vehicle emissions from staff vehicles and maintenance equipment. However, it is likely that no vehicles would be present at the site on a permanent basis, with only occasional visits by standard vehicles. Fuel would also be required for temporary power generation in the event of an unplanned outage.

Maintenance activities during operation would result in some minor, localised dust generation from vehicles travelling on the unsealed access roads. A groundcover management plan would be implemented to ensure adequate vegetation cover is retained beneath the panels and thereby reduce dust production and erosion risks from bare areas. The impacts on local and regional air quality are expected to be negligible during normal operation.

Climate

Concerns have been previously raised regarding the possibility of the heat created from solar arrays resulting in a heat island effect. 'Heat island' is defined as an area having higher average temperature than its surroundings owing to the greater absorption, retention and generation of heat by buildings, pavements and activities. This is usually used in reference to the impact of an urban area on its rural surroundings. Studies have shown that Photovoltaic (PV) panels convert incident solar radiation into heat, and this can alter the airflow and temperature profiles near the panels. Whether such changes may subsequently affect the thermal environment of near-by populations of humans and other species have been questioned (Fthenakis, V., & Yu, Y., 2013). However, to date there have been limited empirical studies on the potential for a heat island effect in utility scale solar farms.

The limited studies that do exist also show results that can be seen as contradictory, as they are site- and project-specific. Some studies suggest that PV systems can actually cause a cooling effect on the local environment, depending on the efficiency and placement of the PV panels while others demonstrate a warming effect (Barron-Gafford, GA., Minor, RL., Allen, NA., Cronin, AD., Brooks, AE., & Pavao-Zuckerman MA., 2016). Other studies conclude that whilst air temperatures may increase within the solar farm itself, they rapidly decrease to the ambient temperature beyond the perimeter of the solar farm (Fthenakis and Yu, 2013).

Fthenakis and Yu (2013) undertook an analysis of the potential for large solar farms to generate a heat island effect and increase air temperature within the solar farm area. The study found at the centre of the solar farm, the annual average air temperature at a height of 2.5 m increased by up to 1.9 °C. However, this increase in temperature dissipated at a height of 5 m. Additionally, the solar farm completely cooled overnight.

The research suggested a small potential effect on climate within the Proposal Site. This effect may actually enhance retention of ground cover in very cold or hot conditions onsite. No impacts on adjacent properties and agricultural activities would occur.

Climate change

The Proposal would, as part of the transition to renewable energy sources, contribute to reducing greenhouse gas emissions and the mitigation of the negative effects of climate change. On an annual basis, the proposed Tilbuster Solar Farm would provide enough clean, renewable energy for about 48 000 average NSW homes. At the same time, it would displace approximately 250,000 metric tonnes of carbon dioxide.

The operation of the solar farm would produce minimal CO_2 emissions when compared to conventional coal and gas fired power stations, refer to Table 8-39.

Table 8-39 Comparison of CO2 equivalent emissions produced per kilowatt hour

Generation method	Emissions produced (grams CO_2 equivalent per kWh)	Source
PV solar farm	19-59	(Wright, M., & Hearps, P., 2010)
Coal-fired power station	800-1000	(Wright, M., & Hearps, P., 2010)
Combined cycle gas turbine	400	(Alsema, E. A., de Wild-Scholten, M. & Fthenakis, V. M.)

8.9.4. Safeguards and mitigation measures

Table 8-40 Safeguards and mitigation measures for climate and air quality impacts

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Track width of internal tracks would be minimised during detailed design.		Design	
2	Dust generation by vehicles accessing the site and earthworks at the site would be suppressed using water applications or other means as required.	C		D
3	Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
4	All vehicles and machinery used at the site would be in good condition, fitted with appropriate emission controls and comply with the requirements of the POEO Act, relevant Australian standards and manufacturer's operating recommendations. Plant would be operated efficiently and turned off when not in use.	C	O	D
5	Fires and material burning is prohibited on the Proposal Site.	C	O	D
6	Track width of internal tracks would be minimised during detailed design.	C		D

8.10. RESOURCE USE AND WASTE GENERATION

8.10.1. Resource use

Estimated resource use

The key resources and estimated quantities (pending the completion of the detailed Proposal design) required to construct the proposed Tilbuster Solar Farm are listed in Table 8-41. The construction of the Proposal would use the majority of the required resources. During operation and decommissioning, resource requirements would consist of machinery, vehicles and water resources used for maintenance activities. Water resources would be required throughout construction, operation and decommissioning. Water use is considered in Section 8.1 of this EIS.

Table 8-41 Resource requirements for the Tilbuster Solar Farm

Resource	Quantity
Gravel (access tracks)	122,400 m^3
Sand (bedding for cables)	5,000 m^3
Concrete	500 m^3
Estimated no of solar panels	405,888
Water during construction	7 ML

8.10.2. Waste

Policy position

Legal requirements for the management of waste are established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The proposal's resource management options would be considered against a hierarchy as shown in Figure 8-18.

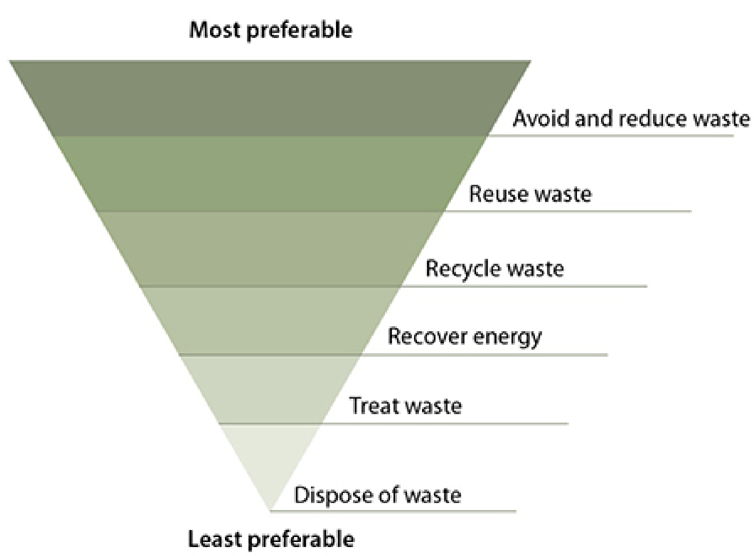

Figure 8-18 Waste hierarchy (source: (EPA, 2020))

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.

8.10.3. Potential impacts

Construction

Resource use

The supply of the materials required for the Proposal are not currently limited or restricted; which is in contrast with the increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources. In considering the volumes required, the Proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

Water would be required during construction for activities including watering of roads and in the site office and amenities. Water use is considered in Section 8.1 of this EIS.

Waste

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

- Packaging materials;
- Excess building materials;
- Scrap metal and cabling materials;
- Plastic and masonry products, including concrete wash;
- Excavation of topsoils and vegetation clearing (expected to be minimal) and
- Liquid bio wastes from onsite septic systems.

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

The impact from waste generation, on regional waste facilities is assessed to be moderate without the implementation of any recycling or re-use measures. However, with the implementation of a Waste Management Plan and identification of recycling waste facilities in the Armidale Regional LGA, the impacts from construction waste disposal on regional landfills, the biological environment and social environment is assessed to be minor.

The Waste Management Plan would include a requirement for separate waste receptors to be located on site during construction to receive recyclable and non-recyclable waste. Recyclable waste is likely to be generated from packaging (carboard, plastic, wood). Non-recyclable waste would be disposed of at an appropriate licensed facility. The following waste facilities are located within the Armidale LGA:

- Armidale Waste Management Facility
- Armidale Recycling Centre
- Guyra Recycling and Transfer Station
- Ebor Waste Transfer Station
- Hillgrove Waste Transfer Station
- Wollomombi Waste Transfer Station

In the event that these waste facilities cannot accept the volume of waste generated, commercial landfills and waste management companies (including those which recycle polystyrene) would be engaged to dispose of the material legally at other facilities.

Where possible, more sustainable packaging material options would be selected (eg reduced insulation/padding thickness and the use of biodegradable starch over cardboard and polystyrene). The proponent would work with Armidale Regional Council and commercial services to recycle as much packaging as practicable.

Operation

Resource use – lifecycle analysis

Lifecycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total life cycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner 2000).

A lifecycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the lifetime of the panels, it is expected that 28 g of GHG emissions would be produced per kWh of energy generated (Fthenakis *et al*. 2011). The 'energy payback time' for multicrystalline PV panels is dependent on the geographical location, however on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer Institute for Solar Energy Systems (ISE), 2015), which is considered comparable to the proposal.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panels. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis, V., Kim, H.C., Frischknecht, R., Raugei, M., Sinha, P., & Stucki, M., 2011). The waste produced during production of the panels which can be recycled include graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis, V., Kim, H.C., Frischknecht, R., Raugei, M., Sinha, P., & Stucki, M., 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it, which is referred to as the system's lifecycle. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer Institute for Solar Energy Systems (ISE), 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems' lifecycle (GA and ABARE, 2010).

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO_2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

Waste

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (U.S. Department of Energy, 2004). Only limited amounts of fuels would be required for maintaining vehicles during operation of the solar farm.

During operation, the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels, lubricants and metals may require replacement over the operational life of the project. Operational waste streams would be very low given the low maintenance requirements of the solar farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation. However, these activities would occur very infrequently and there would be a high potential for recycling or reuse of the waste.

Decommissioning

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

- Solar panels and mounting system;
- Metals from posts, cabling, fencing; and
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

Buildings and major electrical equipment would be removed for resale or reuse, or for recycling as scrap. Items that cannot be recycled or reused, such as excess of above, would be disposed in accordance with applicable regulations and to appropriate facilities.

The proposed energy storage facility would be accompanied with MSDS (Material Safety Data Sheets) which details the exact chemical composition and disposal/recycling requirements of facility components. Potentially hazardous waste is discussed in Section 8.11. It is noted that lithium-ion batteries are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randell Consulting 2016). Lithium-ion batteries do not contain any heavy metals. They do contain valuable material that can be recycled. The Australian Battery Recycling Initiative (ABRI) website indicates four companies which provide a collection and recycling service for used lithium-ion batteries.

The majority of the Proposal components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

8.10.4. Safeguards and mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Potential impacts are to be addressed with regards to the mitigation measures in Table 8-42.

Table 8-42 Safeguards and mitigation measures for resource use and waste generation impacts

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy.	C	O	D

	• Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).			
2	Septic system is installed and operated according to the Armidale Regional Council regulations.	C	O	

8.11. HAZARDOUS MATERIALS AND DEVELOPMENT

8.11.1. Potential impacts

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 Guidelines (DoP, 2011)lists industries that may fall within SEPP 33; the guidelines do not include solar farms and/or energy storage facilities. Appendix 2 of the guidelines provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. Information relevant to the risk screening and the checklist is provided below.

Risk Screening

The SEPP 33 screening procedure is based on the quantity of dangerous goods stored or transported, the frequency of transportation movements and, in some cases, the distance of the materials from the site boundary. The guidelines require goods to be classified according the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The ADG Code lists the following classes of dangerous goods:

- Class 1 Explosives.
- Class 2 Gases.
- Class 3 Flammable liquids.
- Class 4 Flammable solids.
- Class 5 Oxidising substances and organic peroxides.
- Class 6 Toxic and infectious substances.
- Class 7 Radioactive material.
- Class 8 Corrosive substances.
- Class 9 Miscellaneous dangerous substances and articles, including environmentally hazardous substances.

A development which exceeds screening thresholds in the guidelines would be considered potentially hazardous, and a PHA would need to be submitted with the development application. For quantities below the given thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage during construction and operation of the proposed solar farm are identified in Table 8-43, with ADG Code classification, relevant quantity and transportation thresholds, and storage arrangements. The proposed storage sites would be located at the O&M building and the Energy Storage Facility would be located south – west of the onsite substation (refer to Table 8-43). In terms of the class, transportation and storage of dangerous goods, the Proposal would not exceed SEPP 33 thresholds, would not be considered potentially hazardous and would not require the preparation of a PHA.

Table 8-43 Dangerous goods and SEPP 33 thresholds relevant to the proposal

Hazardous material	Storage threshold	Transport threshold		Onsite storage arrangements for the proposal	Exceeds SEPP 33 thresholds?
		Movements	Quantities		
Class 2.1 Flammable gases					
LPG	10 tonnes or 16m^3 (above ground)	>500 cumulative >30/week	2-5 tonnes	Up to 45kg cylinders beside control building, 20 m from boundary.	No
Class 2.2 Non-flammable, non-toxic gases					
Inert fire suppression gas	NA	NA	NA	Compressed in steel bottles in Energy Storage Facility.	No
Class 3 – Flammable liquids (PGII)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	3-10 tonnes	Stored in a bunded Area.	No
Class 6.1 Toxic substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1-3 tonnes	Secure operations storage building.	No
Class 9 Miscellaneous dangerous substances and articles					
Li-ion batteries	NA	>1000 cumulative >60/week	No limit	Energy Storage Facility buildings in a secure compound.	No

Class 2.2 Non-flammable, non-toxic gases

The inert gas stored in compressed form in the Energy Storage Facility for fire suppression would belong to Class 2.2 Non-flammable, non-toxic gases. Gases within this class/division are excluded from the SEPP 33 risk screening process and are not considered to be potentially hazardous with respect to off-site risk. These materials have a Workcover notification threshold of 10,000 litres.

The use of inert gases for fire suppression in enclosed spaces carries asphyxiation risks for staff, site visitors and emergency personnel. Gases commonly used are blends of argon, nitrogen and carbon dioxide. I next gases are used to reduce oxygen content to below 15% to extinguish fires. Levels below 18% are hazardous for humans, and levels below 10% are extremely dangerous. The risk of accidental asphyxiation can be minimised by:

- Proper installation and operation.
- Regular equipment inspection maintenance.
- Provision of warning signs and information to staff.
- Staff and emergency responder training (including during maintenance and rescue/first aid).
- Fixed or personal oxygen monitoring equipment.
- Activation of an audible and visible internal and external alarm prior to gas release.
- Incorporation of an odour in the gas.
- Effective ventilation and air exchange.
- Safe and effective purging system.

Energy Storage Facility – Lithium-ion Batteries

The proposed Energy Storage Facility would provide electricity storage capacity of approximately 40 MWh for each container (40 foot) subject to final specifications. The location and description of the Energy Storage Facility is provided in Section 4.4.7. The average life of the lithium-ion PV solar batteries is assumed to be 15 years. Batteries may require replacement up to a maximum of two times during the life of the solar farm. The batteries are designed for outdoor use, generally only require a secure foundation (i.e. concrete slab), and specified clearances for service access. The batteries are designed for excellent energy density, the ability to operate at any state of charge and reliability and safety (Photon Energy, 2018)

Lithium-ion batteries are classified as a Class 9 miscellaneous dangerous goods and Class 9 hazardous goods (both new and waste batteries). They pose little threat to people or property, although they may pose an environmental hazard (DoP, 2011). Class 9 goods are excluded from the SEPP 33 risk screening process.

Lithium-ion batteries are classified as hazardous waste under the Commonwealth *Hazardous Waste Act 1989*, and are classified as Dangerous Goods under the ADG Code. The ADG Code requires dangerous goods to be carried in a secure, safe and environmentally controlled manner. The code specifies 'special provisions' and 'packing instructions' applying to the transportation of Lithium-ion batteries. The *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998* (the NEPM), which sets the regulatory framework for transporting 'controlled wastes' between Australian states and territories, does not currently cover Lithium-ion batteries.

Waste lithium-ion batteries are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randell Environmental Consulting, 2016) Lithium-ion batteries do not contain any heavy metals. They do contain valuable material that can be recycled. Recycling processors for lithium-ion batteries are similar to recycling of other electronic device battery packs (Photon Energy, 2018). The Australian Battery Recycling Initiative (ABRI) website indicates four companies which provide a collection and recycling service for used lithium-ion batteries.

The major hazard offered by lithium-ion battery technologies is fire, as a result of the flammability of the substances used in the battery (Recharge, 2013). Fire risks associated with lithium-ion batteries are discussed in Section 8.7.2. Class 9 materials have a Workcover notification threshold of 10,000 litres or kilograms, the Proposal is above this threshold. Workcover notification will be required.

Other risk factors

The Proposal would not involve the storage or transport of incompatible materials, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, storage or processing operations involving high (or extremely low) temperatures. There are no known past incidents (or near misses) involving hazardous materials and processes at solar farms.

Potentially offensive industry

The Proposal would result in vehicle and machinery exhaust emissions during the construction phase. The emissions would occur outside, in a rural locality, and would be readily dispersed. The emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would also largely be confined to standard working hours during the construction phase and would not be hazardous to employees or neighbouring residents. Noise impacts have been assessed in Section 8.2. Water pollution risks are assessed as low, subject to identified mitigation measures, with longer term benefits following cessation of cultivation and establishment of groundcover across the site. Water impacts have been assessed in Section 8.3.2.

8.11.2. Safeguards and mitigation measures

Table 8-44 Mitigation measures for hazards

PC: Pre-Construction, C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Design of the Energy Storage Facility would be undertaken to address fire risks (spacing and setbacks).	Design		
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	C	O	D
3	Protocols would be developed for lithium-ion battery energy storage, maintenance, and incident response to mitigate Lithium-ion fire risks.	C	O	D
4	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific ‘special provisions’ and ‘packing instructions’ applying to the transportation of Li-ion batteries.	C	O	D

8.12. CUMULATIVE IMPACTS

8.12.1. Existing environment

Cumulative impacts relate to the combined effect of impacts from several activities on a particular value or receiver. They may occur concurrently or sequentially. Considering the Tilbuster Solar Farm proposal, the relevant cumulative impacts are those associated with other known or foreseeable developments occurring in proximity to the Proposal .

Major projects listed on the Major Projects Register within the Armidale Regional LGA are presented in Table 8-45

Table 8-45 Major Projects within the Armidale Regional LGA (orange indicates potential cumulative impact and requirement for further consultation).

Project title	Status	Potential for cumulative impact
New England Solar Farm	Determination	Yes. Construction was anticipated to commence in 2020

Project title	Status	Potential for cumulative impact
		for a total of three years. Construction has not commenced and may be concurrent with the Tilbuster Solar Farm.
Salisbury Solar Farm	Prepare EIS	Yes. Construction of Salisbury West is anticipated to commence by Q2 2021. Construction of Salisbury East is anticipated to commence by Q2 2022.
Oxley Solar Farm	Prepare EIS	Unknown. Anticipated construction timing is not provided within documentation available on the Major Projects Website.
Tamworth Solar Farm	Assessment	Yes. Construction of the Tamworth Solar Farm is anticipated to commence in late 2020.
Armidale Waste Facility	Determination	No. Construction has been completed.
Metz Solar Farm	Approved	No. Anticipated construction timing is noted as Q2 2020.
UNE New Wright Block	Recommendation	Unknown. Anticipated construction timing is not provided within documentation available on the Major Projects Website.
Armidale High School	Determination	Yes. Construction currently underway with forecast completion early 2021; concurrent with the Tilbuster Solar Farm.

8.12.2. Potential impacts

Potential cumulative impacts are primarily associated with the following:

- Biodiversity impacts;
- Visual and landscape character impacts;
- Noise impacts;
- Traffic impacts;

- Pressure on local facilities, goods and services; and
- Land compatibility impacts.

Biodiversity impacts

Clearing of native vegetation is considered a major factor in the loss of biological diversity and a key threatening process at both the State and Commonwealth level. At least 61 % of native vegetation in NSW has been removed since European settlement (NSW Scientific Committee) and the removal of vegetation for the proposals within the Armidale Regional LGA is contributing further. The cumulative impact of similar renewable energy projects, particularly where EEC is involved, can be considerable given that many poorly-conserved vegetation communities have a substantial portion of their extent represented on private land where most renewable energy projects are proposed. Small losses of vegetative communities may be insignificant at a local level but may accumulate over time to cause a significant reduction in the extent of remnant patches.

Cumulative impacts are considered best addressed by avoiding and minimising. Where avoidance is not possible the impact of each contributing project is assessed on a case by case basis. Long term mechanisms, such as offsetting through the BAM, are structured to address the ongoing impacts of multiple projects in a cohesive manner. For this proposal, biodiversity impacts were considered in the BDAR and credits were generated by the BCC to offset these impacts. However, the overall Proposal has been designed to avoid and minimise impacts to biodiversity.

Visual and landscape character impacts

The visibility of the solar farm during operation may generate a cumulative impact with the existing transmission lines. The Proposal requires security fencing and steel dominated infrastructure. The mitigation measures recommended in this report will act to reduce the cumulative impacts. Screen planting would be undertaken in key locations on-site, outside the perimeter fence, to minimise views of infrastructure.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure within the low relief landscape.

Noise impacts

Noise impacts through the use of plant, machinery and vehicles would ordinarily be increased if the construction of other developments is undertaken concurrently.

However, the majority of residential and other noise sensitive receivers are a considerable distance from the Proposal Site where construction noise from the Proposal are considerably lower than noise management levels (refer section 8.2). During operation, the Proposal would generate negligible noise impacts. Cumulative impacts are therefore unlikely to increase construction noise impacts and are expected to be minor and manageable.

Traffic impacts

Cumulative traffic impacts may occur on common construction access and haulage transport routes, primarily on New England Highway. The New England Highway is a high capacity road designed for heavy vehicle traffic and is likely to absorb any cumulative impacts. Any impact from increased traffic would be predominately limited to the 12-month construction period. Cumulative traffic impacts are considered unlikely or would be for a short period of time.

During operation only a small maintenance team using light vehicles will be required, with the exception of outstanding circumstances requiring unusual maintenance operations such as inverter or transformer replacement.

Pressure on local facilities, goods and services

There is potential that the possible concurrent construction of the Proposal with other SSD or local development would increase pressures on local community services including accommodation. However, there is also a potential for positive cumulative economic effects from the construction of multiple developments in the area. Socio-economic benefit in relation to developments in the region will be a continuous ongoing benefit for the community with increased jobs and economic input into local business.

The Proposal would not result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. It is unlikely that there would be negative cumulative impacts to local facilities, goods and services.

Local agriculture impacts

Approximately 0.64 ha of agricultural land would be converted into solar farm development. The Proposal would not fragment any resource lands throughout the operational period. Upon decommissioning of the solar farm, the development footprint would require rehabilitation to restore it to its pre-existing productive capacity for agricultural land use.

Continued use of this land for sheep grazing would be maintained. Therefore, the development of a solar farm would potentially result in the following agricultural impacts:

- Limited resource loss for the lifetime of the solar farm.
- A potential change to biosecurity risks.
- Potential increased bushfire risks.

These impacts have been assessed in detail in Section 7.3 and found to be highly manageable.

The proposed New England Solar Farm, Salisbury Solar Farm, Oxley Solar Farm and Metz Solar Farm are all proposed within the Armidale Regional LGA, and have had SEARs issued. If all the development applications are submitted and successful, the close proximity of the proposed solar farms has the potential to increase the cumulative impacts affecting land use change and local agriculture. The combined development footprint of the Tilbuster Solar Farm and these proposals equates to approximately 7530 ha.

The Armidale Regional LGA covers an area of approximately 8,621 km^2 (~826,100 ha) and contributes 1.4% of the total agriculture value of NSW. The temporary loss of 178 ha of agricultural land within the Armidale Regional LGA represents a small fraction (0.005%) of the agricultural holdings within the New England and North West region of NSW and would result in a negligible decrease in the overall productivity of the region. A case study of a solar farm in Nyngan by Dr Turlough Guerin of the Agricultural Institute of Australia (Australia Farm Institute 2017) indicated that the project did not significantly reduce the agricultural output of the locality.

Solar farm infrastructure is typically low in height and results in minimal physical impact to the land surface. In relation to the Tilbuster Solar Farm, 132 ha of the Proposal would remain vegetated and approximately 16 ha would be compacted gravel surfaces. These surfaces would include internal access tracks, compounds, inverter and batter storage, hardstands and the substation. As a result of the low scale of development of the solar farms, the agricultural capability of the land would not be affected by the proposals. As previously mentioned, grazing could continue to be managed across the sites to maintain the height of groundcover during the operational period.

The land can be returned to agricultural use following decommissioning of the proposals. There are many benefits of resting the land for a period of time (NSW Government 2012) and include:

- Increased groundcover and diversity of groundcover with biosecurity management.
- Increase in soil moisture and nutrients.

- Increases in soil organic matter means less evaporation, less impact of raindrops, less impact of runoff and less erosion.
- Controlled stocking rates will reduce soil compaction.
- Perennial grasses can be encouraged to increase soil stability of the grassland around the panels.
- A return of soil organisms for decomposition of organic matter, nutrient cycling and improving soil structure.

Potential loss of 178 ha of agricultural land within the region should be measured against wider government strategic goals and environmental benefits, which include:

- Strategic goals of the Commonwealth and NSW Governments for renewable energy development going forward.
- The environmental benefits of solar energy production, in particular the reduction of greenhouse gas emissions.
- The economic benefits of using an area with reliable solar resources and access to existing electricity infrastructure.
- The benefits of alternative and increased energy supply for grid stability and reliability.

Currently, there are 2 part - time staff employed in agriculture at the Proposal Site. The figure is likely to be higher for the proposed Tilbuster Solar Farm. During construction there would be approximately 125 full time equivalent staff on average and 5 full time equivalent staff during operation.

The potential cumulative impact of the reduction in agricultural employment would be balanced by the additional employment during construction and on-going employment of staff during operation. Additional local services could be maintained during operation. For example, to maintain the solar farm area mowing/slashing services would be required. Local agricultural services could be maintained if sheep grazing is maintained within the solar farm.

As such, no cumulative impacts to agricultural enterprise or local agricultural land use are expected.

8.12.3. Safeguards and mitigation measures

The cumulative impacts identified for this Proposal are considered best manages by dealing with each component individually. No additional safeguards are proposed.

9. ENVIRONMENTAL MANAGEMENT

9.1. ENVIRONMENTAL MANAGEMENT FRAMEWORK

The environmental risks associated with the proposed Tilbuster Solar Farm would be managed by implementing a proposal-specific suite of mitigation measures detailed in Sections 7 and Section 8 and summarised below.

All commitments and mitigation measures would be managed through the implementation of a Project Environmental Management Strategy (EMS). The EMS would comprise a Construction Environmental Management Plan (CEMP), an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). These plans would be prepared sequentially, prior to each stage of works by the contractor (CEMP, DEMP) and proponent (OEMP).

The EMS would include performance indicators, timeframes, implementation and reporting responsibilities, communications protocols, a monitoring program, auditing and review arrangements, emergency responses, induction and training and complaint/dispute resolution procedures. The monitoring and auditing program would clearly identify any residual impacts after mitigation. Adaptive management would be used to ensure that improvements are consolidated in updated EMPs

9.2. CONSOLIDATED MITIGATION MEASURES

The mitigation measures contained in this report comprise proposal-specific safeguards, recommendations from specialist assessment reports and reference to a range of best practice guidelines and regulatory requirements. The measures are to be incorporated in Proposal plans and designs, contract specifications and the Construction Environmental Management Plan, Operation Environmental Management Plan and Decommissioning Environmental Management Plan as appropriate. The mitigation measures are consolidated below. Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Table 9-1 Consolidated list of mitigation measures.

ID	Safeguards and Mitigation Measures	C	O	D
Biodiversity				
1	Avoid critical life cycle events: • Where practicable, hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur	C		
2	Clearing protocols to include: • Pre-clearing checklist • Tree clearing procedure • Staged habitat removal • Unexpected threatened species finds procedure • Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance	C		
3	Relocate habitat features:	C		

ID	Safeguards and Mitigation Measures	C	O	D
	• Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement			
4	Manage noise impacts: • Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		
5	Reduce impacts of light spill • Avoid Night Works • Direct lights away from vegetation	C	O	
6	Adaptive dust monitoring programs to control air quality: • Daily monitoring of dust generated by construction and operation activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	C		
7	Program construction activities to avoid impacts: • Where practicable, time construction activities outside Koala breeding season • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur	C		
8	Protect significant environmental features: • Fencing from buffer of riparian zones and drainage lines	C		
9	A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: • Management protocol for declared priority weeds under the *Biosecurity Act 2015* during and after construction	C	O	

ID	Safeguards and Mitigation Measures	C	O	D
	• Weed hygiene protocol in relation to plant, machinery, and fill • The weed management procedure would be incorporated into the Biodiversity Management Plan.			
10	Staff training and site briefing to communicate environmental features: • Site induction • Toolbox talks • Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	C	O	
11	Preparation of a Construction Flora and Fauna Management Plan that would include protocols for: • Protection of native vegetation to be retained • Best practice removal and disposal of vegetation • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist • Weed management • Unexpected threatened species finds • Rehabilitation of disturbed areas	C		
12	Protect connectivity: • No use of barbed wire fencing as it provides a hazard to fauna such as Koala, Greater Glider and microbats • Fencing adjacent to areas of the development site that are connected to areas of bushland outside the development site are to include Koala friendly structures to aid traversal of Koala across their range	C		
13	Fencing to protect features: • Fencing from buffer of riparian zones, drainage lines and farm dams to be retained • Development site to be fenced entirely during construction and operation	C	O	
Aboriginal heritage				

ID	Safeguards and Mitigation Measures	C	O	D
1	A cultural heritage management plan must be prepared for the protection and management of the following sites to be impacted: IF1, 2, 3, 4, 7, 10, 11, 14, 15, 16, 19, 23, 24, 25, 26, 27, 28, 29, 32, 34, 35, 36, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50 This should be prepared prior to construction and will be relevant for all phases of the project. Approval to be gained for the surface salvage of the sites. This must occur prior to construction.	C		
2	A cultural heritage management plan must be prepared for the protection and management of all IFs outside the impact zone . This should be prepared prior to construction and will be relevant for all phases of the project. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and must therefore not be impacted by incidental activity.	C	O	D
3	A cultural heritage management plan must be prepared for the protection and management of all artefact scatters to be impacted: AS2, 3, 4, 5, 6, 7, 10, 11, 12, 14, 15, part of 16, 17, 20, 21, 22, 23, 24, 25, 27 . This should be prepared prior to construction and will be relevant for all phases of the project. Approval to be gained for the surface salvage of the sites. This must occur prior to construction. Monitoring of topsoil removal at sites AS24 and 25 is likely to be requested by RAPs.	C		
4	A cultural heritage management plan must be prepared for the protection and management of all AS outside the impact zone. This should be prepared prior to construction and will be relevant for all phases of the project. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and must therefore not be impacted by incidental activity.	C	O	D
5	A cultural heritage management plan must be prepared for the protection and management of ST4, 5, 6 and CT2. This should be prepared prior to construction and will be relevant for all phases of the project. It is recommended that the proposed design is modified to exclude any impact to these sites plus a 5m buffer surrounding each of them. However, if this is not possible further negotiation with RAPs is required regarding this issue.	C		
6	A cultural heritage management plan must be prepared for the protection and management of ST1, 2, 3 and CT1, 3. This should be prepared prior to construction and will be relevant for all phases of the project.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	Fencing to be placed a minimum of five metres from these sites in order to prevent any impacts to the scar or the health/condition of the trees. The site induction should include information regarding the identified Aboriginal heritage values within the Proposal area outside the development footprint which will be extant during all phases of works and must therefore not be impacted by incidental activity.			
Land and soil				
1	Undertake a base line soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects of soil and groundcover management.	PC		
2	As part of the CEMP, a Soil and Water Management Plan (SWMP) (with erosion and sediment control plans) would be prepared, implemented and monitored during the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions to: • Install, monitor and maintain erosion controls. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability. • Manage topsoil in all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period had passed. • Areas of soil disturbed by the Proposal would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	C		

ID	Safeguards and Mitigation Measures	C	O	D
3	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial grass cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election. • Soil preparation. • Establishment techniques. • Maintenance and monitoring requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live grass cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live grass cover falls below 70%. Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. I.e. any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible	C	O	D
4	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.	Design		
5	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act). • Manage the storage of any potential contaminants onsite.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment • Induct and train all site staff.			
6	The transformers will be filled with oil, and waterproof bunds built around them to manage oil spills.	Design		
7	A protocol would be developed in relation to unexpected discover of buried contaminants within the Proposal Site (e.g. pesticide containers). It would include stop work, remediation and disposal requirements.	C		
8	A Rehabilitation Plan would be prepared to ensure the array site is returned to at least or better than pre-solar farmland and soil capability. The plan would be developed with reference to the base line soil testing and with input from an agronomist to ensure the site is left stabilised, under a cover crop or other suitable ground cover. The soil survey would be based on: • *Australian Soil and Land Survey Handbook* (CSIRO, 2009) • *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008) • *The land and soil capability assessment scheme: second approximation* (OEH, 2012)			D
9	A pest and weed management plan would be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Armidale Regional Council and NSW DPI requirements.	C	O	D
Compatibility with existing land uses				
1	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	PC		
2	Consultation with adjacent landowners, to minimise impact of the Proposal on adjacent agricultural activities and access.	PC		
3	Consultation with DPIE (Crown Lands) would be ongoing and the following would be undertaken: Prior to construction, a license will be applied for to allow construction to commence within Crown roads on the Proposal Site.	PC		

ID	Safeguards and Mitigation Measures	C	O	D
4	Consultation with representatives from nearby major projects, including Salisbury Solar Farm, Oxley Solar Farm, New England Solar Farm, to ensure traffic and pressure on local services are managed adequately	PC/C		
Hydrology and flooding				
1	The design of buildings, equipment foundations and footings for electrical componentry and panel mounts would be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including: • The solar array mounting piers would be designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500mm freeboard, giving regard to the depth and velocity of floodwaters. • The tracking axis for solar tracking modules would be located above 1% AEP flood event plus 500mm freeboard. • The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, would be located above the 1% AEP flood level plus 500mm freeboard. • Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water. • The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater. • Security fencing would be designed so as to create two separate fenced compounds on either side of Duval Creek.	Design		
2	At the substation site, slight raising of the adjacent roadway (or similar type bunding) is recommended in order to divert upslope runoff around this critical piece of infrastructure.	Design		
3	If the proposed crossing structures over Duval Creek will be rendered impassable during significant flood events, the following would occur: i. Flood warning signs and flood level indicators should be placed on each approach to the proposed crossings. ii. A flood refuge building or structure be provided within the Proposal area on the eastern side of Duval Creek, such that in the event the proposed Duval Creek crossings are not trafficable any staff on-site have access to a weatherproof, flood free structure to seek temporary refuge. Such refuge area should be located a minimum of 500mm above the PMF level. A Business Floodsafe Plan be prepared for the development to ensure the safety of employees during flood events in general accordance with the NSW SES "Business Floodsafe Toolkit and Plan".	C	O	D
4	Any road crossings on watercourses within the Proposal Area would be of the type defined in Table 2 of the Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd in Appendix G.	Design		

ID	Safeguards and Mitigation Measures	C	O	D
	Any proposed crossings (vehicular or service) of existing watercourses on the subject site should be designed in accordance with the following guidelines, and in the case of vehicle crossing should preferably consist of bed level crossings constructed flush with the bed of the watercourse on first and second order watercourses to minimise any hydraulic impact: i. Guidelines for Watercourse Crossings on Waterfront Land (NSW DPI, 2012) ii. Guidelines for Laying pipes and Cables in Watercourses on Waterfront Land (NSW DPI, 2012)			
5	Within the floodplain access roads should be constructed as close to natural ground levels as possible so as not to form an obstruction to floodwaters. The surface treatment of roads should be designed giving regard to the velocity of floodwaters to minimise potential for scouring during flood events.	C		
6	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal . The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	C	O	D
Visual amenity and landscape character				
1	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical: • Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown. • Pole mounts will be non-reflective. • Security fencing posts and wire would be non-reflective.		Design	
2	During construction, dust would be controlled in response to visual cues.	C		

ID	Safeguards and Mitigation Measures	C	O	D
3	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).		O	
4	In the event that a Development Application for a residential dwelling on Lot 4 DP800611, the proponent would undertake consultation with the landowner in relation to potential visual impacts.	C		
Noise and vibration				
1	A Noise Management Plan would be developed as part of the CEMP. The plan would include, but not be limited to: • Use less noisy plant and equipment where feasible and reasonable. • Plant and equipment to be properly maintained. • Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. • Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel. • Avoid any unnecessary noise when carrying out manual operations and when operating plant. • Any equipment not in use for extended periods during construction work should be switched off. • Complaints procedure deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. Establish good relations with people living in the vicinity of the site at the beginning of Proposal and maintain. Keep people informed, deal with complaints seriously and expeditiously. The community liaison member of staff should be adequately experienced.	C		
Water use and water quality				
1	Design waterway crossings and services crossing in accordance with the publications: • *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). • *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). • *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012).	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• _Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land_ (NSW DPI, 2012).			
2	All fuels, chemicals, and liquids would be stored at least 50 m from any waterways or drainage lines, not on sloping land and would be stored in an impervious bunded area.	C	O	D
3	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
4	The refueling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
5	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D
6	Adequate incident management procedures would be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
7	Ensure appropriate drainage controls are incorporated into the design to minimise the area of disturbance, runoff and pollutant generation.	Design		
8	If groundwater is to be intercepted at any stage of the development the proponent must obtain the relevant entitlement and approval where required prior to any extraction.	C	O	D
9	Re-use of stormwater should be considered wherever possible.		O	
10	Inspect stormwater control measures at least quarterly, and before and after rainfall of more than 10 mm in 24 hours.	C	O	
Historic heritage				
1	Should an item of historic heritage be identified, the Heritage Division (EES) would be contacted prior to further work being carried out in the vicinity.	C	O	D
Social and economic impacts				
1	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		

ID	Safeguards and Mitigation Measures	C	O	D
2	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
3	Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
4	The Community Consultation Strategy would be implemented to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the Proposal and Proposal benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.). • Protocols to respond to any complaints received.	C		D
Traffic, transport and safety				
1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Direction of traffic flow (both heavy and light). • Loads, weights and length of haulage and construction related vehicles and the number of movements of such vehicles. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.). • All heavy vehicle movements to/from the access point are to be managed to ensure that only one inbound or outbound vehicle is travelling along the access route in the vicinity of the site at a time. • Heavy vehicle movements into and out of the Proposal Site will be controlled via traffic management means, including a traffic controller, temporary lowered speed limit and additional road signage alerting vehicles of truck movements in the area.	C	O	D
2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan will be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan would include, but not be limited to: • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site.	C		D

ID	Safeguards and Mitigation Measures	C	O	D
	• Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the project, especially at the access site along New England Highway. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. • A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the Code. • Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads to minimise dust generation through increased traffic use. • Following construction, a post condition survey of the relevant sections of the existing road network to be undertaken to ensure it is of similar condition to that prior to construction.			
3	Obtain a Section 138 Consent from the relevant council/agency to perform works within the road reserve.	C		
4	The proponent would consult with Armidale Regional Council and TfNSW regarding the proposed upgrade of the unnamed road for site access. The upgrade would be subject to detailed design and would be designed and constructed to the relevant Australian road design standards.	Design		
5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	C		D
6	The proponent would engage an appropriately qualified person to prepare a Road Dilapidation Report for all road routes to be used during the construction (and decommissioning) activities, in consultation with the relevant road authority. This report is to address all road related infrastructure. Reports must be prepared prior to commencement and after completion of construction	PC		D

ID	Safeguards and Mitigation Measures	C	O	D
	(and decommissioning). Any damage resulting from the construction (or decommissioning) traffic, except that resulting from normal wear and tear, must be repaired at the Proponent's cost. Such work shall be undertaken at a time agreed upon between the Proponent and relevant road authorities.			
7	Prior to the commencement of construction on-site, the Proponent would undertake all works to upgrade relevant state roads, their associated road reserve and any public infrastructure in that road reserve to a standard suitable for use by heavy vehicles to meet any reasonable requirements that may be specified by TfNSW. The design, specifications and construction of these works must be completed and certified by an appropriately qualified person to a standard to accommodate the traffic generating requirements of the project. On Classified Roads the geometric road design and pavement design must be to the satisfaction of the TfNSW.	PC		D
8	For works on the State road network the developer is required to enter a Works Authorisation Deed (WAD) with TfNSW before finalizing the design or undertaking any construction work within or connecting to the road reserve. The WAD documentation is to be submitted for each specific change to the state road network for assessment and approval by TfNSW prior to commencement of any works within the road reserve.	PC		
Bush fire				
1	Copper conductors would be used where necessary to electrically bond the metal structures to earth to protect personnel and equipment in the event of lightning strikes and electrical faults.	Design		
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: The storage and handling of flammable and combustible liquids.	C	O	D
3	Develop a Bush Fire Management Plan to include but not be limited to: • Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting). • Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements. • Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies. • Document all firefighting resources maintained at the site with an inspection and maintenance schedule.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• Monitoring and management of vegetation fuel loads. • A communications strategy incorporating use of mobile phones, radio use (type, channels and call-signs), Fire Danger Warning signs located at the entrance to the site compounds, emergency services agency contacts. • In developing the Bush Fire Management Plan, NSW RFS would be consulted on the volume and location of water supplies, fire-fighting equipment maintained on-site, fire truck connectivity requirements, proposed APZ and access arrangements, communications, vegetation fuel levels and hazard reduction measures.			
4	An APZ of minimum 10 m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4 m wide gravel access track. Average grass height within the APZ would be maintained at or below 5 cm on average throughout the October-March fire season. Average grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 cm throughout the fire season.	C	O	
5	The overhead powerlines at the site would be managed by maintaining appropriate vegetation clearance limits to minimise potential ignition risks, in accordance with the ISSC 3 Guideline for Managing Vegetation Near Power Lines.		O	
6	Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment would include fire extinguishers, a 1000 L water cart retained on site on a precautionary basis, particularly during any blasting and welding operations. Equipment lists would be detailed in Work Method Statements.	C		
7	The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
8	Following commissioning of the solar farm, the local RFS and Fire and Rescue brigades would be invited to an information and orientation day covering access, infrastructure, firefighting resources on-site, fire control strategies and risks/hazards at the site.		O	
9	The perimeter access track would comply with the requirements for Fire Trails in the PBP guidelines. All access and egress tracks on the site would be maintained and kept free of parked vehicles to enable rapid response for firefighting crews and to avoid entrapment of staff in the case of bush fire emergencies. Access tracks would be constructed as through roads as far as practicable. Dead end tracks would be signposted and include provision for turning firetrucks.	C	O	D
10	A Hot Works Permit system would be applied to ensure that adequate safety measures are in place. Fire extinguishers would be present during all hot works. Where practicable hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
11	Machinery capable of causing an ignition would not be used during bush fire danger weather, including Total Fire Ban days.	C	O	D
12	Prior to operation of the solar farm, an Emergency Response Plan (ERP) would be prepared in consultation with the RFS and Fire and Rescue NSW. This plan must include but not be limited to: • Specifically addresses foreseeable on site and off site fire events and other emergency incidents. • Risk control measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. • Two copies of the ERP are stored in a prominent 'Emergency Information Cabinet' which is located in a position directly adjacent to the site's main entry point/s. Once constructed and prior to operation, the operator of the facility would contact the relevant local emergency management committee (LEMC).		O	
13	Fire risks associated with the lithium-ion energy storage facility would include: • Locating the Energy Storage Facility as far as practicable from any sensitive receptors or large stands of vegetation. • Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems. • Installing reliable integrated fire detection and fire suppression systems (inert gas). • Ensuring the battery containers are not vulnerable to external heat effects in the event of a bush fire. • Designing appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility. • Compliance with all relevant guidelines and standards. • Preparation of a specific Battery Fire Response Plan, under the general Bush fire Management Plan, in consultation with fire authorities, fire suppression experts and in reference to relevant standards and guidelines. Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades.		O	
14	A Fire Safety Study (FSS) will be undertaken and developed in accordance with the requirements of Hazardous Industry Planning Advisory Paper No. 2 (HIPAP No.2) and consultation with FRNSW prior to commencement of construction. The FSS will consider	PC		

ID	Safeguards and Mitigation Measures	C	O	D
	the limited operational capacity of local fire agencies and the need for the facility to achieve an adequate level of on-site fire and life safety dependence.			
Electric and magnetic fields				
1	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
2	All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
3	Design of electrical infrastructure would minimise EMFs.	C		
Air quality and climate				
1	Track width of internal tracks would be minimised during detailed design.		Design	
2	Dust generation by vehicles accessing the site and earthworks at the site would be suppressed using water applications or other means as required.	C		D
3	Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
4	All vehicles and machinery used at the site would be in good condition, fitted with appropriate emission controls and comply with the requirements of the POEO Act, relevant Australian standards and manufacturer's operating recommendations. Plant would be operated efficiently and turned off when not in use.	C	O	D
5	Fires and material burning are prohibited on the Proposal Site.	C	O	D
6	Track width of internal tracks would be minimised during detailed design.	C		D
Resource and waste generation				
1	A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant).	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).			
2	Septic system is installed and operated according to the Armidale Regional Council regulations.	C	O	
Hazardous materials and development				
1	Design of the Energy Storage Facility would be undertaken to address fire risks (spacing and setbacks).	Design		
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	C	O	D
3	Protocols would be developed for lithium-ion battery energy storage, maintenance, and incident response to mitigate Lithium-ion fire risks.	C	O	D
4	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	C	O	D

10. CONCLUSION

10.1. PROPOSAL OVERVIEW

The proposed Tilbuster Solar Farm would be located 17 km north of Armidale, NSW and accessed via the New England Highway. The Proposal would connect to the existing TransGrid 330kV Armidale to Dumaresq transmission line, crossing the Proposed Site.

The Tilbuster Solar Farm Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar farm which would generate approximately 150MW (AC) to be supplied directly to the national electricity grid. Development of the solar farm would make use of existing electricity infrastructure and contribute to Australia's transition to a low emission energy generation economy. The Proposal is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its current land capability, for agricultural or other alternative land uses.

10.2. BENEFITS OF AND NEED FOR THE PROPOSAL

The Tilbuster Solar Farm has been designed with the following objectives:

- Developing a utility scale solar electricity generation site with the capability for on-site energy storage to support the high voltage transmission network
- To develop a profitable solar farm with minimal environmental and social impact on the community
- Work collaboratively with key stakeholders to ensure all relevant requirements are considered in the location, design, construction and operation of the proposal.
- Provide local and regional employment opportunities and other social benefits during the construction and operation of the facility.
- To obtain a social license to operate in becoming a member of the local community

The source of renewable energy from the Tilbuster Solar Farm also supports efforts to mitigate the effect of climate change by:

- Assisting the NSW and Commonwealth Governments to meet Australia's renewable energy targets
- Providing a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions.
- Generation of enough clean, renewable energy for about 48,000 average NSW homes.
- Displacement of approximately 250,000 metric tonnes of carbon dioxide.

10.3. ENVIRONMENTAL IMPACTS AND MANAGEMENT

The key environmental risks have been investigated through specialist investigations, and include impacts to:

- Biodiversity
- Aboriginal heritage
- Agriculture and land use
- Hydrology and flooding
- Visual amenity and landscape character

Enerparc has undertaken comprehensive consultation with affected landowners, the local community and other relevant stakeholders in developing the proposal. Enerparc has informed and engaged with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners on the proposal.

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

10.4. ABILITY TO BE APPROVED

This EIS indicates that the Proposal can be approved, subject to the identified mitigation measures. In summary, this is because:

- The Proposal meets relevant planning requirements, as set out in Section 5.
- The environmental risks associated with the Proposal are well understood and manageable, as set out in Section 7 and Section 8. Specifically,
    - The Proposal has demonstrated consideration of avoidance and minimisation of key environmental features as part of the layout and mitigation strategy development.
    - The impacts are largely reversible, and offsetting would be undertaken to ensure an overall 'not net biodiversity loss' outcome for the proposal.
    - The principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development.

Consideration has been given to the compatibility of the Proposal with the existing electricity network and the compatibility of the site for the generation of solar energy. This ensures construction and operating costs are reduced, maximising the viability of the Proposal and its contribution to meeting energy needs into the future. Considerations during initial site investigations included:

- Proximity to and capacity of the electrical transmission network
- Availability of an abundant solar resource
- Availability of suitable land (i.e. topography, aspect, presence of native vegetation)
- Suitability in terms of the interests of other stakeholders and the environment.

The consequences of not proceeding with the proposed Tilbuster Solar Farm would result in:

- Loss of opportunity to reduce GHG emissions and move towards cleaner renewable electricity generation
- Loss of a renewable energy supply that would assist in reaching the NSW renewable energy targets
- Loss of additional electricity generation and supply into the National grid
- Loss of social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.

The preferred option assessed in this EIS provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the proposal. Furthermore, the Proposal is consistent with the principles of ESD and forms an important part of Australia's transition to renewable energy generation.

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APPENDIX A SECRETARYS ENVIRONMENTAL ASSESSMEMENT REQUIREMENTS

NSW GOVERNMENT | Planning & Environment

Planning Services
Resource Assessments
Contact: Anthony Barnes
Phone: (02) 8289 6709
Email: anthony.barnes@planning.nsw.gov.au

Benjamin Hannig
Managing Director
Enerparc Australia Pty Ltd
223 Liverpool Street
Darlinghurst NSW 2010

Dear Mr Hannig

Tilbuster Solar (SSD 9619)
Environmental Assessment Requirements

I have attached the Environmental Assessment Requirements for the preparation of an Environmental Impact Statement (EIS) for the Tilbuster Solar project.

The requirements are based on the information you provided on 24 September 2018 and have been prepared in consultation with the relevant government agencies. The agencies comments are attached for your information (see Attachment 2).

Please note that the Department may alter these requirements at any time, and that you must consult further with the Department if you do not lodge a development application and EIS for the project within the next two years.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will also require approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment in Canberra (6274 1111 or www.environment.gov.au).

Please contact the Department at least two weeks before you plan to submit the development application and EIS for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1AA, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the required number of copies of the EIS.

It is important for you to recognise that the Department will review the EIS for the project before putting it on public exhibition. If it fails to adequately address these requirements, you will be required to submit an amended EIS.

Yours sincerely

CPreshaw 12/10/18

Clay Preshaw
Director
Resource Assessments
as nominee of the Secretary

Environmental Assessment Requirements

State Significant Development

Section 4.12(8) of the *Environmental Planning and Assessment Act 1979 and*
Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*

<table>
<tr><td>Application Number</td><td>SSD 9619</td></tr>
<tr><td>Proposal</td><td>Tilbuster Solar Farm which includes:
• construction and operation of a photovoltaic (PV) generation facility with an estimated capacity of 300 MW;
• associated infrastructure, including a grid connection and energy storage facility; and
• construction of an access road off the New England Highway.</td></tr>
<tr><td>Location</td><td>New England Highway, Tilbuster NSW 2350</td></tr>
<tr><td>Applicant</td><td>Enerparc Australia Pty Ltd</td></tr>
<tr><td>Date of Issue</td><td>12 October 2018</td></tr>
<tr><td>General Requirements</td><td>The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

In particular, the EIS must include:
• a stand-alone executive summary;
• a full description of the development, including:
– details of construction, operation and decommissioning;
– a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);
– a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development;
• a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:
– a description of the existing environment likely to be affected by the development;
– an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;
– a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and
– a description of the measures that would be implemented to monitor and report on the environmental performance of the development;
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and
• the reasons why the development should be approved having regard to:
– relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been</td></tr>
</table>

	incorporated in the design, construction and ongoing operations of the development; – the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and – feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. • a detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter. The EIS must also be accompanied by a report from a suitably qualified person providing: – a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived; and – certification that the information provided is accurate at the date of preparation. The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).
Specific Issues	The EIS must address the following specific issues: • **Biodiversity** – including: – an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values; – the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and – an assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts; • **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*; • **Land** – including: - an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including: o a consideration of agricultural land, flood prone land, Crown lands (including Crown roads), mining, mineral or petroleum rights; o a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and o a cumulative impact assessment of nearby developments; - an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including: o consideration of the zoning provisions applying to the land, including subdivision, and; o completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide*; and

	- a description of measures that would be implemented to remediate the land following decommissioning in accordance with *State Environmental Planning Policy No 55 - Remediation of Land.* • **Visual** – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners; • **Noise** – including an assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry 2017, cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria; • **Transport** – including: – an assessment of the peak and average traffic generation, including any over-dimensional vehicles and construction worker transportation; – an assessment of the likely transport impacts to the site access route (including New England Highway), site access point, any Crown land, particularly in relation to the capacity and condition of the roads; – a cumulative impact assessment of traffic from nearby developments; – a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and – a description of the measures that would be implemented to mitigate any transport impacts during construction; • **Water** – including: – an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; – details of water requirements and supply arrangements for construction and operation; and – a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004); • **Hazards and Risks** – including: – a preliminary risk screening in accordance with *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* and *Applying SEPP 33* (DoP, 2011), and if the preliminary risk screening indicates the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (*DoP, 2011) and *Multi-Level Risk Assessment* (DoP, 2011); and – an assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure; and • **Socio-Economic** – including an assessment of the likely impacts on the local community, demands on Council infrastructure and a consideration of the construction workforce accommodation.

Consultation	During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Armidale Regional Council. The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.
Further consultation after 2 years	If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS.
References	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. While not exhaustive, the following attachment contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this proposal.

ATTACHMENT 1

Environmental Planning Instruments, Policies, Guidelines & Plans

Biodiversity	
	Biodiversity Assessment Method (OEH)
	Threatened Species Assessment Guidelines - Assessment of Significance (OEH)
	Biosecurity Act 2015
	Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI)
	Policy and Guidelines for Fish Habitat Conservation and Management (DPI)
	Fisheries Management Act 1994
Heritage	
	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)
	Code of Practice for Archaeological Investigations of Objects in NSW (OEH)
	Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW (OEH).
	NSW Heritage Manual (OEH)
Land	
	Primefact 1063: Infrastructure proposals on rural land (DPI)
	Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA)
	Local Land Services Act 2013
	Australian Soil and Land Survey Handbook (CSIRO)
	Guidelines for Surveying Soil and Land Resources (CSIRO)
	The land and soil capability assessment scheme: second approximation (OEH)
	Land Use Conflict Risk Assessment Guide (DoI – L&W)
Noise	
	NSW Noise Policy for Industry (EPA)
	Interim Construction Noise Guideline (EPA)
	NSW Road Noise Policy (EPA)
Light	
	Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring (DPE)
Transport	
	Guide to Traffic Generating Developments (RTA)
	Austroads Guide to Road Design & relevant Australian Standards
	Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development
Water	
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Floodplain Development Manual (OEH)
	Guidelines for Controlled Activities on Waterfront Land (DPI Water)
	Water Sharing Plans (DPI Water)
	Floodplain Management Plan (DPI Water)
	Guidelines for Watercourse Crossings on Waterfront Land (DPI Water)
Hazards and Risks	
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DPE)
	Multi-Level Risk Assessment (DPE)
Waste	
	Waste Classification Guidelines (EPA)
Electromagnetic Interference	

	ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields
Environmental Planning Instruments	
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	State Environmental Planning Policy (Rural Lands) 2008
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
	State Environmental Planning Policy No. 55 – Remediation of Land
	Armidale Dumaresq Local Environmental Plan 2012

ATTACHMENT 2
AGENCY CORRESPONDENCE

Anthony Barnes

From:	Easements& Development <Easements& Development@transgrid.com.au>
Sent:	Tuesday, 25 September 2018 11:46 AM
To:	Anthony Barnes
Subject:	2018-469 SSD 9619 - Tilbuster Solar Farm project

Good morning,

TransGrid Number: 2018-469

Location: Tilbuster Solar Farm project SSD 9619

Proposal: Request for Input

Thank you for referring the above mentioned Development Application to TransGrid for review.

Please be advised after reviewing the proposed works at Tilbuster Solar Farm project SSD 9619

TransGrid has determined the proposed works acceptable subject to the following conditions of approval being met and comments expressed noted and as appropriate actioned:

- The project scope description should include all ancillary electricity transmission works (all works associated with connection to the National Electricity Market, such as ancillary substation works, transmission line works (direct and upstream), and telecommunications works) that would be necessary for the construction and operation of the Project.

- The EIS should identify all land parcels affected by these works and include them within the project boundary.

a) For all future communication please contact: Mr Shara Karamian Program Manager Infrastructure Services 02 9284 3353 or Mobile 0403 685 838

Regards

Michael

Michael Platt
Development Assessment and Control Officer | Network Planning and Operations
____
TransGrid | 200 Old Wallgrove Road, Wallgrove, NSW, 2766
T: (02) 9620 0161 M: 0427 529 997
E: Michael.Platt@transgrid.com.au W: www.transgrid.com.au

Transport
Roads & Maritime
Services

File No: NTH18/00138
Your Ref: SSD 9619

The Manager
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Anthony Barnes – Senior Environmental Assessment Officer

Dear Sir / Madam,

Secretary's Environmental Assessment Requirements for SSD 9619 – **Tilbuster Solar Farm**

I refer to your email of 24 September 2018 requesting input to the Secretary's Environmental Assessment Requirements (SEARs) for the abovementioned development proposal.

Roles and Responsibilities

The key interests for Roads and Maritime Services are the safety and efficiency of the road network, traffic management, the integrity of infrastructure and the integration of land use and transport.

New England Highway is a classified (State) road. In accordance with Section 7 of the Roads Act 1993 (the Act) Armidale Regional Council is the Roads Authority for this road and all other public roads (other than freeways or Crown roads) in the local government area pursuant to Section 7 of the Roads Act. Roads and Maritime is the roads authority for freeways and can exercise roads authority functions for classified roads in accordance with the Roads Act. Any proposed works on a classified (State) road will require the consent of Roads and Maritime. Consent is provided under the terms of a Works Authorisation Deed (WAD).

Roads and Maritime Response

Roads and Maritime requests that the Environmental Assessment be supported by a Traffic Impact Assessment (TIA) prepared by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Roads and Maritime Supplement and RTA Guide to Traffic Generating Developments. The TIA is to address the following;

- The total impact of existing and proposed development on the road network with consideration for a 10 year horizon.
- The volume and distribution of traffic generated by the proposed development.
- Intersection sight distances at key intersections along the nominated access route/s to the site.
- Existing and proposed site access standards.
- Details of proposed improvements to affected intersections, in particular assessments of impacts on safety and efficiency of junctions with the classified road network.
- 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 of potential glare/reflectivity generated from on-site infrastructure towards public roads.
- Details of a Transport Management Plan (TMP) to identify and manage impacts of construction and operational traffic on the safety and efficiency of the affected road network. The TMP may include temporary measures such as Traffic Control Plans to address construction related traffic at specific locations. The TMP should include a Driver Code of Conduct, which may include, but not be limited to the following;
  - A map of the primary haulage routes highlighting critical locations.
  - Safety initiatives for haulage through residential areas and/or school zones.
  - Code of Conduct and induction process for haulage vehicle operators and regular toolbox meetings.
  - A complaint resolution and disciplinary procedure.
  - Any community consultation measures for peak construction or haulage periods.

The current Austroads Guidelines, Australian Standards and Roads and Maritime Supplements are to be adopted for any proposed works on the classified road network.

The Developer would be required to enter into a Works Authorisation Deed (WAD) with Roads and Maritime for any works deemed necessary on the classified (State) road network. The developer would be responsible for all costs associated with the works and administration for the WAD.

Further information on undertaking private developments adjacent to classified roads can be accessed at:

http://www.rms.nsw.gov.au/projects/planning-principles/index.html

If you have any further enquiries regarding the above comments please contact Liz Smith, Manager Land Use Assessment on (02) 6640 1362 or via email at: development.northern@rms.nsw.gov.au

Yours faithfully

for Monica Sirol
Network & Safety Manager, Northern Region

Date: 12 October 2018

NSW RURAL FIRE SERVICE

NSW GOVERNMENT

The Secretary
NSW Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Your Ref: SSD 9619
Our Ref: D18/7424
DA18092615271 PC

ATTENTION: Anthony Barnes

10 October 2018

Dear Mr Barnes,

Agency Comment - SEARs for Tilbuster Solar Farm Project (SSD 9619)

I refer to your correspondence dated 24 September 2018 seeking NSW Rural Fire Service (NSW RFS) input to the SEARs for the above State Significant Development proposal.

The subject land is partly mapped as bush fire prone land by Armidale Regional Council. The NSW RFS is the primary response agency for fighting fires within the site and surrounding locality.

The NSW RFS recommends that the SEARs for the project include a requirement to address the follow, having regard to the requirements of 'Planning for Bush Fire Protection 2006':

- potential bush fire threats to the facility;
- potential hazards to fire fighters;
- management of bush fire (including grass fire) impacting on, and structural fire emanating from, the proposed solar farm and its associated infrastructure;
- fire fighting water supplies;
- vehicle access and defendable space around the solar farm;
- land and vegetation management opportunities;
- proposed emergency management procedures; and
- the extent to which the proposed subdivision conforms with, or deviates from the standards, specific objectives and performance criteria of 'Planning for Bush Fire Protection 2006'.

As part of any consent issued for the project, the NSW RFS will require the proponent to develop a Fire Management Plan, in consultation with the local NSW RFS District Fire Control Centre.

For any queries regarding this correspondence, please contact Paul Creenaune on 6691 0400.

Yours sincerely,

Alan Bawden
Team Leader – Development Assessment & Planning

The RFS has made getting information easier. For general information on 'Planning for Bush Fire Protection, 2006', visit the RFS web page at www.rfs.nsw.gov.au and search under 'Planning for Bush Fire Protection, 2006'.

Our Ref: DOC18/711816
Your Ref: SSD 9619

Mr Colin Phillips
Team Leader, Planning Services
Resources Assessments
Department of Planning and Environment
PO Box 39
Sydney NSW 2001

Attention: Anthony Barnes. Senior Environmental Assessment Officer

Dear Mr Phillips

Re: Request for OEH Environmental Assessment Requirements – Tilbuster Solar Farm, Armidale Regional local government area (SSD 9619

Thank you for your email dated 24 September 2018 about the Tilbuster Solar Farm (SSD 9619) near Armidale seeking Secretary's Environmental Assessment Requirements (SEARs) from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide input.

The OEH notes that the proposal will be assessed as State Significant Development in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Environmental Impact Statement (EIS) SEARs provided by OEH are limited to Aboriginal cultural heritage, biodiversity, OEH estate, historic heritage, acid sulphate soils, flooding, stormwater and coastal erosion.

The OEH advises that these OEH SEARs, as they relate to biodiversity, have been issued with respect to the *Biodiversity Conservation Act 2016.*

The proposal involves:

- construction and operation of a large-scale photovoltaic solar farm with an estimated capacity of 300 MW;
- installation of a battery storage system;
- grid connection; and
- ancillary infrastructure (including access road off the New England Highway).

The proponent should ensure that the EIS will be sufficiently comprehensive to enable unambiguous assessment of all direct and indirect impacts of the proposal. The EIS should include an assessment of the potential impacts on biodiversity, including threatened species, populations, ecological communities, or their habitats likely to occur on or near the subject site, as well as Aboriginal cultural heritage values and flooding. We consider that this information is necessary for a comprehensive EIS for the proposal.

The full lists of OEH's standard requirements that may need to be addressed in the EIS are provided in **Attachment A.** In preparing the EIS, the proponent should refer to the relevant guidance material listed in **Attachment B.**

The Preliminary Environmental Assessment identifies that the site may contain White Box – Yellow Box– Blakely's Red Gum Grassy Woodland and Derived native grassland which is listed as an endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Also, it identifies threatened species listed under the EPBC Act that may occur on the site.

Therefore, the project may require referral to the Commonwealth Department of the Environment and Energy for determination of whether it is a controlled action. Please ensure that you advise the OEH whether the proposal is determined to be a controlled action under the EPBC Act. If it has been determined to be a controlled action the OEH requests a copy of any additional SEARs that are issued. We also recommend the referral process happen concurrently with the SSD assessment process as the OEH will be required to provide comment on both the NSW and Commonwealth threatened entities.

If you have any further questions about this issue, Ms Rachel Lonie, Senior Conservation Planning Officer, Conservation and Regional Delivery, OEH, can be contacted on 6650 7130 or at rachel.lonie@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 5 October 2018

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
<u>Conservation and Regional Delivery</u>
Contact officer: RACHEL LONIE 6650 7130

Enclosures: Attachment A - OEH Standard Environmental Assessment Requirements for the Tilbuster Solar Farm SSD 9619 (SSD 9619); Attachment B - Guidance Material

Attachment A – OEH Environmental Assessment Requirements- Tilbuster Solar Farm (SSD 9619)

Biodiversity
1. Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2017 the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and Biodiversity Assessment Method, unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values. 2. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method. 3. The BDAR must include details of the measures proposed to address the offset obligation as follows; • The total number and classes of biodiversity credits required to be retired for the development/project; • The number and classes of like-for-like biodiversity credits proposed to be retired; • The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; • Any proposal to fund a biodiversity conservation action; • Any proposal to conduct ecological rehabilitation (if a mining project); • Any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. 4. The BDAR must be submitted with all spatial data associated with the survey and assessment as per Appendix 11 of the BAM. 5. The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the *Biodiversity Conservation Act 2016*.
Aboriginal cultural heritage
6. The EA must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (OEH 2010), and guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011) and consultation with OEH regional branch officers.
7. Consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.

8. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.

Historic heritage

9. The EA must provide a heritage assessment including but not limited to an assessment of impacts to *State and local heritage* including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:
   a. outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996),
   b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),
   c. include a statement of heritage impact for all heritage items (including significance assessment),
   d. consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and
   e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.

Water and soils

10. The EA must map the following features relevant to water and soils including:
   a. Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).
   b. Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).
   c. Wetlands as described in s4.2 of the Biodiversity Assessment Method.
   d. Groundwater.
   e. Groundwater dependent ecosystems.
   f. Proposed intake and discharge locations.

11. The EA must describe background conditions for any water resource likely to be affected by the development, including:
   a. Existing surface and groundwater.
   b. Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.
   c. Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.

d. Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government. e. Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions http://www.environment.nsw.gov.au/research-and-publications/publications-search/risk-based-framework-for-considering-waterway-health-outcomes-in-strategic-land-use-planning
a. The EA must assess the impacts of the development on water quality, including: b. The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction. c. Identification of proposed monitoring of water quality. d. Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan)
e. The EA must assess the impact of the development on hydrology, including: f. Water balance including quantity, quality and source. g. Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas. h. Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems. i. Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches). j. Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water. k. 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. l. Identification of proposed monitoring of hydrological attributes. m.
Flooding and coastal hazards
12. The EA must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: a. Flood prone land. b. Flood planning area, the area below the flood planning level. c. Hydraulic categorisation (floodways and flood storage areas). d. Flood hazard
e. The EA must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the probable maximum flood, or an equivalent extreme event.
f. The EA must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:

g. Current flood behaviour for a range of design events as identified in 14 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.

13. Modelling in the EA must consider and document:
14. Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.
15. The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.
16. Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.
17. Relevant provisions of the NSW Floodplain Development Manual 2005.

18. The EA must assess the impacts on the proposed development on flood behaviour, including:
    a. Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
    b. Consistency with Council floodplain risk management plans.
    c. Consistency with any Rural Floodplain Management Plans.
    d. Compatibility with the flood hazard of the land.
    e. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
    f. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
    g. Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
    h. Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.
    i. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.
    j. Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.
    k. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

Attachment B – Guidance material (SSD 9619)

Title	Web address
Relevant Legislation	
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/63/full
Coastal Management Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/20/full
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Wilderness Act 1987	http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N
Biodiversity	
Biodiversity Assessment Method (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf
Biodiversity Development Assessment Report	https://www.legislation.nsw.gov.au/#/view/act/2016/63/part6/div3/sec6.12
Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/guidance-decision-makers-determine-serious-irreversible-impact-170204.pdf
Accreditation Scheme for Application of the Biodiversity Assessment Metho Order 2017	https://www.legislation.nsw.gov.au/regulations/2017-471.pdf
Biodiversity conservation actions	www.environment.nsw.gov.au/resources/bcact/ancillary-rules-biodiversity-actions-170496.pdf
Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules	www.environment.nsw.gov.au/resources/bcact/ancillary-rules-reasonable-steps-170498.pdf
OEH Threatened Species Website	www.environment.nsw.gov.au/threatenedspecies/
NSW BioNet (Atlas of NSW Wildlife)	www.bionet.nsw.gov.au/

Title	Web address
NSW guide to surveying threatened plants (OEH 2016)	www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf
OEH threatened species survey and assessment guideline information	www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm
BioNet Vegetation Classification - NSW Plant Community Type (PCT) database	www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm
OEH Data Portal (access to online spatial data)	http://data.environment.nsw.gov.au/
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
Revocation, recategorisation and road adjustment policy (OEH, 2012)	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013)	http://www.environment.nsw.gov.au/resources/protectedareas/development-land-adjoining-130122.pdf
Aboriginal Cultural Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)	http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
Aboriginal Site Recording Form	http://www.environment.nsw.gov.au/resources/parks/SiteCardMainV1_1.pdf
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/resources/cultureheritage/120558asirf.pdf
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Care Agreement Application form	http://www.environment.nsw.gov.au/resources/cultureheritage/20110914TransferObject.pdf
Heritage	
The Burra Charter (The Australia ICOMOS charter for places of cultural significance)	http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf
Statements of Heritage Impact 2002 (HO & DUAP)	http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf
NSW Heritage Manual (DUAP) (scroll through alphabetical list to 'N')	http://www.environment.nsw.gov.au/Heritage/publications/

Title	Web address
Water and Soils	
Acid sulphate soils	
Acid Sulfate Soils Planning Maps via Data.NSW	http://data.nsw.gov.au/data/
Acid Sulfate Soils Manual (Stone et al. 1998)	http://www.environment.nsw.gov.au/resources/epa/Acid-Sulfate-Manual-1998.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.environment.nsw.gov.au/resources/soils/acid-sulfate-soils-laboratory-methods-guidelines.pdf This replaces Chapter 4 of the Acid Sulfate Soils Manual above.
Flooding and Coastal Erosion	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Guidelines for Preparing Coastal Zone Management Plans	Guidelines for Preparing Coastal Zone Management Plans http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf
NSW Climate Impact Profile	http://climatechange.environment.nsw.gov.au/
Climate Change Impacts and Risk Management	Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Heritage Council of New South Wales

Level 6, 10 Valentine Avenue
Parramatta NSW 2150
Locked Bag 5020
Parramatta NSW 2124

Telephone: 61 2 9873 8500
Facsimile: 61 2 9873 8599
heritagemailbox@environment.nsw.gov.au
www.heritage.nsw.gov.au

File No: EF14/9695
Ref No: DOC18/716630
Your ref: SSD 9619

Mr Anthony Barnes
Senior Environmental Assessment Officer
Resource Assessments - Planning Services
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Sent by e-mail to: anthony.barnes@planning.nsw.gov.au

Dear Mr Barnes

Request for input into Secretary's Environmental Assessment Requirements (SEARs) for Tilbuster Solar Farm, located approximately 13 km northwest of Armidale (6 km northwest of Tilbuster), within the Armidale Regional Council LGA - (SSD 9619).

Reference is made to your email and supporting documentation received on 24 September 2018, requesting input into SEARs from the Heritage Council of NSW, for the above development.

The Preliminary Environmental Assessment (PEA), prepared by ngh Environmental and Draft SEARs have been reviewed and the following comments are provided:

There are no State Heritage Register (SHR) items within the site. Black Mountain Railway Station (SHR 001087) is the nearest SHR item to the site and is approximately 6km north of the site. However, it is noted that local heritage registers were not searched as part of the PEA analysis and there is no information if any local heritage items would be impacted by the proposed development.

In addition, it is noted that excavation is generally limited to discrete footings for inverters, switch station and office buildings, however no details are provided and reference to archaeology is not included in the documents received.

Based on this, it is recommended that the following SEARs be included:

- The EIS must include a Heritage Impact Statement (HIS), prepared in accordance with Heritage Division, Office of Environment and Heritage, guidelines. The HIS should identify any places of heritage significance within the State Significant Development (SSD) site or in the vicinity and assess their significance and the impacts of the proposal on these and provide mitigation recommendations where appropriate. The HIS should also include a baseline Historical Archaeological Assessment prepared by a suitably qualified and experienced Historical Archaeologist. The Baseline assessment should identify what relics, if any, are likely to be present within the SSD site or in the vicinity, assess their significance and consider the impacts from the proposal on this potential resource.

If you have any questions regarding Tilbuster Solar Farm, please contact James Quoyle, Senior Heritage Assessment Officer, at the Heritage Division, Office of Environment and Heritage on telephone 9873 8612 or by e-mail: james.quoyle@environment.nsw.gov.au.

Yours sincerely

27/09/2018
Katrina Stankowski
A/Manager, Northern Region
Heritage Division
Office of Environment & Heritage
As Delegate of the Heritage Council of NSW

Fire & Rescue NSW

NSW GOVERNMENT

File ref. no: BFS18/2733 (4902)
Doc. ref. no: D18/72057
Contact: Qualified Firefighter Nathan Everett

9 October 2018

Department of Planning and Environment
C/- Anthony Barnes
GPO Box 39
Sydney NSW 2001

E: Anthony.Barnes@planning.nsw.gov.au

Dear Ms Bandaruk,

Secretary's Environmental Assessment Requirements (SEARs)
Tilbuster Solar Farm (SSD 9619)
New England Highway, Tilbuster (Armidale Regional Council)

I refer to the above development proposal and the Department of Planning and Environment's (the Department) invitation for agencies to provide input for consideration in development of the SEARs. Fire + Rescue (FRNSW) have reviewed aspects of the proponent's Preliminary Environmental Assessment and the following comments and recommendations are submitted for consideration.

Large scale solar farm developments are usually located within NSW Rural Fire Services' (RFS) fire districts. Notwithstanding, in the event of either a significant fire event or hazardous material incident (hazmat), FRNSW will be responded to either assist the RFS or to fulfill the role of the designated hazmat combat agency.

It is FRNSW experience that small and large-scale photovoltaic installations present unique electrical hazard risks to our personnel when fulfilling their emergency duties. It is highlighted that the Fire Brigades Act 1989 (the Act) imposes specific statutory functions and duties upon the Commissioner of FRNSW. Section 6 of the Act requires the Commissioner to take all practicable measures for preventing and extinguishing fires and protecting and saving life and property within a FRNSW fire district. Section 6 of the Act also requires the Commissioner to protect and save life and property endangered by hazmat incidents and for confining a hazmat incident and for rendering the hazmat site safe.

In addition, the Work Health and Safety (WHS) Act 2011 (and its subordinate Regulation) classify FRNSW as a person (entity) conducting a business or undertaking (PCBU). Clauses 34 and 35 of the WHS Regulation impose specific obligations upon a PCBU to identify hazards and manage risks at workplaces. A site involved in fire or hazmat incident is deemed to be a FRNSW place of work.

Due to the electrical hazards associated with large scale photovoltaic installations and the potential risk to the health and safety of firefighters, both FRNSW and the NSW Rural Fire Service must be able to implement effective and appropriate risk control measures when managing an emergency incident at the proposed site.

Recommendations

In the event of a fire or hazardous material incident, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP) requirements of Clause 43 of the Work Health and Safety Regulation 2000 (the Regulation), the following matters are recommended to be addressed:

1. That a comprehensive ERP is developed for the site.

2. That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (such as fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents.

3. That the ERP details the appropriate risk control measures that would need to be implemented to safely mitigate potential risks to the health and safety of firefighters and other first responders (including electrical hazards).

   Such measures will include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures to be instigated, minimum evacuation zone distances and a safe method of shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment).

4. Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP.

5. That two copies of the ERP (detailed in recommendation 1 above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.

6. Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC). The LEMC is a committee established by Section 28 of the State Emergency and Rescue Management Act 1989. LEMCs are required to be established so that emergency services organisations and other government and non-government agencies can proactively develop comprehensive inter agency local emergency procedures for significant hazardous sites within their local government area. The contact details of members of the LEMC can be obtained from the relevant local council.

Fire and Rescue NSW | **ABN** 12 593 473 110 | **firesafety.fire.nsw.gov.au**
Community Safety Directorate
Infrastructure Liaison Unit
Locked Bag 12,
Greenacre NSW 2190
T (02) 9742 7434
F (02) 9742 7483

For further information please contact the Fire Safety Infrastructure Liaison Unit, referencing FRNSW file number BFS18/2733. Please ensure that all correspondence in relation to this matter is submitted electronically to firesafety@fire.nsw.gov.au.

Yours sincerely

Superintendent Mick Henly
Manager
Infrastructure Liaison Unit

Planning & Environment
Resources & Geoscience

5 October 2018

Anthony Barnes
Senior Environmental Assessment Officer
Planning Services - Resource Assessments
Department of Planning & Environment
GPO BOX 39
SYDNEY NSW 2001

Your Ref: SSD 9619
Our Ref: DOC18/733180

Emailed: anthony.barnes@planning.nsw.gov.au

Dear Mr Barnes

Re: Proposal – Tilbuster Solar Farm (SSD9619) – Request for SEARs

Thank you for the opportunity to provide advice on the request for Secretary's Environmental Assessment Requirements for the Tilbuster Solar Farm (SSD9619). This is a response from the Department of Planning & Environment – Division of Resources & Geoscience (the Division).

The Division is responsible for providing strategic advice relating to the current and potential future uses of land in NSW pursuant to State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 and the *Environmental Planning & Assessment Act 1979*. The Division's role is to ensure that proposals, including associated electricity transmission infrastructure do not unnecessarily preclude access to known resources or exploration for future resource discovery and extraction. The Division will also assess the application with respect to biodiversity offset considerations.

The Division has reviewed the Draft SEARs and Preliminary Environmental Assessment for the Tilbuster Solar Farm (SSD9619). The Draft SEARs require the proponent to assess the project's potential impacts on existing land uses including mining, mineral and petroleum rights. The Draft SEARS also includes the requirement for consultation during the preparation of the Environmental Impact Statement (EIS) with exploration licence holders, quarry operators and mineral title holders.

According to Departmental records there are no current mineral, coal or petroleum titles, or operating quarries or mines over, or adjacent the site. The subject site is wholly within exploration license application (ELA) 5706 applied by Australian precious Metals Corporation Pty Ltd for group 1 (metallic) minerals on 10 July 2018. The PEA has identified the exploration license application and referenced the Department's Minview map viewer.

In fulfilling the Secretary's Requirements relating to the State's mineral resources and rights to assess and extract those resources, the Division requires the following project specific requirements to be addressed in the EIS:

- The proponent should undertake an updated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date referenced map. It should also be noted in the EIS there are no operating quarries or mines in the vicinity. The search referenced in the PEA should be updated for the EIS. Current mining and exploration titles and applications can be viewed through the Division's Minview map viewer at:

  http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/geoscience-information/services/online-services/minview

- Should exploration license application (ELA) 5706 be granted prior to submission of the EIS, the proponent must make contact with the titleholder to determine their level of interest and provide authentic consultation to the Division. This should include a letter of notification of the proposal to the title holder including a map indicating the solar farm proposal area (including associated electricity transmission infrastructure) in relation to the exploration title boundaries, and a letter of response from the title holder to the proponent. If responses are not received from the titleholder, the Proponent is to contact the Division.

- The Division recommends the proponent register a Minview account profile where users can set an alert to be notified by email when a title changes or is due to expire. An alert may be set up to notify the proponent when changes to the status of ELA 5706 occur. Details regarding registration are provided on the webpage via the above link. The Division can provide contact details for the titleholder if required.

- Consultation with the Division in relation to the proposed location of any offsite biodiversity offset areas or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.

Queries regarding the above information should be directed to the GSNSW Land Use team at landuse.minerals@geoscience.nsw.gov.au.

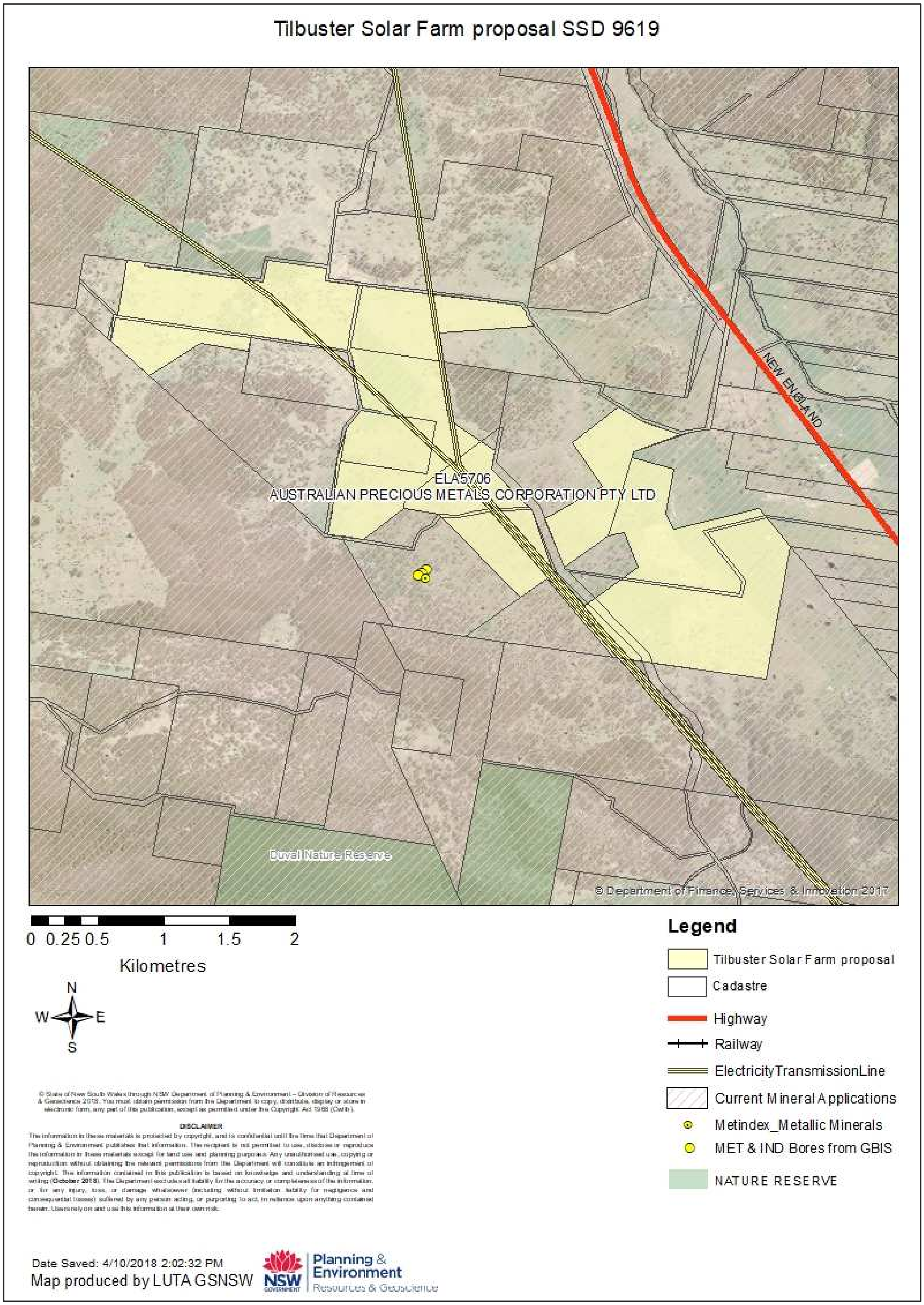
Yours sincerely

Cressida Gilmore
Manager – Land Use

for Paul Dale
Director – Land Use & Titles Advice

NSW GOVERNMENT | Planning & Environment | Resources & Geoscience

Figure 1: Tilbuster Solar Farm Proposal (SSD 9619)



OUT18/14968

Anthony Barnes
Senior Environmental Assessment Officer
Resource Assessments
NSW Department of Planning and Environment

anthony.barnes@planning.nsw.gov.au

Dear Mr Barnes

Tilbuster Solar Farm (SSD 9619)
Comment on the Secretary's Environmental Assessment Requirements (SEARs)

I refer to your email of 24 September 2018 to the Department of Industry (DoI) in respect to the above matter. Comment has been sought from relevant branches of Lands & Water and Department of Primary Industries (DPI), and the following requirements for the proposal are provided:

<u>DoI - Water</u>

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

<u>DoI - Lands</u>

- The authorised use and/or disposal of Crown roads and land affected by the proposal should be addressed within the EIS.

<u>DPI - Fisheries</u>

The EA should specifically address impacts on the aquatic ecology of waterways or any Key Fish Habitats (defined as Third order streams or larger (Strahler Stream Ordering System)) such as Duval Creek and some of its tributaries and controls to be established for tracks, cabling, transmission lines or road upgrades within these Key Fish Habitats. To achieve this, an aquatic ecological environmental assessment should be prepared in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)*. Further details are provided in **Attachment A**.

<u>DPI - Agriculture</u>

The proposed solar farm is to be developed adjacent a small area of agricultural land that is mapped as Biophysical Strategic Agricultural Land (BSAL). The proposed development is stated to cover a reasonable area (150ha) of productive agricultural land. The EIS should include the following in accordance with the details provided in **Attachment A**:

- Assessment of impacts to agriculture;
- A Land Use Conflict Risk Assessment;
- Rehabilitation and Decommissioning/Closure Management Plans; and
- A biosecurity risk assessment.

Any further referrals to Department of Industry can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

Yours sincerely

Alison Collaros
A/Manager, Assessment Advice
11 October 2018

<u>DPI - Fisheries</u>

AQUATIC ECOLOGICAL ASSESSMENT

The aquatic ecological environmental assessment should include the following information;

- A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided.
- Area which may be affected either by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).
- Waterways within the area of development are to be identified.
- The extent of aquatic habitat removal and riparian vegetation removal or modification which may result from the proposed development.
- Details of the location and design of proposed tracks or road upgrades crossing Key Fish Habitats.
- Details of the methodology (e.g trenching, boring) for any underground cabling, transmission lines or services that pass through Key Fish Habitats.

WATERWAY CROSSINGS

The project is likely to involve tracks, cabling, transmission line construction, roads and services upgrades across *Key Fish Habitat*. Construction of waterway crossings or services through waterways should be undertaken in accordance with DPI Fisheries Policy & Guideline document: *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013).*

LOSS OF RIPARIAN VEGETATION

There is also the likelihood of a loss of riparian vegetation associated with the proposed solar development footprint. The *"degradation of native riparian vegetation"* has been listed as a Key Threatening Process under the provisions of the *Fisheries Management Act* 1994. Terrestrial buffer zones should be incorporated as per the *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)* available on the Department's website at www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/fish-habitat-conservation.

<u>DPI – Agriculture</u>

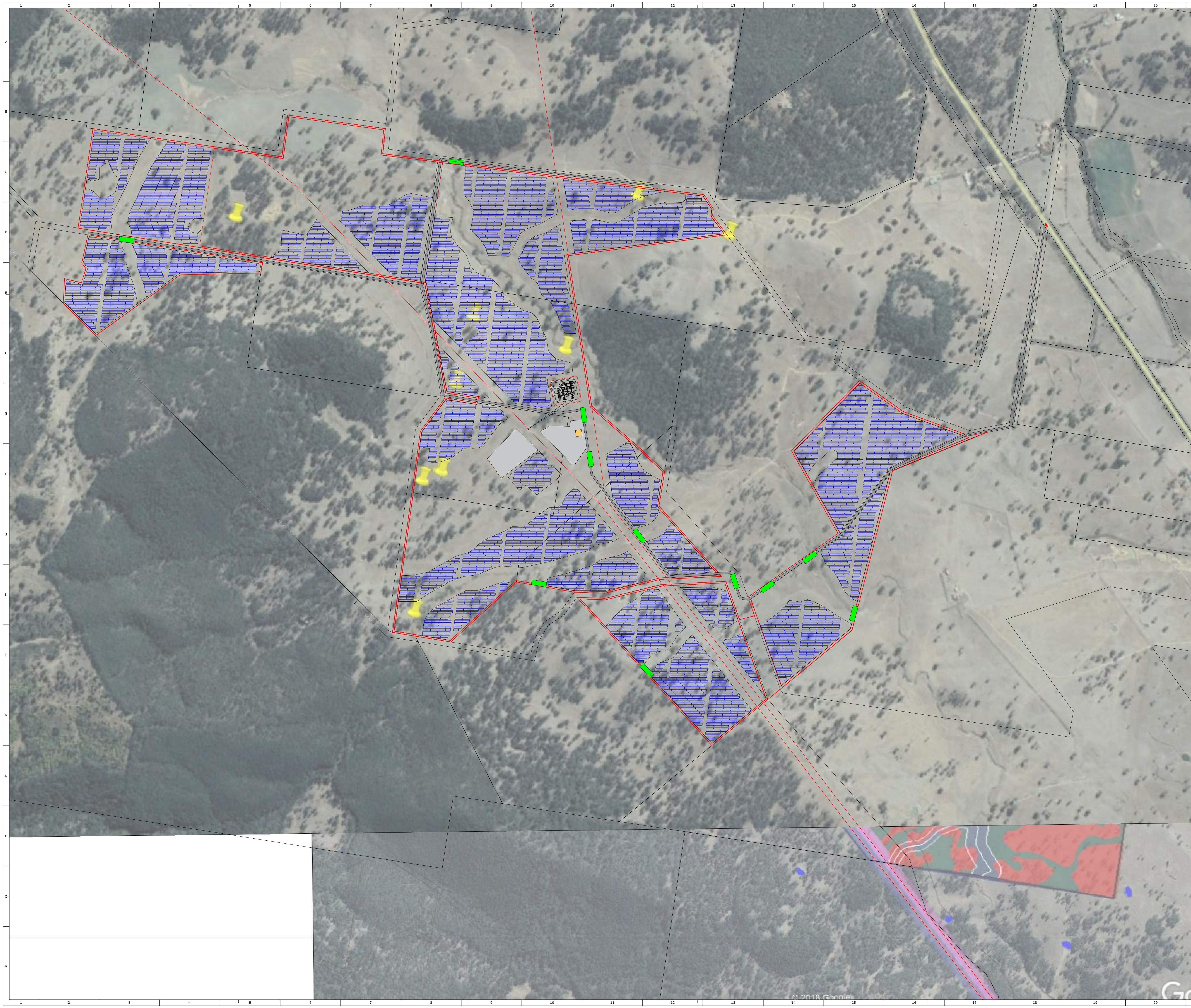
The EIS is required to address or provide the following:

- Describe the current and potential Important Agriculture Land on the proposed development site and surrounding locality including the land capability and agricultural productivity.
- Consideration of impacts to agricultural landuses and industries for both the proposal site and surrounding ones, including impacts resulting in a temporary or a permanent loss to land capability or agricultural productivity. This would include demonstration that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated.
- Complete a Land Use Conflict Risk Assessment (see link below), including:
    - Identification of potential land use conflict, in particular relating to separation distances and management practices to minimise dust, noise and visual impacts from sensitive receptors. For example, this may include outlining strategies to avoid land use conflict around agricultural aerial spraying and fertilising in the area.
    - Consultation and negotiation with owners/managers of affected adjoining agricultural operations.
- Rehabilitation and Decommissioning/Closure Management Plans should be developed to identify rehabilitation objectives and strategies including, but not limited to:
    - Describing the design criteria of the final land use and landform;
    - Indicators to guide the return of the land back to agricultural production (that also includes soil survey information that provides a basis to final land restoration outcomes);
    - Monitoring and mitigation measures to be adopted for rehabilitation remedial actions, and

  - Commitment to the removal of all infrastructure on any land with a cropping history or land with a capability for cropping.
- Include a biosecurity risk assessment outlining the likely plant (e.g. weeds), animal (e.g. pests and livestock disease) and community risks (as per the Infrastructure Proposal guideline – see link below) including monitoring and mitigation measures.

Guidelines for assessment:
- Land Use Conflict Risk Assessment Guide
  - www.dpi.nsw.gov.au/content/agriculture/resources/lup/development-assessment/lucra
- Infrastructure Proposals on Rural Land
  - http://www.dpi.nsw.gov.au/content/agriculture/resources/lup/development-assessment/infrastructure-proposals

APPENDIX B PROPOSAL PLANS



Battery storage area
Waterstream crossing area
Moduletable 3Px28 / 3Px14
Trafostation
Transferestation
Monitoringcontainer
Fence (h=2m)
Entry
Service area
Service Roads 6 Meter width

Module
Type: Longi HPH-72 440 Wp
Quantity: 400.878 pieces
Power DC: 176.386,32 kWp

Inverter
Type SMA
Quantity: XX pieces

Structure
Type: 3 Modules portrait
Tilt: 20°

Main Layout

Builder:		Date:	Name:
Enerparc	Editor	20-03-16	Neumann
	Check		
	Allowed		
	Norm		

Index	Modification	Date	Name

General contractor: ENERPARC
Address: Zirkusweg 2 / Astra Tower
20359 Hamburg (Germany)
Telephone: +49 40 756 644 9-0
Fax: +49 40 756 644 9-65

Project: Tillbuster
Scale: ...
Drawing-No. ML 01
Path:
A0

APPENDIX C COMMUNITY CONSULTATION STRATEGY

Community Consultation Strategy

TILBUSTER SOLAR FARM

AUGUST 2018

ngh environmental

www.nghenvironmental.com.au

Document Verification

Project Title:	Tilbuster Solar Farm
Project Number:	18-300
Project File Name:	Tilbuster CCS Draft v1

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Final v1	6/08/18	Vitaly Kolin	Nick Graham-HIggs	Brooke Marshall
Final v1	14/08/18	Vitaly Kolin	Brooke Marshall	Brooke Marshall

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www.nghenvironmental.com.au e: ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
8/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Brisbane
suite 4, level 5, 87 wickham terrace
spring hill qld 4000 (t 07 3129 7633)

Newcastle - Hunter and North Coast
7/11 union st
newcastle west nsw 2302 (t 02 4929 2301)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Bega - ACT and South East NSW
suite 1, 216 carp st (po box 470)
bega nsw 2550 (t 02 6492 8333)

CONTENTS

TABLES

FIGURES

1/216 carp st (po box 470) bega nsw 2550 australia t 61 2 6492 8333 f 61 2 6494 7773
www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

unit 9/65 tennant st (po box 1037)
fyshwick act 2609 australia
t 61 2 6280 5053 f 61 2 6280 9387

18/21 mary st
surry hills nsw 2010 australia
t 61 2 8202 8333 f 61 26494 7773

po box 8323
perth bc wa 6849 australia
t 61 8 9759 1985 f 61 2 6494 7773

102/63-65 johnston st (po box 5464)
wagga wagga nsw 2650 australia
t 61 2 6971 9696 f 61 2 6971 9693

suite 6/234 naturaliste tce (po box 1037)
dunsborough wa 6281 australia
t 61 8 9759 1985 f 61 2 6494 7773

ACRONYMS AND ABBREVIATIONS

CCS	Community Consultation Strategy
EIA	Environmental impact assessment
Ha	Hectares
kV	Kilovolt
MW	Megawatt
NSW	New South Wales

1 INTRODUCTION

1.1 COMMUNITY CONSULTATION PRINCIPLES

Best practice community consultation involves the community in all decision making stages of a project. The community plays a role from project conception, through the assessment process and on to project development. Effective community consultation has three important functions:

1. It facilitates deeper understanding of issues and decisions required for the project;
2. It enhances the quality of decisions made for the project;
3. It allows people to contribute to decisions that affect their lives.

Important community engagement principles for a project include:

- Openness – combats assumptions and misinformation.
- Inclusiveness - consultation should be diverse and representative, not responding only to the most vocal stakeholders.
- Effective communication – requiring trust between parties and tools appropriate to the task.
- A communication strategy – clarity about what is being undertaken:
    - Inform - one-way communication to deliver information about the project.
    - Consult - two-way communication to seek input into the project.
    - Collaborate and involve – seek participation in elements of the project design and implementation.
- Early rather than late communication – to maximise engagement opportunities.
- Accountability – the process should be monitored and evaluated to ensure its aims are being achieved.

1.2 AIM OF THIS STRATEGY

This Community Consultation Strategy (CCS) has been developed for the Tilbuster Solar Farm proposal.

The aim of the strategy is to:

1. **Identify effective methods to inform the community about the Tilbuster Solar Farm**
2. **Facilitate engagement with the community, including allowing meaningful contributions from the community into the environmental assessment and project development.**
3. **Obtain social license to operate from the local community, allowing for good long-term relationships with community stakeholders**

The strategy identifies:

- Community stakeholders for the project;
- Issues / risks related to the engagement of each stakeholder group;
- A consultation strategy for each stakeholder group;
- A set of consultation activities against the project development time line.

Effective engagement will require an understanding of community stakeholders and prioritisation of potential impacts. It also relies on the community understanding the project and specific issues of interest to them, in order to contribute effectively. The focus of the consultation strategy will be on providing this understanding and engagement.

1.3 STRUCTURE

The structure of this strategy is:

1. Proposal overview
2. Identification of community stakeholders for the project
3. Issue management – what specific issues need consideration?
4. Project based activities – what activities will be undertaken to achieve the goals of this CCS?

1.4 Implementation and revision of this document

This strategy has been developed to coincide with the early planning and assessment stages of the Tilbuster solar project.

If the project is approved, consultation will also be required to continue into the construction and operational phases of the project. These phases will require a new or updated strategy, to reflect any changes to consultation objectives but also the increasing knowledge gained about the community. At this stage, only pre approval project stages are addressed.

1.5 RELEVANT GUIDELINES

This CCS has been prepared with reference to the following guidelines / references:

- *Establishing the social licence to operate large scale solar facilities in Australia: Insights from social research for industry,* Australian Renewable Energy Agency (ARENA).
- *Beyond Public Meetings: Connecting community engagement with decision making,* Twyford Consulting 2007.
- *Large-scale solar energy guideline draft for state significant development 2017,* NSW Government.

2 PROPOSAL OVERVIEW

2.1 TILBUSTER SOLAR FARM

The proposed solar farm would be located on lot 1 of DP 225170, Lot 1 of DP 585523, Lot 3 of DP800611 and Lot 4 of DP800611. On the western side of the New England Highway, approximately 6km north-west of the Tilbuster township. The proposal area would be located within the Armidale Regional Local Government Area (LGA). The proposed solar farm would connect to a substation that would be constructed on-site.

The proposed Tilbuster Solar farm will generate up to 300 MW of renewable energy that would supply electricity to the national grid.

The current access to the proposal site is via an unnamed, unsealed road. The site is located adjacent to the New England Highway - approximately 12km north of the intersection between the Puddledock Road, which joins Tilbuster township to the New England Highway.

A new substation will be constructed within the site boundary. Two existing transmission lines transect the proposal site; a 132kV eastern line and a 330kV central line. Both lines are currently being considered for the connection for the proposed solar farm. Both the eastern and central line run south east to north west through the proposal site.

2.2 CONSTRUCTION

The Tilbuster Solar Farm would be expected to operate for 30 years.. After the initial 30-year operating period, the solar farm would either be decommissioned, removing all above ground infrastructure and returning the proposal area to its existing land capability, or repowered with new PV equipment subject to landowner and planning consents.

It is anticipated that the proposed solar farm would include development of the following infrastructure:

- Construction facilities including laydown and parking areas.
- PV modules and inverter stations.
- Single axis tracker or fixed mounting systems on steel frames
- An energy storage facility.
- Site office and maintenance building including monitoring container.
- Internal access tracks.
- Transformers and substation, including ancillary equipment.
- Security fence and cameras.
- Electrical cabling including overhead lines and underground electrical conduits to connect the PV arrays onsite to the newly built substation.
- Access road upgrades.
- Construction of creek crossings where required.
- Visual screening, if required, for specific receivers.

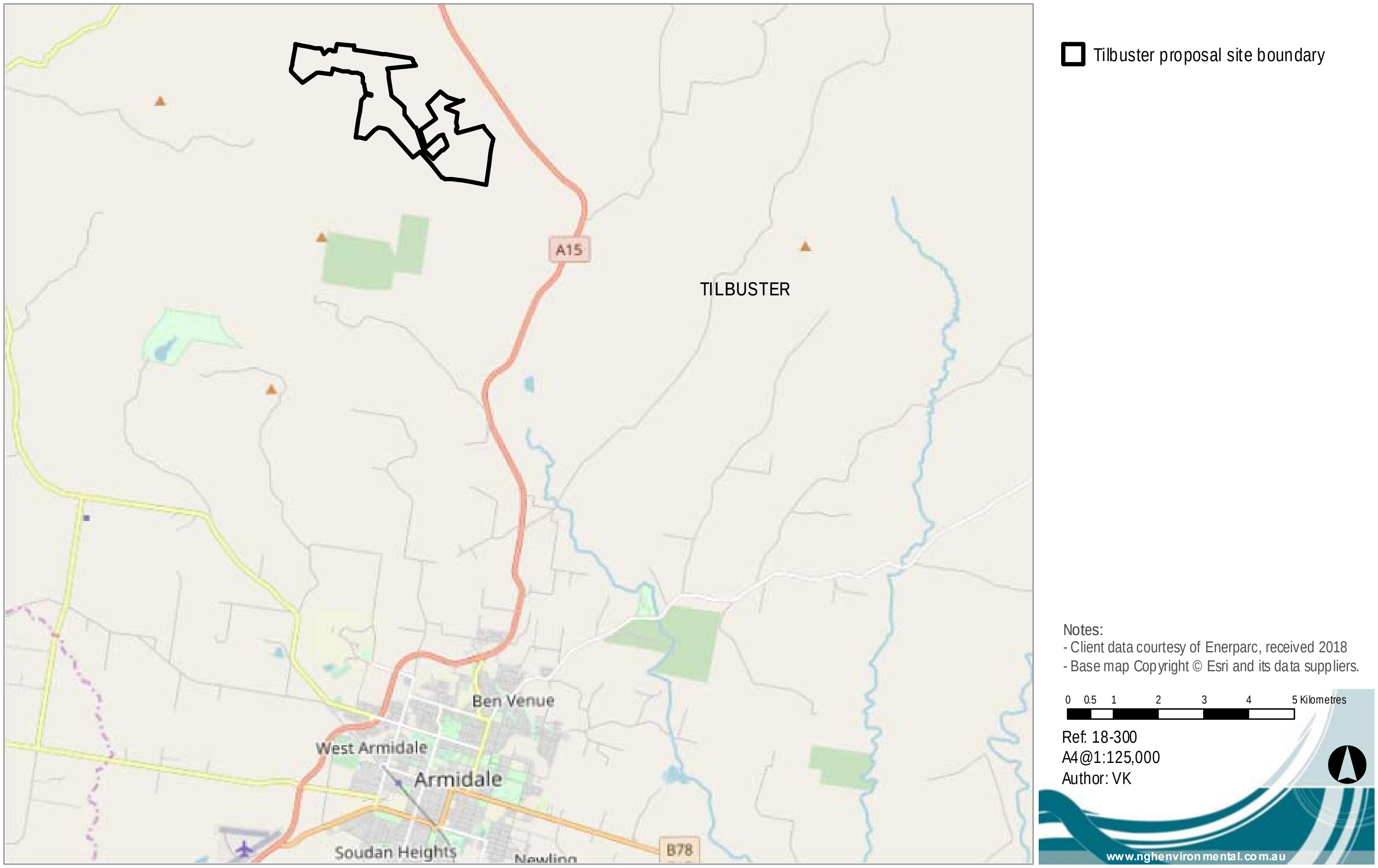

Figure 2-1 Site location

3 COMMUNITY PROFILE

Understanding the makeup and values of a community is essential to finding effective ways to reach the community. It is also important to understand ways which project may impact the community. This may not be limited to the construction and operational stages of a project but may also include the pre-lodgment assessment phase, as the project is being shaped. This section provides a broad overview of the community demographics in the Armidale Regional Local Government Area (LGA) and the local township of Tilbuster.

3.1 ARMIDALE REGIONAL LOCAL GOVERNMENT AREA

The proposal site is located within the Armidale Regional Local Government Area (LGA), which covers an area of 8,621 km^2. The area was formed in 2016 after the merger of the former Armidale Dumaresq Shire with the surrounding Guyra Shire. The 2016 Census indicates that the Armidale Regional LGA had a population of 29,449, which is a 22% increase since 2011, the median age is 36 (ABS, 2011). Aboriginal and Torres Strait Islanders make up 7.9% of the population.

There was 7,128 people employed in the Armidale Regional LGA labour force in 2016, with a median age of 45-54 for those working full time. Female workers make up 39% of the workforce, males making up the remainder 61%. Education and training employ the highest percentage of workers (19.4%). Other major industries were healthcare and social assistance, retail, and, agriculture, forestry and fishing.

The ABS Socio-Economic Indices for Areas (SEIFA) is a summary of social and economic data that provides a measure of relative disadvantage in relation to social conditions of people and households within a region. The SEIFA score ranges from 121 (most disadvantaged) to 1193 (least disadvantaged). The SEIFA score for the Armidale Regional LGA in 2016 was 980 (ABS 2011). These indices of wellbeing indicate that the Armidale Regional LGA have a relatively high standard of living without many social or economic disadvantages (ABS 2016).

The Armidale Regional LGA is located in northern New South Wales at an altitude >1000m. The region brings approximately 750,000 visitors annually to experience various events and natural attractions; areas of wilderness and wild rivers, granite boulder formations and waterfalls within world heritage listed national parks. The area holds significant Aboriginal heritage, including a rock art sites. Some of the main community and economic features for the Armidale Regional LGA are:

- Education facilities, including 11 public primary schools and two public high schools, and, five private schools.
- Health facilities including a major public and private hospital In the Armidale city centre.
- Transport services, including Armidale airport, coach and bus services, and a Country Link train service.
- Recreational and sporting facilities, including the Armidale City Gymnastics Club and Armidale Sport and Recreation Centre
- Community facilities, including showgrounds, parks, saleyards, halls and libraries.

3.2 TILBUSTER

The closest township to Tilbuster Solar Farm is Tilbuster – located approximately 6km south-east of the proposed Tilbuster solar farm; Tilbuster has a population of 62 people, a workforce of 29 people and a median age of 47. Tilbuster is comprised of large agricultural land holdings, including sparsely distributed dwellings. Agriculture and education are the primary employment industries in Tilbuster (ABS, 2016). Town facilities are limited due to the proximity and accessibility to the Armidale regional city centre.

Tilbuster Station is a large property located within the Tilbuster township – approximately 6km south-east of the proposed Tilbuster solar farm; it was gifted to the Pathfinders organisation by a private benefactor for its conversion into a multi-functional youth and family centre. The Pathfinders is a not for profit (NFP) organisation aimed at improving the quality of life and wellbeing of disadvantaged children, youth and families. Tilbuster Station allows young people to participate in a range of agricultural, horticultural and trade skills programs such as crop and vegetable production, beef cattle production, welding and building constructions

3.3 ARMIDALE

Armidale is approximately 13km south east from the proposal area; it is the closest regional centre to the proposal area and the administrative centre for the northern tablelands region. The discovery of gold in the mid-19th century led to the towns establishment and rich history. Town facilities include a university, TAFE, schools, hospitals, airport and it is well known for its cathedral and heritage buildings. The surrounding land is primarily used for large lot agricultural enterprises (ABS, 2016). The population of Armidale was 23,352 (ABS, 2016) which is 79% of the Armidale Regional LGA. The median age was 34 and the median personal income was $564. The main Industries of employment are education and training. Other major industries were healthcare and social assistance and retail.

4 STAKEHOLDER GROUPS AND CONSULTATION STRATEGIES

It is important to identify key stakeholder groups and relevant characteristics of the groups in order to tailor engagement strategies to suit them. Different levels of engagement will be appropriate to different groups, depending on the potential interest or impacts on the groups:

- Where impacts are minor, the International Association for Public Participation (IAP2) consultation spectrum suggests approaches such as ‘Inform’ and ‘Consult’.
- Greater impacts on communities require approaches such as ‘Involve’, ‘Collaborate’ and ‘Empower’.

Proposed strategies are set out below for each stakeholder group. Levels of engagement may change, depending on issues identified during the consultation process.

Table 4-1 Stakeholder group consultation strategies

Stakeholder group	Defining characteristics	Consultation strategies
1. Adjacent neighbours	Neighbours on subject land adjacent to the project for example: those with a view of infrastructure, or, have potential for noise or vibration from the haulage route or construction activities. 1 residence located adjacent of the site. This residence is owned and leased by the land owner.	**Inform, consult, involve, collaborate** Face to face consultation and direct feedback is required. Mitigation strategies may require changes to the project or the development of specific plans of management i.e. screening visual impact. All consultation should be documented.
2. Near neighbours and residents of Tilbuster community	Impacts for this group would be less than adjacent neighbours but being a major development close to a small settlement - direct impacts may be of great interest to residents. This is a large development with potential to define the locality in some ways. There are 25 residences within 2km of the proposal area; none are expected to have a view of the proposed solar farm.	**Inform and consult** Understanding the values and potential impacts to this group is highly important. It will assist the assessment process and development of appropriate mitigation strategies and in gaining social license to operate from the local community. The opportunity for face to face consultation and direct feedback should be provided upon request. All consultation should be documented.

Stakeholder group	Defining characteristics	Consultation strategies
3. Small Local Businesses	Local businesses in the regional city centre of Armidale may be impacted by the influx of workers during construction. This development may be of particular interest to business owners in the area, opportunities and potential impacts will need to be considered. Local business can benefit the project by distributing information about the project and may play a large part in influencing community opinions	**Inform and consult** Understanding the values and potential impacts to this group is highly important. It will assist the assessment process and development of appropriate mitigation strategies and in gaining social license to operate from the local community. The opportunity for face to face consultation and direct feedback should be provided upon request. Potential opportunity to distribute project information and understand community sentiment. All consultation should be documented.
4. Representative bodies	Representatives of groups such as: • Armidale Regional Council • Armidale Chamber of Commerce • Armidale Local Aboriginal Land Council	**Inform** Specific information may be required for this group. An avenue to receive information and provide specific feedback or ask questions should be provided.
5. Special interest groups	There may be benefit in contacting special interest groups, to ensure that any special areas of interest will be addressed in the assessment of the project. Local information can be important. One was identified specific to this proposal: • Sustainable Living Armidale • Tilbuster Station	**Inform** These should be specifically contacted. Specific information or assessment may be required to understand and mitigate impacts for these groups. An avenue to provide feedback or ask questions should be provided.

Stakeholder group	Defining characteristics	Consultation strategies
6. Broader community	It is important to ensure a clear and consistent message is delivered to the broader community. There may be opportunities and impacts to the broader community that are important to understand during the assessment of the project. Accommodation and services for project construction staff and other economic matters may be of interest.	**Inform** Newsletters, advertisements, website information used to relay information about the project. A contact should be provided to this group, for further information / provision of feedback.

5 ISSUE MANAGEMENT

A set of project-specific issues and risks to maximising community engagement in the project have been identified below. These issues pose potential risks to the effective identification and mitigation of impacts important to the community and ultimately, to achieving social license to operate from the community. Strategies have been developed below, specific to the identified issues. These have been incorporated into the Project-based Activities, in Section 6.

Table 5-1 Risks and strategies

Issue	Risks	Strategies
The project may define / overwhelm the locality / Township of Tilbuster	This may polarise the community. They may not feel that the project reflects their values. The scale of the project may overwhelm the existing local character.	Early dissemination of information about the project and its specific justification and benefits, particularly with reference to developing new income streams on agricultural land and the ability to restore the land capability after decommissioning. This may include material about the role of solar energy in the country's energy mix, the technology and its impacts. Particularly, visualisations (representative montages) can assist to understand the actual versus perceived impacts. Seek direct input into how the project may reflect the communities 'personality' and values. How the benefits of the project may be spread to the local community. Clear communication of key environmental impacts and mitigation strategies of the project. Offer direct contact with project manager.
Misinformation / left out of engagement	Feel left out, disengaged, misinformed Rural residences can be difficult to contact and word of mouth travels very fast in small communities.	Direct communication early to local community – adjacent landowners first, near neighbours second, then the wider community. Multiple means to identify all relevant residences undertaken – mapping, Council, engagement with other members of the community.
Lack of support for project	Lack of interest, leading to low levels of public support. Unaddressed concerns may generate opponents of this project.	Early dissemination of information about the project and its justification and benefits. Clear communication of key environmental impacts and mitigation strategies. Make participation easy – to ensure all concerns are addressed. Be creative – seek support for renewable project that demonstrates how benefits are felt at the local level. Look for opportunities – ways the project could benefit local businesses, for example.
The approvals process can be long and complex.	Perception that the process is too difficult to become involved in. Suspicion that input will not be valued. Overly technical information provided, use of jargon.	Clearly illustrate approvals process. Clearly define opportunities for community input including what is required and when it is required. Communicate back, identifying where input has been used. Reinforce this at each relevant stage for community input – pre lodgement, during public exhibition etc. Milestone events should be identified early and celebrated.

Issue	Risks	Strategies
Distrust in environmental assessment process.	Distrust of impact identification and mitigation strategies.	Establish credentials of assessment team and Enerparc solar. Present these in the EIS and in newsletters etc. Make participation easy – create opportunities to discuss issues with the team.
Representative	Risk of biased consultation, serving only the ‘squeaky wheel’. Sections of the community may be “overpowered” and may be marginalised.	Ensure community is engaged in a forum that minimises risk of debate being side tracked. Follow up with smaller groups where required. Use established social (and media) channels in dissemination of materials, i.e. sport clubs.
Unified message	Differing messages may create confusion and mistrust.	Limit points of contact. Have message clearly set out for use, rather than reinventing it for each consultation activity.
Unequal distribution of benefits	Residents close to the development are likely to feel more strongly.	Identification of stakeholder groups should reflect differences in impacts.

6 PROJECT BASED ACTIVITIES

The following table outlines the different project stages and associated community consultation objectives and activities, in chronological order. The stages include:

- Decision to proceed with early investigations, proposal development
- Receipt of EIS format and content requirements from DPE
- Detailed assessment and proposal development
- EIS on public exhibition, submissions reporting

Further stages apply post approval.

During this progression, mile stone events should be celebrated, and used as an opportunity to keep the community on board. Milestones can include:

1. Announce project – notify near residents first, follow up with consistent information
2. Early studies update – meet the community face to face
3. EIS submitted – explain avenues for input
4. Approval – celebrate in a way that involves the community

Further milestones apply post approval.

Table 6-1 Proposed engagement activities

Stakeholder group	Issue	Consultation objective	Community engagement targets	Format
Decision to proceed with early investigations, proposal development, and receipt of SEARs				
Adjacent landowners	Misinformation / left out of engagement Lack of support for project	Inform, consult, involve, collaborate	Early dissemination of information about solar development generally. Early dissemination of information about the project and its justification and benefits. Seek direct input to include in assessment approach and development of proposal.	Face to face meetings with Project Manager. Encourage ongoing direct contact with Project Manager.
Near neighbours, Tilbuster local community and Tilbuster station	Misinformation / left out of engagement May define locality Lack of support Unequal distribution of benefits	Inform and consult	Early dissemination of information about solar development generally. Early dissemination of information about the project and its justification and benefits. General feeling toward solar development	Newsletter introduction to the project, contact number provided and supplementary information on website Provide opportunity for follow up call by Project Manager if requested.
Local small business owners	Misinformation / left out of engagement Lack of support for project	Inform and consult	Build relationship with these owners and staff as they may assist to 'get the word out'. Discuss specific impacts and opportunities.	Face to face meeting / direct contact with Project Manager. Encourage ongoing direct contact with Project Manager.
Large local employer / land use	Misinformation / left out of engagement Lack of support for project	Inform and consult	Early dissemination of information about solar development generally. Early dissemination of information about the project and its justification and benefits.	Face to face meeting / direct contact with Project Manager. Encourage ongoing direct contact with Project Manager.

Stakeholder group	Issue	Consultation objective	Community engagement targets	Format
Broader community	Distrust in environmental assessment process The approvals process can be complex.	Inform	Make information on the project team and assessment team available	Newsletter to include graphic showing stage of the process and opportunities for input
Detailed assessment and proposal development				
Adjacent landowners	Lack of support	Inform, consult, involve, collaborate	Discuss and understand specific impacts on these receivers. Feed information into the final assessment to ensure all their issues have been identified and addressed by the project.	Face to face meeting / Phone call
Near neighbours and Tilbuster local community	May define locality Lack of support	Inform, consult, involve, collaborate	Identify ways the community can participate in the project and seek input on these: Vegetation screen planting, adopt a tree (one for project, one for landowner?) Signage / logo for solar farm (will be prominent part of the village? Other renewable or energy saving programs that the proponent could support?	Competitions, Adopt a tree, other programs
Armidale local community	Distrust in environmental assessment process. Unequal distribution of benefits Risk of biased consultation, serving only the 'squeaky wheel'.	Inform and consult	Update community on detailed project, its impacts Seek input – any additional concerns, input into visual assessment if required. Meet specialists Feed information into the final assessment to ensure all community issues have been identified and addressed by the project, differentiating between stakeholder groups	Open house information day (provide links to relevant information, provision of feedback forms - also now on website)

Stakeholder group	Issue	Consultation objective	Community engagement targets	Format
Broader community	Representative	Inform and consult	Outline ways they can continue to have input into project Seek broad feedback on how the community feels about solar farms generally and this project specifically.	Media release, link to website (including feedback form)
EIS on public exhibition, submissions reporting				
Adjacent landowners	Relationship with landowners and community	Inform, consult, involve, collaborate	Update on project status.	Phone call update
Near neighbours and Tilbuster local community	Relationship with community	Inform and consult	Update on project status. Outline ways they can continue to have input into project	Newsletter update
Armidale local community	Relationship with community	Inform and consult	Update on project status. Outline ways they can continue to have input into project	Newsletter update
Broader community	The approvals process can be long and complex.	Inform	Update on project status. Outline ways they can continue to have input into project	Media release
Approval determination				
Adjacent landowners	Relationship with landowners and community	Inform, consult, involve, collaborate	Update on project status.	Phone call update
Near neighbours and Tilbuster local community	Relationship with community	Inform	Update on project status. Thank the community for their involvement	Media release Website

7 MONITORING AND EVALUATION

To ensure this strategy is effective during the implementation of activities, and adapts as required to new information, the following review actions will be undertaken alongside implementation activities:

- Appoint and maintain a consultation manager for the project to implement activities and review this strategy regularly.
- Keep an accurate record of all feedback from consultation activities and all correspondence with the community.
- Monitor regularly and respond promptly to email and phone queries.
- Monitor if the activities reaching a diverse and representative section of the community; do new activities need to be implemented?
- Has relevant information been passed back to:
    - Those developing the detailed project description
    - Assessment staff.

APPENDIX D COMMUNITY CONSULTATION NEWSLETTERS

TILBUSTER SOLAR FARM

FEBRUARY 2020

PRELIMINARY ENVIRONMENTAL ASSESSMENT

A Preliminary Environmental Assessment (PEA) has been completed and submitted to the NSW Department of Planning, Industry and Environment (DPIE). This is the first step to more detailed project planning and assessment. The PEA is publicly available and can be viewed at the following website:

Department of Planning, Industry and Environment
Major Projects Assessments
www.majorprojects.planning.nsw.gov.au

To receive regular project updates, please register your interest by emailing:

info@tilbustersolarfarm.com

The chart belows shows the current project status and opportunities for community input.

COMMUNITY INFORMATION SESSION

Prior to the submission of the Environmental Impact Statement (EIS), Enerparc will be holding a community information session to provide further information about the proposed Tilbuster Solar Farm.

Enerparc are inviting all members of the community to drop in at any point during the session, for a one on one discussion during the available times below:

19th February
5pm – 8pm
Chamber and Committee Room
135 Rusden St
Armidale NSW 2350

This session will offer a forum to learn more about the proposal and provide feedback directly to Enerparc and Environmental Assessment representatives. This will assist a thorough assessment process.

We hope to provide an opportunity for those who attend to better understand the benefits of our project.

NSW STATE SIGNIFICANT APPROVAL PROCESS

223 Liverpool Street
Darlinghurst, NSW 2010

(02) 8311 1338

www.enerparc.com

FEEDBACK FORM

Your feedback will assist us properly assess the impacts of the proposed Tilbuster Solar Farm. All contact details will be kept anonymous. Only the geographic information will be used in collating the information.

Your name: ………………………………………………………………

Tick which best describes how far you live from the proposed Tilbuster Solar Farm:

less than 1 km ☐ 1-2 km ☐ 2-5 km ☐ more than 5 km ☐ not a member of the local community

Tell us what you value about the local area and the proposed solar farm.

What do you value most about the local area? Tick one or more:

Landscape and views ☐ Community/family ties ☐ Historic values ☐ Work opportunities

Recreational opportunities, including sport, nature based etc. ☐ Other

Please discuss in more detail

……

……

……

What views or landscape characteristics in the region / local area are important to you?

……

……

……

What do you like about solar farms? Tick one or more:

Renewable energy generation ☐ Diversification of land use and income streams

Local economic opportunities, including jobs, tourism and economic stimulus ☐ Other

Provide more detail about your answer

……

……

……

Do you have any concerns about solar farms? Tick all that apply:

Effects on land use or land values ☐ Visual impacts ☐ Noise impacts ☐ Traffic impacts

Effects on recreational opportunities ☐ Community impacts ☐ Effects on natural areas ☐ Other

Do you have any specific concerns regarding the proposed solar farm at Tilbuster?

……

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……………………………………………………………………………………………

(02) 8311 1338
info@tilbustersolarfarm.com.au
www.enerparc.com

ENERPARC

Feedback Form

We’re always interested in feedback from the community. You can return your feedback using the reply paid envelope.

What are your views on solar farms generally?

What do you think of the proposed Tilbuster Solar Farm?

What do you value most about the local area? Are any local views of importance to you?

What other concerns or comments would you like us to consider in moving forward with this proposal?

Tilbuster Solar Farm

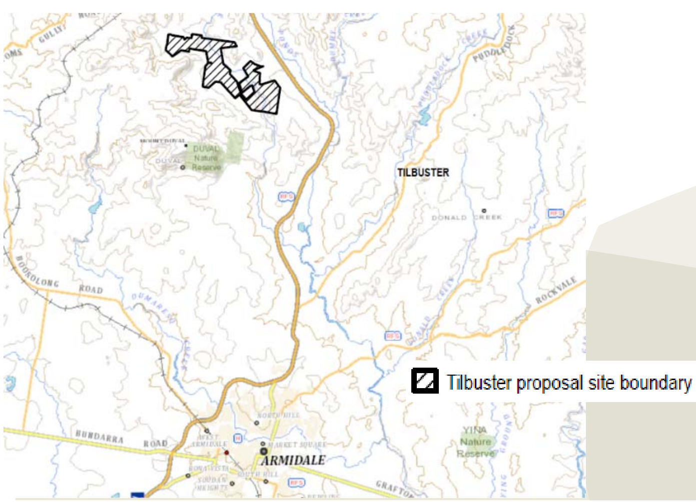
AUGUST 2018

Dear Resident,

We at **Enerparc Australia** are reaching out to inform you of the proposed Tilbuster Solar Farm project located on the western side of the New England Highway near Tilbuster. Once operational, this project would feed electricity into the transmission network and be capable of producing enough clean reneweable energy to supply approximately 93,000 NSW homes.

The Tilbuster Solar Farm is being developed by Enerparc Australia based in Sydney, part of a leading company which develop, engineer, build and operate utility-scale photovoltaic systems. With a proven track record of industry experience, we have installed more than 2,200 megawatts of solar power in 20 countries.

Enerparc wishes to help reach renewable energy targets in NSW whilst maintaining honest and transparent engagement with all landowners, government and community stakeholders.



The proposed site features approximately 300 hectares of unobstructed land, making it ideal for affordable clean energy generation. The land is currently used for grazing. Sheep are likely to continue to graze during the operation (managed at a lesser stocking rate). The proposal would have no affect on farming for neighbouring properties. A number of high level studies have already taken place including careful and strict consideration of *biodiversity, cultural heritage, visual amenity, noise, traffic, soil and socio-economic* concerns. These are presented in the Preliminary Assessment Report, which will shortly be on public display at http://www.majorprojects.planning.nsw.gov.au/. These will be progressed as part of a comprehensive Environmental Impact Statement (EIS) which will be submitted with the planning application and also made available for public access.

We are commited to sharing the benefits of our project with the community. And as neighbours of the proposed project, we would appreciate the opportunity to address any questions you may have. You can also find further information on the project website TilbusterSolarFarm.com.au which will be live in October.
Please find a feedback form overleaf.

Kind Regards,

223 Liverpool Street
Darlinghurst, NSW 2010

(02) 8311 1338
www.enerparc.com

APPENDIX E BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT (BDAR)

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

Tilbuster Solar Farm

September 2020

Project Number: 18-645

BEGA • BRISBANE • CANBERRA • GOLD COAST • NEWCASTLE • SYDNEY • WAGGA WAGGA

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DOCUMENT VERIFICATION

Project Title:	Tilbuster Solar Farm
Project Number:	18-645
Project File Name:	18-645 Tilbuster Solar Farm BDAR Final V1.0

Revision	Date	Prepared by	Reviewed by	Approved by
Draft 1.1	10/12/2019	Brendon True (BAAS 18155)	Mitch Palmer (BAAS17051)	Mitch Palmer (BAAS17051)
Final V1	14/05/2020	Brendon True (BAAS 18155)	Brooke Marshall (BAAS 18149)	Brooke Marshall (BAAS 18149)
Final V1.1	21/09/2020	Brendon True (BAAS 18155)	Mitch Palmer (BAAS17051)	Brooke Marshall (BAAS 18149)

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W. www.nghconsulting.com.au

E. ngh@nghconsulting.com.au

BEGA - ACT & SOUTH EAST NSW
Suite 11, 89-91 Auckland Street (PO Box 470) Bega NSW 2550 **T.** (02) 6492 8333

BRISBANE
Suite 4, Level 5, 87 Wickham Terrace
Spring Hill QLD 4000 **T.** (07) 3129 7633

CANBERRA - NSW SE & ACT
8/27 Yallourn Street (PO Box 62)
Fyshwick ACT 2609 **T.** (02) 6280 5053

GOLD COAST
PO Box 466
Tugun QLD 4224 **T.** (07) 3129 7633

NEWCASTLE - HUNTER & NORTH COAST
Unit 2, 54 Hudson Street
Hamilton NSW 2303 **T.** (02) 4929 2301

SYDNEY REGION
Unit 18, Level 3, 21 Mary Street
Surry Hills NSW 2010 **T.** (02) 8202 8333

WAGGA WAGGA - RIVERINA & WESTERN NSW
Suite 1, 39 Fitzmaurice Street (PO Box 5464)
Wagga Wagga NSW 2650 **T.** (02) 6971 9696

TABLE OF CONTENTS

FIGURES

TABLE

ACRONYMS AND ABBREVIATIONS

AWS	Automatic weather station
BAM	Biodiversity Assessment Methodology 2017
BAM-C	Biodiversity Assessment Methodology Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
BioNet VC	BioNet Vegetation Classification
BOM	Australian Bureau of Meteorology
Cm	Centre metre
DBH	Diameter at Breast Height
DPIE	Department of Planning, Infrastructure and Environment
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
GIS	Geographic Information System
ha	hectares
HBT	Hollow-bearing tree
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometres
kV	Kilovolt
LEP	Local Environment Plan
LLS Act	Local Land Services Act
LRET	Large Scale Renewable Energy Target
m	Metres
MW	Megawatt
NES	Matters of National environmental significance under the *EPBC Act* (c.f.)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PCT	Plant Community Type
PV	Photovoltaic
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
sp/spp	Species/multiple species

SAT	Spot Assessment Technique
SSD	State Significant Development
TEC	Threatened Ecological Community
CEEC	Critically Endangered Ecological Community
VIS	Vegetation Integrity Score

EXECUTIVE SUMMARY

Enerpac Australia Pty Ltd (Enerpac) proposes to construct, operate and decommission a photovoltaic (PV) solar farm with an estimated capacity of 150 MW. The Tilbuster Solar Farm (the proposal) would be located on a rural property 17 km north of Armidale, NSW. This Biodiversity Development Assessment Report (BDAR) has been prepared by NGH on behalf of the proponent, Enerpac.

The aim of this BDAR is to address the requirements of the *Biodiversity Conservation Act 2016* (BC Act). This BDAR forms part of a Development Application (DA) prepared under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to be lodged with the NSW Department of Planning, Industry and Environment (DPIE) (Formerly known as NSW Department of Planning and Environment (DPE)).

The Biodiversity Assessment Methodology (BAM) is the required assessment methodology for local developments that trigger the NSW Biodiversity Offsets Scheme (BOS), under the BC Act. This report follows the field work methodologies and assessment required by the BAM.

Comprehensive mapping and field surveys were completed in accordance with the requirements of the BAM. The majority of the 310 ha development site has been cleared of native vegetation, and purposed for stock grazing, which is the dominant land use in the area. Around 241.3 ha of native vegetation occurs in the development site as cleared, under scrubbed and thinned treed areas comprised of:

- 145.9 ha of PCT 567 - Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion (PCT 567)
- 6.1 ha of PCT 575 Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion (PCT 575)
- 89.2 ha of Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion (PCT 704)

All areas of PCTs 567 and 704 are considered to constitute the BC Act listed community *White box Yellow box Blakely's red gum woodland*. Some areas are considered to constitute the federally listed counterpart *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*. PCT 575 does not constitute a state or federally listed community.

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

- 78 ha of PCT 567, generating 422 ecosystem credits
- 0.9 ha of PCT 575, generating 14 ecosystem credits
- 48.5 ha of PCT 704, generating 185 ecosystem credits

Two species credit species, Southern Myotis *Myotis macropus* and Koala *Phascolarctos cinereus*, were recorded during target surveys in November 2019. Two further species credit species, Pale-headed Snake *Hoplocephalus bitorquatus* and Bluegrass *Dichanthium setosum*, were not surveyed for and are assumed to occur based on habitat presence, albeit sub-optimal. The recorded or assumed presence of these species credit species generated the following species credits:

- 564 species credits for Bluegrass for the proposed removal of 120.1 ha of assumed habitat
- 185 species credits for Pale-headed Snake for the proposed removal of 12.6 ha of assumed habitat
- 185 species credits for Koala for the proposed removal of 12.6 ha of breeding habitat
- 228 species credits for Southern Myotis for the proposed removal of 57.2 ha of habitat.

An additional assessment of impacts on entities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was completed for:

- Koala
- Bluegrass
- Greater Glider *Petauroides volans*
- *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands*

These impacts have been assessed in accordance with the EPBC Act guidelines and in the case of Greater Glider and Koala, referral to the Federal Department of Environment was recommended on the basis of the proposal potentially resulting in a significant impact to either or both species. The proposed Tilbuster Solar Farm was determined to be a controlled action and will be assessed by NSW under an accredited assessment in accordance with section 87 of the EPBC Act. Supplementary SEARs for this proposal have been addressed in this BDAR. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.

Biodiversity impacts have been assessed at a worst-case scenario, based on detailed plans that have been revised and altered with a reduction in impacts to higher quality vegetation. Consideration has been given to avoiding and minimising impacts to biodiversity where possible during the design revision. Design options have been assessed against key environmental, social and economic criteria. Mitigation and management measures will be put in place to adequately address impacts associated with the proposal, both direct and indirect.

1 INTRODUCTION

Enerparc Australia Pty Ltd (Enerpac) proposes to construct, operate, and decommission a photovoltaic (PV) solar farm with an estimated capacity of 150 Megawatts. The Tilbuster Solar Farm (the proposal) would be located on a rural property approximately 17 km north of Armidale on a 310 hectare (ha) plot of land that is currently owned by one landowner.

The proposal is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP) and therefore a 'major project'. This Biodiversity Development Assessment Report (BDAR), prepared on behalf of Enerpac, assesses the impacts of the proposal according to the NSW Biodiversity Assessment Methodology (BAM) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal.

The following terms are used in this document:

- **Proposal:** the construction, operation and decommissioning of a 150 MW solar farm as outlined in detail in Section 1.1 below.
- **Development site:** the area of land that is subject to a proposed development, inclusive of direct and indirect impacts. The development site is around 310 ha. The development site is the area surveyed for this assessment.
- **Development footprint:** the area of land that is directly impacted by the proposal. In this case it is the area within the development site identified in Figure 2-4 as the development footprint. The development footprint includes the solar array design, perimeter fence, access roads, transmission line footprint, Asset Protection Zones (APZ) and areas used to store construction materials. The development footprint is approximately 178.6 ha.
- **Subject land:** the combined areas of the development site and development footprint, and an area where the BAM has been applied.
- **Buffer area:** all land within 1500 metres (m) of the outside edge of the boundary of the development footprint.

1.1 THE PROPOSAL

The proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 150 Megawatts (AC) to be supplied directly to the national electricity grid. The Proposal would provide enough clean, renewable energy for about 48,000 average NSW homes while displacing approximately 250,000 metric tons of carbon dioxide annually. The development site is approximately 310 ha of which approximately 178.6 ha would be developed for the solar farm and associated infrastructure (development footprint). Two existing TransGrid transmission lines transect the site, a 132 kilovolts eastern line and a 330 kilovolts central line. The 330 kilovolts transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during construction and operation for light and heavy vehicles would be off New England Highway, east of the site. The proposed infrastructure map (Figure 6-1) illustrates the indicative layout, including a concept development footprint for the solar arrays. This would be refined during the detailed design phase.

Key development and infrastructure components would include:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system

- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8 km in length
- Perimeter security fencing and tracks
- Security camera poles
- Construction of 11 creek crossing, largely fords

In total, the construction phase of the proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. Up to five fulltime equivalent operations and maintenance staff and service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability.

The proposal would require subdivision of Deposited Plan Lots within the development site for lease and purchase agreement purposes with the involved landowner.

1.2 THE DEVELOPMENT SITE

1.2.1 Site description

The development site is located on land zoned RU1 Primary Production to the north east under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Regional LEP). Crown Land is located within the south east part of the development site. The development site, associated transmission and access roads are located on land zoned RU1 Primary Production under the Armidale Regional LEP.

The topography of the development site is generally undulating with steep forested hills to the east and west of the site. The Site is accessed from a single access point on the New England Highway. The Proposal is not visible from the New England Highway.

Nine dams occur within the development site; two within the south eastern portion of the development site, three within the central portion and four within the north western portion. One ephemeral watercourse and approximately eighteen other tributaries traverse the development site. The largest of the watercourses, Duval Creek, traverses the middle of the development site in a north-west to south-east direction and discharges into Tilbuster Ponds approximately 6.5 km south of the development site. Most of the smaller watercourses/overland flow paths are tributaries of Duval Creek.

An existing TransGrid 330 kV transmission line transects the central portion of the development site.

There are no current exploration licences or mining leases within the development site.

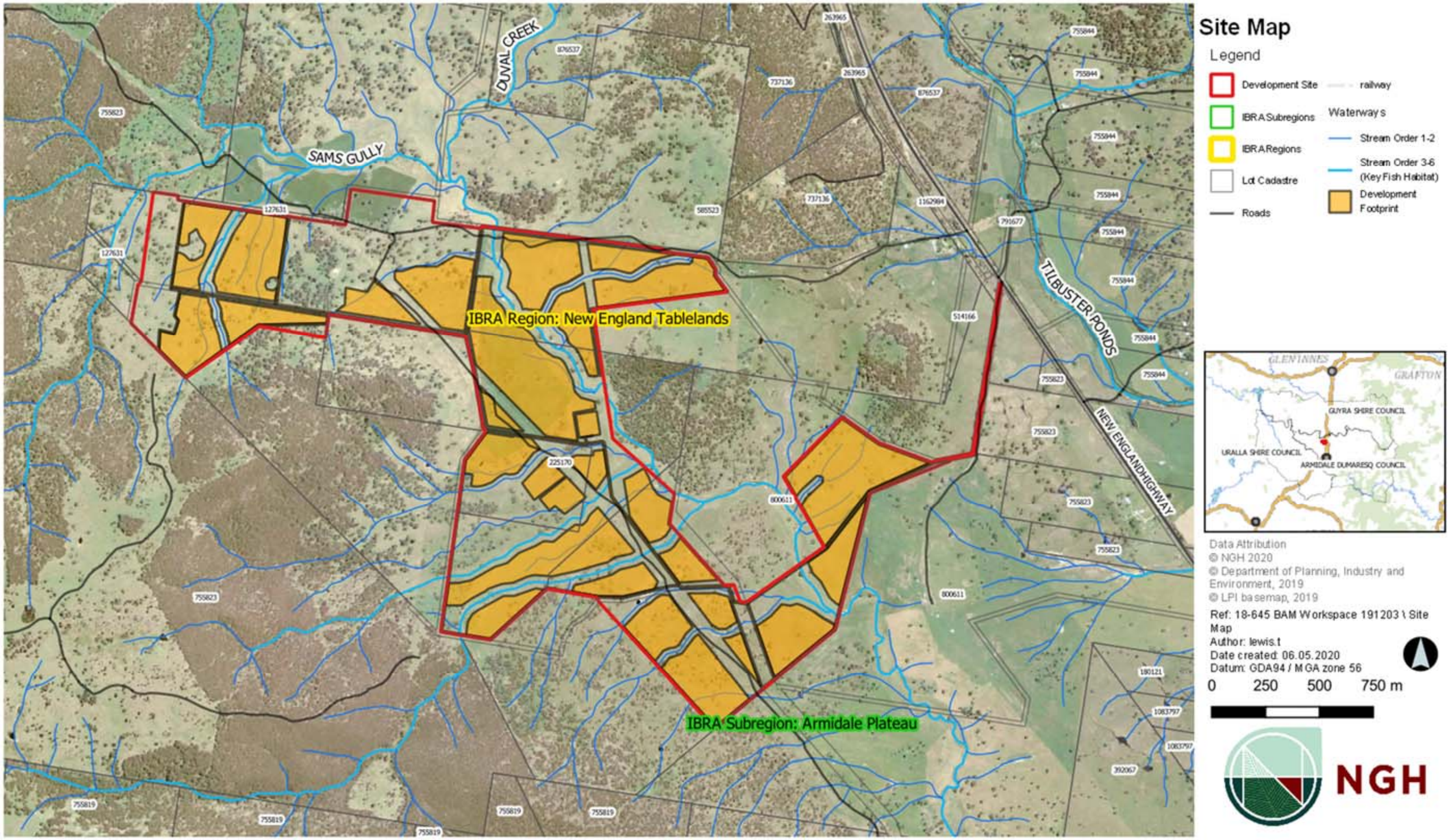


Figure 1-1 Site map

1.2.2 Site location

The development site is located on a 310 ha plot of land that is currently owned by one landowner. Pending project approval, the proposal site is intended to be leased by Enerparc.

Table 1-1 Affected lots associated with the proposed Tilbuster Solar Farm

Development footprint	Owner 1	Crown Land	Existing use	Ownership arrangements
All proposed solar farm infrastructure including solar arrays, connection infrastructure, internal roads and ancillary infrastructure.	Lot 3 DP800611 Lot 1 DP225170 Lot 1 DP585523	N/A	Agriculture	Enerparc would lease or purchase this land.

1.3 STUDY AIMS

This BDAR has been prepared by NGH on behalf of Enerpac. The aim of this BDAR is to address the requirements of the BAM, as required in the Secretary's Environmental Assessment Requirements (SEARs) and summarised below.

Secretary's Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues: • **Biodiversity** – including an assessment of the likely biodiversity impacts of the development	• An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values. • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.

No specific considerations for any threatened species, populations or communities were specified in the SEARs or by Department of Planning, Infrastructure and Environment (DPIE).

1.4 SOURCE OF INFORMATION USED IN THE ASSESSMENT

The following information sources were used in this BDAR:

- Proposal layers, construction methodology and concept designs provided by Enerpac.

- Australian Government's Species Profiles and Threats (SPRAT) database http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- NSW OEH's Threatened Species Profiles http://www.environment.nsw.gov.au/threatenedspeciesapp/
- DPI profiles of threatened species, population, and ecological communities
- Commonwealth Department of Environment and Energy Protected Matters Search Tool

  Accessed online at http://environment.gov.au/epbc/protected-matters-search-tool
- Australia's IBRA Bioregions and sub-bioregions. Accessed September 2019 http://environment.gov.au/land/nrs/science/ibra/australias-bioregions-maps
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- NSW OEH's Biodiversity Assessment Method (BAM) calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx).
- NSW OEH's BioNet threatened biodiversity database

  Accessed online via login at http://www.bionet.nsw.gov.au/.
- NSW OEH Threatened Species Profiles Accessed September 2019

  http://www.environment.nsw.gov.au/threatenedSpeciesApp/ and

  www.environment.nsw.gov.au/AtlasApp/UI_Modules/
- OEH BioNet Vegetation Classification Database

  Accessed online via login at http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx
- Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Method.
- NSW Government SEED Mapping

  https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- NSW Biodiversity Values Map
  https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap

2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGION

Interim Biogeographic Regionalisation for Australia (IBRA) Bioregions are geographically distinct bioregions based on common climates, geology, landforms and native vegetation (Thackaway and Creswell, 1995) There are 89 IBRA bioregions within Australia. The development site falls within the New England Tablelands IBRA Bioregion and Armidale Plateau Subregion.

The New England Tablelands is one of the smaller bioregions within NSW, occupying 3.5% of the state. In NSW, the bioregion boundary extends from north of Tenterfield to south of Walcha and includes towns such as Armidale and Guyra. The climate of the bioregion is temperate to cool, characterised by warm summers. Patches of montane climate occur at higher elevations, and these are characterised by mild summers and no dry season.

The bioregion is a stepped plateau of hills and plains with elevations between 600 and 1500 m on Permian sedimentary rocks, intrusive granites and extensive tertiary basalts. Soils change with topography and bedrock, with the overlying vegetation highly diverse with a high degree of endemism.

The Armidale plateau Subregion is characterised by an undulating to hilly plateau to 1100 m over fine grained carboniferous sedimentary rock, granites and multiple tertiary basalt flows. Soils contain a mix of texture contrast soils on sedimentary rocks and granite, mellow and well drained on upper slopes, harsh and poorly drained on lower slopes, variably stony loams to deep black earths in valley floors on basalt and deep, dark loamy alluvium in swampy valleys. The vegetation present reflects this range of substrates including open Ribbon Gum *Eucalyptus viminalis* forest and woodland on basalt. Sedimentary areas generally contain Blakely's Red Gum *E. blakelyi*, Yellow Box *E. melliodora* and Rough-barked Apple *Angophora floribunda*. Dryer aspects contain Stringybarks and Ribbon Gum on flats.

2.2 NSW LANDSCAPE REGIONS AND AREA

The development site is situated on the Dingo Spur Meat-sediments Mitchell Landscape. This landscape was entered into the BAM calculator (BAM-C) for this assessment.

2.3 NATIVE VEGETATION

As determined by aerial imagery and Geographic Information System (GIS) mapping, approximately 1988 ha of native vegetation occurs in the surrounding 1500 m buffer area. The native vegetation within this buffer contains a mix of Stringybark dominated woodland and forest in higher rocky areas transitioning to Yellow Box and Blakely's Red Gum on valley flats and Ribbon Gum in riparian areas.

2.4 CLEARED AREAS

An assessment of cleared areas in the 1500 m buffer area was undertaken using aerial imagery, State Vegetation Mapping (OEH, 2016), NSW Land use Mapping (OEH, 2017) and field assessments. Within the 1500 m buffer area, approximately 110 ha is cleared or significantly thinned of native vegetation. This is predominantly for farming, such as improved pasture and forage cropping, but also includes the New England Highway, residences and a central transmission line.

2.5 RIVERS AND STREAMS

Within the development site, several waterways and ephemeral drainage lines occur, approximately 50% of which are 1st order streams. The presence of named watercourses is limited to Duval Creek (5th order) which is situated north-west to south-east. Tributaries of Duval Creek are mapped as a combination of 1st, 2nd and 3rd order streams. All of these waterways are ephemeral and contained no water during August or November 2019 and August 2018. Duval Creek itself, during August and November 2019 surveys, contained no water and little evidence of where remaining water may have collected before completely drying out (Figure 2-1). During August 2018, Duval Creek contained some evidence of water in isolated patches and damp depressions.

Figure 2-1 Duval Creek at the eastern end of the development site during November 2019

2.6 WETLANDS

No wetlands occur within the development site. The nearest Wetland of International Importance (RAMSAR) is Gwydir wetlands, 200 – 30 km upstream. The nearest downstream wetland is Riverland, over 1000 km away.

Nine farm dams are present within the development site, two of which contained water during November 2019 surveys (Figure 2-2). None of the dams contain fringing vegetation which may present habitat.

Figure 2-2 Dam in the north of the development site during November 2019

2.7 CONNECTIVITY FEATURES

Much of the development site has been cleared or thinned of native vegetation, however, significant tracts of relatively uninterrupted bushland occur along the northern, western and southern boundary, from Black Mountain to the north to Duval Nature Reserve to the south. This bushland is a prominent connectivity feature in the landscape. In the north, west and south, this connectivity feature extends into the development site as areas of remnant trees with a cleared understory subject to grazing. These disturbed remnants often fail to extend the width of the development site wholly or without substantial disconnects, in large part due to clearing that was required to enable the construction of a transmission line situated north-south through the development site. One location in the north of the development site contains a relatively consistent canopy from the northern to opposing boundary. This area constitutes the greatest connectivity through the development site and it has been avoided by the development footprint.

Given the above, connectivity through the development site is generally poor for species that require a consistent canopy for traversal. Species that can cross the ground may utilise the development site for traversal in treed as well as wholly cleared areas. However, relatively undisturbed bushland surrounding the development site is likely to be preferred.

2.8 AREAS OF GEOLOGICAL SIGNIFICANCE

No karsts, caves, significant crevices or cliffs occur within the development site. However, in the north-east a geological feature, colloquially referred to as 'Red Rock' is present (Figure 2-3). Red Rock is a deep marine chert which are typically grey or greenish, however, this one is red as it is a Jasper variety. The Jasper is part of the older accretionary wedge; sea floor sediments that were scraped off the down going oceanic plate about 380 – 320 million years ago.

The New England Tablelands contains other examples of this formation, but this is likely to be the most significant in terms of its size and relatively unique colouring.

Figure 2-3 Formation known as 'Red Rock' in the north-east of the development site

2.9 SITE CONTEXT COMPONENTS

Method Applied

The proposal conforms to the definition of a site-based development under the BAM and therefore the site-based development assessment methodology has been used in this BAM assessment. Native Vegetation was calculated by estimating the percent cover of native vegetation relevant to the benchmark for the Plant Community Type (PCT). PCTs were allocated based on existing vegetation mapping, detailed survey and aerial imagery.

Percent Native Vegetation Cover

The 1500 m buffer area around the development site comprises an area of 2889 ha. As determined by GIS mapping from aerial imagery, approximately 1988 ha of native vegetation occurs in the 1500 m buffer area (Figure 2-5).

The Percent Native Vegetation Cover within the 1500 m buffer area surrounding the development site prior to the development was calculated to be 68.7%. This was entered into the BAM-C for the assessment.

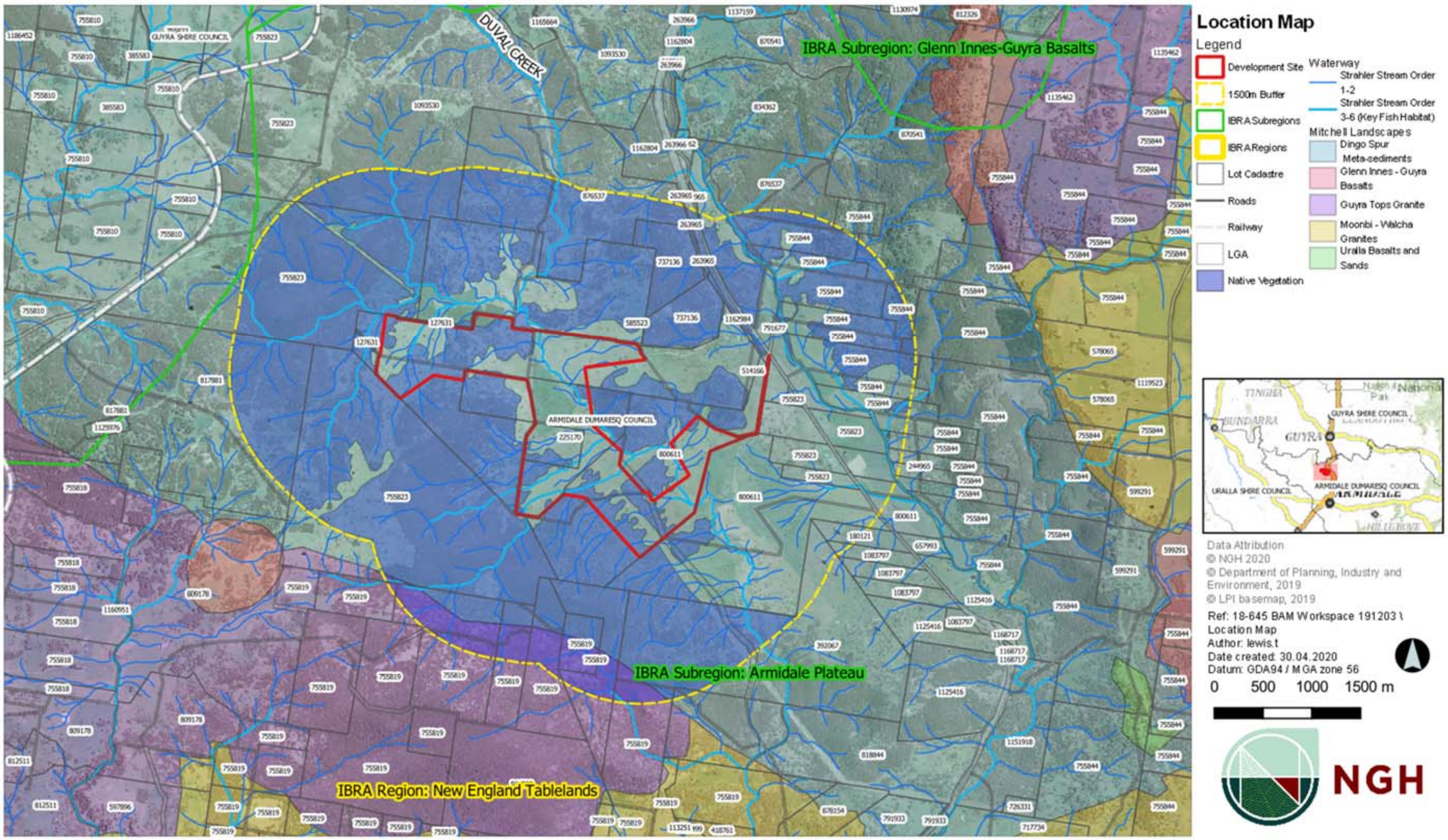


Figure 2-4 Location map

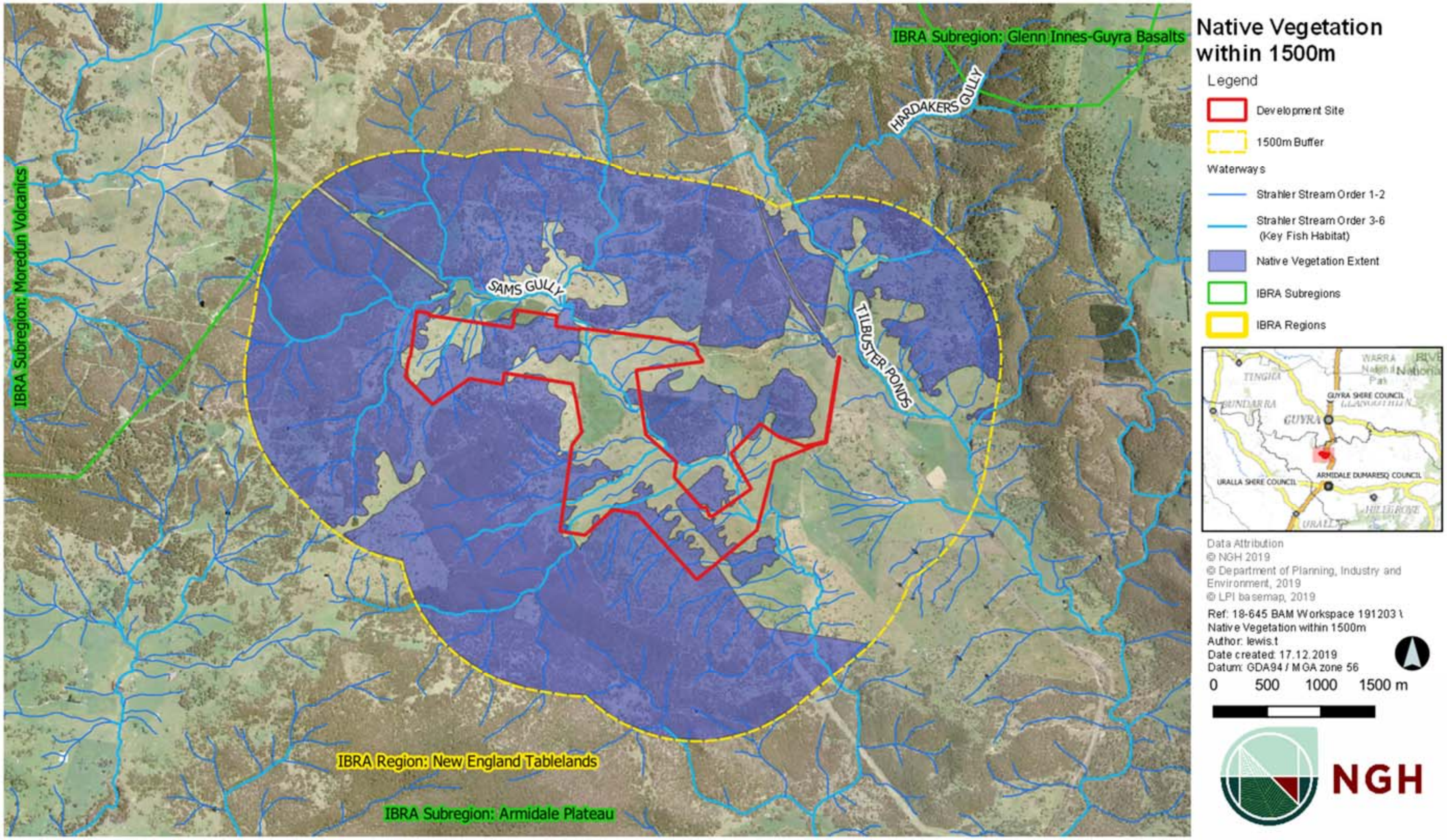


Figure 2-5 Native Vegetation Extent with the 1500 m buffer

3 NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT

About 241.2 ha of native vegetation occurs within the development site, comprised of:

- 55.2 ha of treed areas dominated by Broad-leaved Stringybark *Eucalyptus caliginosa*. This community generally occurs in higher elevations and may be associated with rock outcropping. Where it extends into lower lying areas, Yellow Box and Blakely's Red Gum are common associates. Scattered trees over Category 1 land (see below) and Category 2 land that has been cropped also occur.
- 23.5 ha of treed areas dominated by Yellow Box and Blakely's Red Gum on valley floors. Scattered trees over Category 1 land (see below) and Category 2 land that has been cropped also occur.
- 6 ha of dry sclerophyll forest where Tenterfield Woollybutt *Eucalyptus banksii* occurs with Stringybarks, Yellow Box and Blakely's Red Gum.
- 156.5 ha of modified and grazed grasslands, derived of the communities above, that have a long history of grazing and pasture improvement.

No paddock trees occur within the development site. Paddock trees are defined as:

- a tree or a group of up to three trees less than 50 m apart from each other, and
- over an exotic groundcover, and
- more than 50 m away from any other living tree greater than 20 cm DBH, and
- on category 2 land surrounded by category 1 land (as defined by the BAM, 2017).*

*The regulatory land mapping has not been yet been published under the new Local Land Service Act 2016 (LLS Act). During the transitional period, land categories are to be determined in accordance with the definitions of regulated land in the LLS Act. In this case, the paddock trees are located on land with native vegetation present since January 1990, surrounded by land that has been cleared of native vegetation since January 1990

About 68.8 ha of non-native occurs including exotic vegetation, cropped Category 1 exempt lands and cropped Category 2 lands.

3.2 LAND CATEGORY ASSESSMENT

Until the entire Native Vegetation Regulatory (NVR) map is finalised and released, assessors may establish the categorisation of land for the consent authority to consider by approximating the method used to make the NVR map under the provisions of the *Biodiversity Conservation Act 2016* (BC Act) and the *Local Land Services Amendment Act 2016* (LLS Act). That is, for developments occurring on rural land (not including RU5 land), accredited assessors can establish whether land is Category-1 – exempt land. Under the BC Act (S6.8(3)), the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on Category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3 of the BAM. Additionally, with the BAM (S2.3.1.1), biodiversity values associated with the assessment of the impacts of any clearing of native vegetation and loss of habitat on Category 1-exempt land (within the meaning of Part 5A of the LLS Act), other than the additional biodiversity impacts in accordance with clause 6.1 of the BC regulation are not required to be assessed. As Category 1 Land regulatory maps are not yet publicly available, an assessment of whether the cleared areas meet the definition of the Category 1 - exempt land was undertaken (APPENDIX A).

In order to determine and justify land identified as Category 1-exempt land, the following information was analysed via a precautionary approach;

- NSW Land Use mapping (OEH 2017)
- Woody Vegetation layer (OEH 2015)
- Sensitive Regulated Land and Vulnerable Regulated Land Mapping
- Historic aerial imagery

Using the above resources, 62.7 ha was considered to be classed as Category 1 Land (APPENDIX A). These areas are exempt from further assessment in the BAM with exception to prescribed impacts as stated in Section 6.3 of the BC Act.

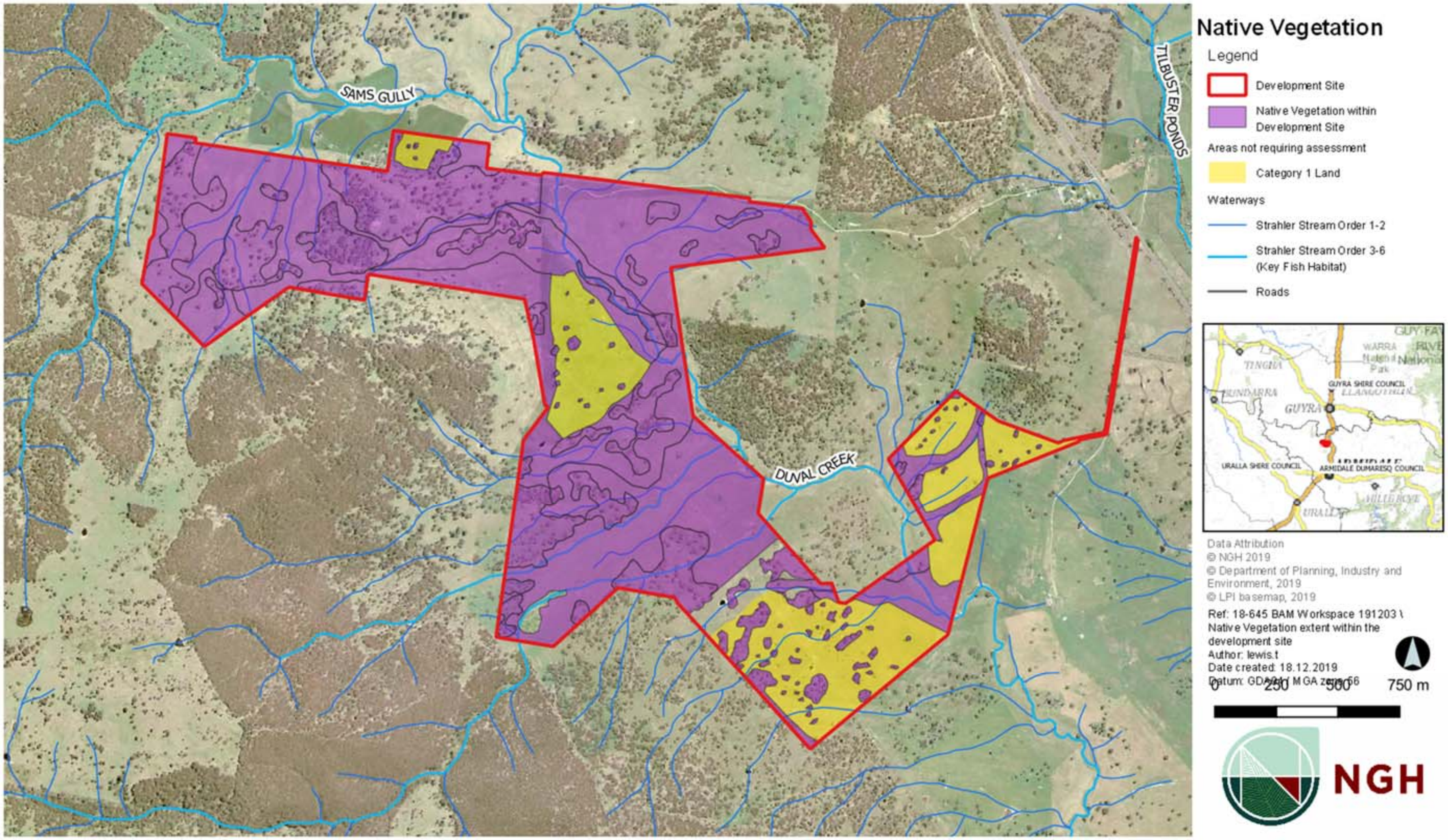


Figure 3-1 Native vegetation extent within the development site

3.3 PLANT COMMUNITY TYPES (PCTS)

3.3.1 Methods to assess PCTs

Review of existing information

A search was undertaken of the BioNet Vegetation Classification (BioNet VC) database and NSW SEED Data Sharing Portal to access existing vegetation mapping information within the subject land. The nearest State Vegetation Map layer was that of the Border Rivers Gwydir/Namoi Region (VIS_ID 4467, DPIE 2015). Despite this mapping layer terminating 2 km to the west of the subject land, it provided insight into the PCTs which are likely to be present including:

- PCT 526: Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion
- PCT 559: Youman's Stringybark - Mountain Gum open forest of the western New England Tableland Bioregion
- PCT 565: Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion
- PCT 568: Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion
- PCT 736: Broad-leaved Stringybark - Mountain Gum - Apple Box open forest of the New England Tableland Bioregion

Floristic survey

A site overview was undertaken on the 13th – 15th of August 2018. The entire subject land was surveyed by one ecologist with the aim of confirming the PCTs present, along with their extent and condition by way of rapid data collection techniques. Random meander searches were conducted to gain an overview of the plant species present and determine variation within vegetation types. Potential PCTs were identified using the BioNet VC based on the native species present, landform, physiography and location in the IBRA subregion. The PCTs were then stratified into areas of similar condition class to determine vegetation zones for each PCT.

Detailed floristic surveys were undertaken over the 26th – 30th November 2018 and again by two ecologists over the 18th – 21st November 2019. The surveys were undertaken using the methodology presented in the BAM. The required number of vegetation integrity plots of 20 m by 50 m were established in each vegetation zone. Data was collected on the composition, structure and function of the vegetation (Appendix B-I). The extended drought conditions present across the New England Tablelands, coupled with grazing pressure, served as a severe limitation to collection of plot data as minimal groundcover vegetation was present. This is expanded upon in Section 7.6. Personnel undertaking the field work have been trained and accredited under the BAM (Appendix B-LXVI).

3.3.2 PCTs identified on the development site

Three PCTs were identified within the development site:

- PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion
- PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion
- PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion

A description of the PCTs identified within the development site follows overleaf.

Table 3-1 PCT 567 Summary

Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	New England Grassy Woodland	
Vegetation type	PCT ID	567
	Common Community Name	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion
Approximate extent within the development site	145.9 ha: • 53.2 ha as woodland • 2 ha as scattered trees over cropped (Cat 1 and 2) land • 90.7 ha as grassland	
Species relied upon for PCT identification	Species name	Relative abundance
	Broad-leaved Stringybark *Eucalyptus caliginosa*	10
	Yellow Box *Eucalyptus melliodora*	2
	Blakeley's Red gum *Eucalyptus blakelyi*	1
	Silver-top Stringybark *Eucalyptus laevopinea*	1
	Cassinia quinquefaria	0.1
	Slender Rat's Tail Grass *Sporobolus creber*	1
	Peach Heath *Lissanthe strigosa*	0.2
	Swamp Dock *Rumex brownii*	0.1
	Purple Wiregrass *Aristida ramosa*	0.1
	Snow Grass *Poa sieberiana*	0.1
	Red Grass *Bothriochloa macra*	0.1
Justification of evidence used to identify the PCT	Entry of the dominant canopy species recorded at BAM plots 1, 4 and 5 filtered by the Armidale Plateau subregion into the BioNet VC produced a candidate list of 14 potential PCTs for this community. While PCTs such as 568, do contain a canopy dominated by Broad-leaved Stringybark, only 567 contains the full suite of other canopy species recorded. Furthermore, 567 contains the shrub species, although few were within BAM plots, that were also recorded or incidentally noted in similar vegetation adjacent to the western border of the development site. Given this strong affinity in regard to characteristic species, as well as suitable landscape position	

Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	
	(ridges, flats and lower slopes) PCT 567 was chosen as the most likely PCT for this community.
TEC Status	This PCT is associated with the following TECs: • White Box Yellow Box Blakely's Red Gum Woodland (BC Act – Endangered) • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act – Critically Endangered) This PCT has been confirmed to represent White Box Yellow Box Blakely's Red Gum Woodland, however, only in part. Areas of this PCT where only Stringybarks occur or dominate, would not qualify as the TEC. However, the BAM-C lacks the functionality to differentiate these areas from the remaining areas of the PCT that do represent the TEC (where Yellow Box and Blakely's Red Gum occur as at minimum co-dominants). The PCT has been entered as being associated with the TEC in the BAM-C. Some areas of this PCT have been found to represent White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. These areas are predominantly in the west of the development site where larger patches of the PCT are present or where disturbed remnants within the development site adjoin areas of the TEC outside the development site such that they are considered the same patch.
Estimate of percent cleared	62%
Examples	 Figure 3-2 Example of PCT 567 woodland

Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	
	 Figure 3-3 Example of PCT 567 grassland  Figure 3-4 Example of PCT 567 scattered

Table 3-2 PCT 575 Summary

Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion		
Vegetation formation	Dry Sclerophyll Forests)Shrub/grass sub-formation)	
Vegetation class	New England Dry Sclerophyll Forests	
Vegetation type	PCT ID	575
	Common Community Name	Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion
Approximate extent within the development site	6.1 ha: • 5.4 ha as forest • 0.7 ha as a clump of trees over cropped (Cat 1) land	
Species relied upon for PCT identification	Species name	Relative abundance
	Tenterfield Woollybutt *Eucalyptus banksii*	10
	Broad-leaved Stringybark *Eucalyptus caliginosa*	10
	Yellow Box *Eucalyptus melliodora*	2
	Variable Tick-trefoil *Desmodium varians*	0.1
	Peach Heath *Lissanthe strigosa*	0.2
	Native Geranium *solanderi*	0.2
	Sticky Cassinia *uncata*	0.1
	Snow Grass *Poa sieberiana*	0.1
	Red Grass *Bothriochloa macra*	0.1
Justification of evidence used to identify the PCT	Entry of the dominant canopy species recorded at BAM plots 3 and 8 filtered by the Armidale Plateau subregion into the BioNet VC produced only PCT 575 as a candidate. PCT 575 was also suggested to occur by DPIE (2015). Given the local occurrence of Tenterfield Woollybutt *Eucalyptus banksii* in two areas, and that there is only one PCT in the subregion to contain this species, PCT 575 was assigned to these areas.	
TEC Status	PCT 575 is not associated with any TECs.	
Estimate of percent cleared	40%	

Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion	
**Examples**	 Figure 3-5 Example of PCT 575 forest

Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion	
	 Figure 3-6 Example of PCT 575 scattered

Table 3-3 PCT 704 Summary

Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	New England Grassy Woodlands	
Vegetation type	PCT ID	704
	Common Community Name	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion
Approximate extent within the development site	89.2 ha: • 17.9 ha as woodland • 5.5 ha as a clump of trees over cropped (Cat 1 and Cat 2) land • 65.8 ha derived grassland	
Species relied upon for PCT identification	Species name	Relative abundance
	Yellow Box *Eucalyptus melliodora*	15
	Blakey's Red Gum *Eucalyptus blakelyi*	10
	Apple Box *Eucalyptus bridgesiana*	2
	Snow Grass *Poa sieberiana*	1
	Red Grass *Bothriochloa macra*	0.1
Justification of evidence used to identify the PCT	Entry of the dominant canopy species recorded at BAM plots 9 and 11 filtered by the Armidale Plateau subregion into the BioNet VC produced a list of 30 candidate PCTs for this community. Further filtering by New England Grassy Woodlands as vegetation class reduced this list to 10 PCTs. Of which , PCTs 704 and 510 (Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion) display the strongest affinity to the vegetation observed. PCT 704 was chosen over PCT 510 as the geographic distribution of PCT 704 aligns better with the development site. Also, 704 contains more of the canopy species incidentally observed in conjunction with Yellow Box and Blakely's Red Gum such as Youman's Stringybark *Eucalyptus youmanii*.	
TEC Status	This PCT is associated with the following TECs: • White Box Yellow Box Blakely's Red Gum Woodland (BC Act – Endangered) • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act – Critically Endangered) This PCT has been confirmed to represent White Box Yellow Box Blakely's Red Gum Woodland.	

Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	
	Some areas of this PCT have been found to represent White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. These areas are predominantly in the west of the development site where larger patches of the PCT are present or where disturbed remnants within the development site adjoin areas of the TEC outside the development site such that they are considered the same patch. Further discussion is presented in Section 5.2.
Estimate of percent cleared	80%
Examples	 Figure 3-7 Example of PCT 704 woodland

Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	
	 Figure 3-8 Example of PCT 704 grassland  Figure 3-9 Example of PCT 704 scattered

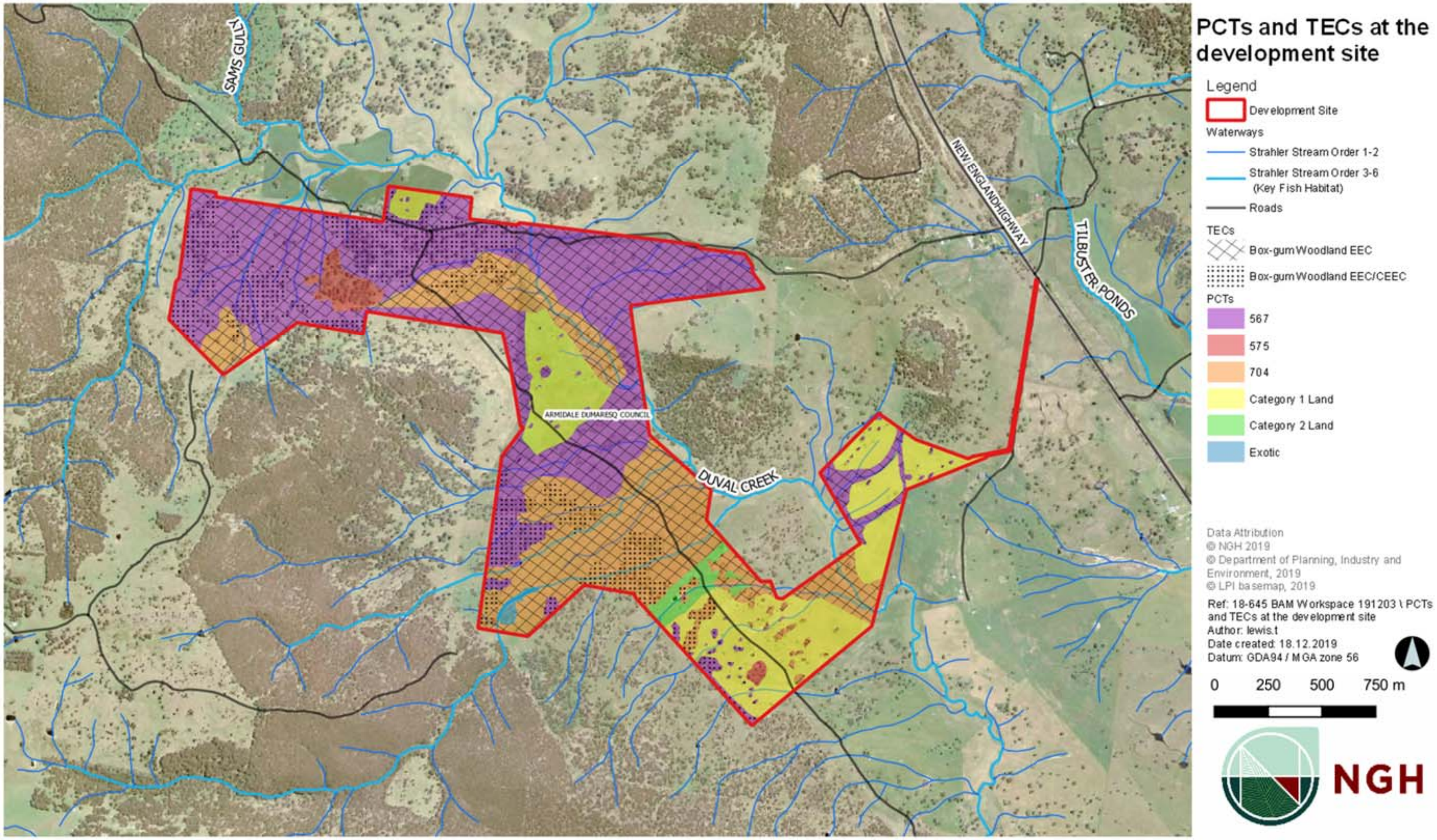


Figure 3-10 PCTs and TECs at the development site

3.4 VEGETATION INTEGRITY ASSESSMENT

3.4.1 Vegetation zones and survey effort

The PCTs identified within the development site were further stratified into zones according to condition described below.

Table 3-4 Vegetation zones at the development site and development footprint

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
1	567_Woodland	Areas of canopy over predominantly native grassland and very occasional midstory	53.4	14.9	5	>100	

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
2	567_Grassland	Areas where the canopy has been removed and a predominantly native understory remains	90.7	61.4	5	>100	
3	567_Scattered	Scattered canopy over cropped land (Cat 1 and Cat 2)	2	1.7	1	>100	

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
4	575_Forest	Areas of PCT 575 with a native canopy, midstory and understory	5.3	0.2	1	>100	

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
5	704_Woodland	Areas of canopy over predominantly native grassland and very occasional midstory	17.9	8.3	3	>100	
6	704_Grassland	Areas where the canopy has been removed and a predominantly native understory remains	65.8	35.9	4	>100	

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
7	704_Scattered	Scattered canopy over cropped land (Cat 1 and Cat 2)	5.5	4.3	2	>100	

Zone ID	PCT ID	Condition	Zone area development site (ha)	Zone area development footprint (ha)	Survey effort (# plots)	Patch size (ha)	Photographic example
8	575_Scattered	Scattered canopy over cropped land (Cat 2)	0.7	0.7	1	>100	

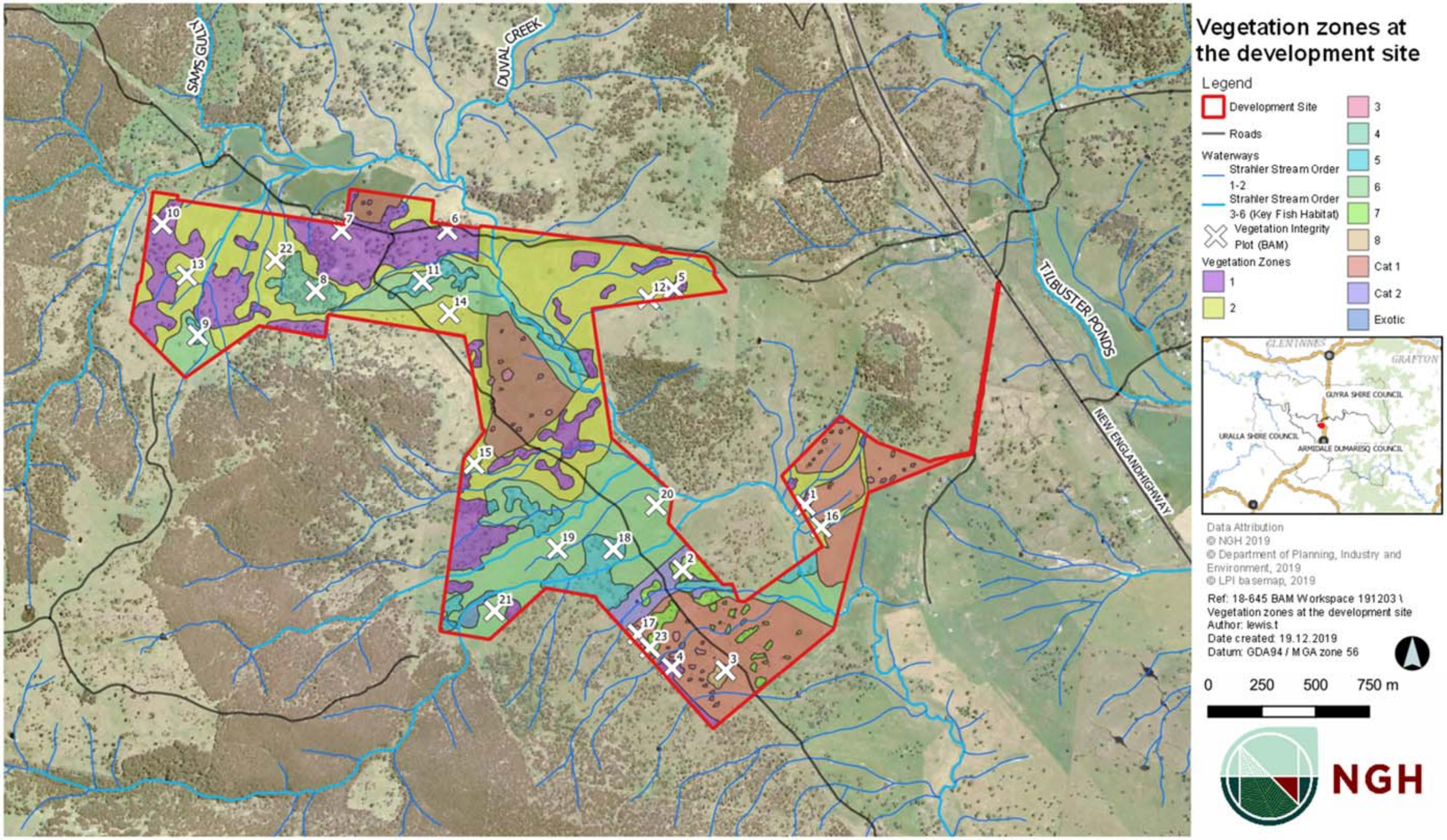


Figure 3-11 Vegetation zones at the development site

3.4.2 Vegetation integrity assessment results

The plot data from vegetation integrity survey plots undertaken were entered into the BAM calculator by accredited assessor (Brendon True - BAAS18155). The results of the vegetation integrity assessment are summarised in Table 3-5 for the vegetation zones that are impacted.

The results of the vegetation integrity assessment are provided in Table 3-5.

Table 3-5 Current vegetation integrity scores for each vegetation zone within the development site

Zone ID	Composition score	Structure score	Function score	Vegetation Integrity Score
1	56.5	54	52.7	**54.4**
2	5.8	0	15	**0.4**
3	5.7	31.5	33.4	**18.2**
4	52	50.2	78.9	**59.1**
5	19.6	33.9	57.7	**33.7**
6	5.3	0	15	**0.5**
7	10.9	31.7	28.3	**21.4**
8	28.8	27.7	66.7	**37.6**

4 THREATENED SPECIES

4.1 ECOSYSTEM CREDIT SPECIES

The following ecosystem credit species were returned by the calculator as being associated with the PCTs present on the development site:

Ecosystem Credit Species	Vegetation type(s)	NSW Listing Status	National listing status
Anthochaera phrygia Regent Honeyeater (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Critically Endangered	Critically Endangered
Artamus cyanopterus Dusky Woodswallow	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Chalinolobus nigrogriseus Hoary Wattled Bat	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Chthonicola sagittata Speckled Warbler	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Circus assimilis Spotted Harrier	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	Vulnerable	Not listed
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	Vulnerable	Not listed

Ecosystem Credit Species	Vegetation type(s)	NSW Listing Status	National listing status
	PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion		
Daphoenositta chrysoptera Varied Sittella	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Dasyurus maculatus Spotted-tailed Quoll	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Endangered
Falsistrellus tasmaniensis Eastern False Pipistrelle	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Glossopsitta pusilla Little Lorikeet	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Grantiella picta Painted Honeyeater	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Vulnerable
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Hieraaetus morphnoides Little Eagle (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion	Vulnerable	Not listed

Ecosystem Credit Species	Vegetation type(s)	NSW Listing Status	National listing status
	PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion		
Lathamus discolor Swift Parrot (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Endangered	Critically Endangered
Lophoictinia isura Square-tailed Kite (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Melanodryas cucullata Hooded Robin (south-eastern form)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Melithreptus gularis Black-chinned Honeyeater (eastern subspecies)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Neophema pulchella Turquoise Parrot	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Ninox connivens Barking Owl (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed

Ecosystem Credit Species	Vegetation type(s)	NSW Listing Status	National listing status
Ninox strenua Powerful Owl (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Petaurus australis Yellow-bellied Glider	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Petroica boodang Scarlet Robin	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Petroica phoenicea Flame Robin	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Phascolarctos cinereus Koala (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Vulnerable
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Vulnerable
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed

Ecosystem Credit Species	Vegetation type(s)	NSW Listing Status	National listing status
Scoteanax rueppellii Greater Broad-nosed Bat	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Stagonopleura guttata Diamond Firetail	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed
Tyto novaehollandiae Masked Owl	PCT 567: Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion PCT 575: Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion PCT 704: Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	Vulnerable	Not listed

4.1.1 Species excluded from the assessment

No ecosystem credit species were excluded from the assessment; all are assumed to occur and contribute to ecosystem credits.

4.2 SPECIES CREDIT SPECIES

4.2.1 Candidate species to be assessed

The BAM-C predicted the following species credit species to occur at the development site. Note that habitat constraints and geographic restrictions have been sourced from the BAM-C and/or Threatened Biodiversity Data Collection (DPIE 2019). Assessment of habitat constraints was undertaken post initial site survey including some BAM plot collection, hollow-bearing tree (HBT) mapping and general habitat assessment.

Table 4-1 Candidate species credit species requiring assessment

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Adelotus brevis - endangered population Tusked Frog population in the Nandewar and New England Tableland Bioregions	Rainforests, wet forests and flooded grassland and pasture. They are usually found near creeks, ditches and ponds, and call while hidden amongst vegetation or debris	Very High	Endangered	Not listed	No moist plant community types present. Duval Creek unsuitable habitat.	Excluded	No suitable habitat or habitat degraded
Anthochaera phrygia Regent Honeyeater (Breeding)	Mapped Important areas (DPIE)	High	Critically Endangered	Critically Endangered	Outside mapped important areas (DPIE)	Excluded	Not mapped as an important habitat area
Bertya ingramii Narrow-leaved Bertya	Grows among rocks or in thin soils close to cliff-edges in dry woodland with she-oaks, wattles and tea-trees. Within 20 m of cliffs escarpments rocky areas	High	Endangered	Endangered	Limited rocky areas present. Dry woodland present but highly degraded generally. No associate species present.	Included	Low quality potential habitat present. Survey undertaken.
Boronia granitica Granite Boronia	Grows on granitic soils amongst rock outcrops, often in rock crevices, and in forests and woodlands on granite scree and shallow soils.	High	Vulnerable	Endangered	Limited rock outcrops and crevices. Soils may be suitable.	Included	Low quality potential habitat present. Survey undertaken
Burhinus grallarius Bush Stone-curlew	Fallen/standing dead timber including logs	High	Endangered	Not Listed	Small areas of suitable habitat, particularly in the west of the subject land	Included	Low quality habitat present, survey undertaken

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Callitris oblonga Pygmy Cypress Pine	Usually grows in sand along watercourses in shrubland and open woodland in granite country; it also occurs in drier sites, including exposed ridges. East of Chandler River	High	Vulnerable	Vulnerable	One watercourse present. Some rocky areas	Excluded	Subject land not east of Chandler River
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.	High	Vulnerable	Not Listed	Suitable HBTs present within development site	Included	Potential breeding habitat present, survey undertaken
Cercartetus nanus Eastern Pygmy-possum	Relies on hollow bearing for breeding and nesting as well as banksia, eucalypts and callistemon for foraging.	High	Vulnerable	Not Listed	Suitable HBTs present within development site but minimal foraging habitat and patch size	Excluded	No suitable habitat in development site due to the absence of preferred and abundant foraging species. Habitat degraded such that species is unlikely to occur
Chalinolobus dwyeri Large-eared Pied Bat	Within two kilometers of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometers of old mines or tunnels.	Very High	Vulnerable	Not Listed	No suitable habitat present	Excluded	No suitable habitat in development site
Chiloglottis platyptera Barrington Tops Ant Orchid	Grows in moist areas in tall open eucalypt forest with a grassy understorey, and also around rainforest edges. It generally occurs in rich brown loam soils	High	Vulnerable	Not listed	No moist areas present which could support this species	Excluded	No suitable habitat in development site

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Dichanthium setosum Bluegrass	Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	High	Vulnerable	Vulnerable	Pasture and grassland areas present, though highly disturbed	Included	Low quality habitat present
Diuris pedunculata Small Snake Orchid	Grows on grassy slopes or flats. Often on peaty soils in moist areas. Also, on shale and trap soils, on fine granite, and among boulders.	High	Endangered	Endangered	Grassy slopes flats present. No boulders or moist areas.	Excluded	General habitat constraints present, however, potential habitat highly degraded. Species unlikely to persist through years of stock grazing.
Eucalyptus magnificata Northern Blue Box	Grassy open forest or woodland on shallow, sandy or loamy soils. Occurs on moderately hilly sites and at the edge of gorges, usually at altitudes from 900 - 1050 m.	High	Endangered	Not listed	Grassy open woodland present	Included	Habitat present. Survey undertaken.
Eucalyptus nicholli Narrow-leaved Black Peppermint	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Tends to grow on lower slopes in the landscape.	High	Vulnerable	Vulnerable	Dry Grassy woodland present on low slopes	Included	Potential habitat present. Survey undertaken.

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Grevillea beadleana Beadle's Grevillea	Oxley Wild Rivers National Park or within a 10 km buffer of the NP. Within 200 m of cliffs, escarpments or rocky areas.	High	Endangered	Endangered	Not within 10 km of Oxley Rivers National Park	Excluded	Geographic limitation not met
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	Living or dead trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.	High	Vulnerable	Not Listed	Duval Creek present with large trees within 1 km thereof, though dry at the time of writing	Included	Low quality habitat present. Survey undertaken
Haloragis exalata subsp. *velutina* Tall Velvet Sea-berry	Grows in damp places near watercourses. This subspecies also occurs in woodland on the steep rocky slopes of gorges.	High	Vulnerable	Vulnerable	Duval Creek present	Excluded	Habitat degraded such that the species is unlikely to occur.
Hieraaetus morphnoides Little Eagle (Breeding)	Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. Isolated trees may also be used.	High	Vulnerable	Not Listed	Duval Creek present with large trees present alongside. Isolated trees also present.	Included	Low quality habitat present. Survey undertaken
Hoplocephalus bitorquatus Pale-headed Snake	Can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. Frogs are main prey.	High	Vulnerable	Not listed	HBTs and suitable vegetation classes present, however, habitat degraded. Duval Creek unlikely to present consistent foraging habitat	Included	Low quality habitat present.
Lathamus discolor Swift Parrot	Mapped Important areas (DPIE)	Moderate	Endangered	Critically Endangered	Outside mapped important areas (DPIE)	Excluded	Outside mapped important area (DPIE)

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Lepidium hyssopifolium Aromatic Peppercress	In NSW the species was known to have occurred in both woodland with a grassy understorey and in grassland. The species may be a disturbance opportunist, as it was discovered at the most recently discovered site (near Bungendore) following soil disturbance.	High	Endangered	Endangered	Grassy woodland present, however, degraded	Excluded	Habitat degraded such that the species is unlikely to occur. Species unlikely to persist through years of stock grazing
Litoria subglandulosa Glandular Frog	Glandular Frogs may be found along streams in rainforest, moist and dry eucalypt forest or in subalpine swamps.	Very High	Vulnerable	Not listed	Duval Creek only waterbody, which is dry at the time or writing	Excluded	Habitat degraded such that species is unlikely to occur
Lophoictinia isura Square-tailed Kite (Breeding)	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	High	Vulnerable	Not listed	Potential nest trees present	Included	Low quality habitat present, survey undertaken
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Breeding)	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Very High	Vulnerable	Not listed	No suitable habitat present	Excluded	No suitable habitat present
Myotis macropus Southern Myotis	Hollow-bearing trees within 200 m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone	High	Vulnerable	Not Listed	Habitat constraints present, however, Duval Creek unlikely to present consistent forage	Included	Habitat constraints present, though habitat poor quality. Survey undertaken.
Ninox connivens Barking Owl (Breeding)	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	High	Vulnerable	Not listed	Potential breeding habitat present	Included	Habitat present, survey undertaken

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
Ninox strenua Powerful Owl (Breeding)	Living or dead trees with hollow greater than 20 cm diameter. Within 5 km of Macleay Georges subregion	High	Vulnerable	Not listed	Breeding constraint present, not within geographic limitation	Excluded	Geographic limitation not met
Petaurus norfolcensis Squirrel Glider	Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart).	High	Vulnerable	Not listed	Suitable breeding habitat present	Included	Suitable habitat present, survey undertaken
Petrogale penicillata Brush-tailed Rock Wallaby	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	Very High	Endangered	Vulnerable	Habitat not present	Excluded	Suitable habitat not present
Phascolarctos cinereus Koala (Breeding)	Areas identified via survey as important habitat based on density of Koalas and quality of habitat.	High	Vulnerable	Vulnerable	Survey required to identify if habitat present	Included	Habitat present, survey undertaken
Picris evae Hawkweed	Its main habitat is open Eucalypt forest including a canopy of *Eucalyptus melliodora*, *E. crebra*, *E. populnea*, *E. albens*, Angophora subvelutina, Allocasuarina torulosa , and/or Casuarina cunninghamiana with a Dichanthium grassy understory.	High	Vulnerable	Vulnerable	Eucalyptus melliodora woodland present and grassy understory, though degraded	Excluded	Habitat degraded such that species is unlikely to occur
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	Breeding camps. Breeding camps will need to be identified by survey	High	Vulnerable	Vulnerable	Breeding camps not present	Excluded	Habitat assessment undertaken, no

Species Credit Species	Habitat constraints, components and geographic limitations	Sensitivity to gain class	NSW Listing Status	National listing status	Habitat components and abundance present	Included or excluded	Reasoning
							breeding camps present
Swainsona sericea Silky Swainson-pea	Box-gum woodland in southern tablelands and South West Slopes. Sometimes in association with cypress pines.	High	Vulnerable	Not Listed	Box-gum woodland present, though degraded	Excluded	Habitat degraded such that species is unlikely to occur
Thesium australe Austral Toadflax	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda triandra*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	High	Vulnerable	Vulnerable	Grassy woodland present but contains little Kangaroo Grass	Excluded	Habitat degraded such that species is unlikely to occur
Tyto novaehollandiae Masked Owl (Breeding)	Living or dead trees with hollows greater than 20cm diameter. Paddock trees may be used. There is no seasonal variation in its distribution. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	High	Vulnerable	Not listed	Potential breeding HBTs present	Included	Habitat present, survey undertaken

4.2.2 Inclusions and exclusions based on habitat features and geographic limitations

The following species credit species have been either included or excluded from further assessment based on the lack of habitat features or geographic limitations associated with the species not being met. habitat features present development site.

Table 4-2 Species credit species included and excluded based on habitat features

Species Credit Species	Habitat constraints, components and geographic limitations	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Anthochaera phrygia Regent Honeyeater (Breeding)	Mapped Important areas (DPIE)	Outside mapped important areas (DPIE)	Excluded	Not mapped as an important habitat area
Callitris oblonga Pygmy Cypress Pine	Usually grows in sand along watercourses in shrubland and open woodland in granite country; it also occurs in drier sites, including exposed ridges. East of Chandler River	One watercourse present. Some rocky areas	Excluded	Subject land not east of Chandler River
Chalinolobus dwyeri Large-eared Pied Bat	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	No suitable habitat present	Excluded	No suitable breeding habitat in development site
Chiloglottis platyptera Barrington Tops Ant Orchid	Grows in moist areas in tall open eucalypt forest with a grassy understorey, and also around rainforest edges. It generally occurs in rich brown loam soils	No moist areas or rainforest edges present which could support this species	Excluded	Habitat not present
Grevillea beadleana Beadle's Grevillea	Oxley Wild Rivers National Park or within a 10 km buffer of the NP. Within 200 m of cliffs, escarpments or rocky areas.	Not within 10 km of Oxley Rivers National Park	Excluded	Geographic limitation not met
Lathamus discolor Swift Parrot	Mapped Important areas (DPIE)	Outside mapped important areas (DPIE)	Excluded	Outside mapped important area (DPIE)
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	Caves are the primary roosting habitat, but also use	No suitable habitat present	Excluded	No suitable breeding habitat present

Species Credit Species	Habitat constraints, components and geographic limitations	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
(Breeding)	derelict mines, storm-water tunnels, buildings and other man-made structures.			
Ninox strenua Powerful Owl (Breeding)	Living or dead trees with hollow greater than 20 cm diameter. Within 5 km of Macleay Georges subregion	Breeding constraint present, not within geographic limitation	Excluded	Geographic limitation not met
Petrogale penicillata Brush-tailed Rock Wallaby	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	Habitat constraints not present	Excluded	Habitat constraints not present
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	Breeding camps. Breeding camps will need to be identified by survey	Breeding camps not present	Excluded	Habitat assessment undertaken indicated no breeding camps are present

4.2.3 Exclusions based on habitat quality

Under Section 6.4.1.17 of the BAM, a species credit species can be considered unlikely to occur on a development site (or within specific vegetation zones) if following field assessment it is determined that the habitat is substantially degraded such that the species is unlikely to utilise the development site (or specific vegetation zones). These species are identified in Table 4-3 along with justification regarding the habitats present.

Table 4-3 Species credit species excluded based on habitat quality

Species Credit Species	Habitat constraints, components and geographic limitations	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Adelotus brevis - endangered population Tusked Frog population in the Nandewar and New England Tableland Bioregions	Rainforests, wet forests and flooded grassland and pasture. They are usually found near creeks, ditches and ponds, and call while hidden amongst vegetation or debris	No moist plant community types present. Duval Creek unsuitable habitat and is dry at the time of writing. Duval Creek is unlikely to be able to support the species.	Excluded	Habitat degraded such that the species is unlikely to occur
Cercartetus nanus Eastern Pygmy-possum	Relies on hollow bearing for breeding and nesting as well as banksia, eucalypts and callistemon for foraging.	Suitable HBTs present within development site, however, PCTs present lack key foraging resources and connectivity such that the subject land is unlikely to be able to support the species.	Excluded	Habitat degraded such that species is unlikely to occur
Diuris pedunculata Small Snake Orchid	Grows on grassy slopes or flats. Often on peaty soils in moist areas. Also on shale and trap soils, on fine granite, and among boulders	Grassy slopes flats present. No boulders or moist areas.	Excluded	Habitat degraded such that the species is unlikely to occur. Unlikely the species would persist through years of stock grazing.
Haloragis exalata subsp. velutina Tall Velvet Sea-berry	Grows in damp places near watercourses and woodland on steep rocky slopes of gorges.	Watercourses present but have been dry for over 12 months. No steep rocky slopes of gorges present.	Excluded	Habitat degraded such that the species is unlikely to occur
Lepidium hyssopifolium Aromatic Peppercress	In NSW the species was known to have occurred in both woodland with a grassy understorey and in grassland	Woodland and grassland present, but highly degraded due to land use.	Excluded	Habitat degraded such that species is unlikely to occur
Litoria subglandulosa Glandular Frog	Glandular Frogs may be found along streams in rainforest, moist and dry eucalypt forest or in subalpine swamps.	Duval Creek only waterbody, which is dry at the time or writing. Subject land is unlikely to be able to support the species.	Excluded	Habitat degraded such that species is unlikely to occur
Picris evae Hawkweed	Its main habitat is open Eucalypt forest including a canopy of *Eucalyptus melliodora*.	Woodland containing Yellow Box present, but highly degraded due to land use.	Excluded	Habitat degraded such that species is unlikely to occur

Species Credit Species	Habitat constraints, components and geographic limitations	Habitat components and abundance on site	Included or excluded	Reason for inclusion or exclusion
Swainsona sericea Silky Swainson-pea	Found in Natural Temperate Grassland and Snow Gum Eucalyptus pauciflora Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes.	Box-gum woodland present, but highly degraded due to land use.	Excluded	Habitat degraded such that species is unlikely to occur
Thesium australe Austral Toadflax	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Grassy woodland present but highly degraded due to land use. Kangaroo Grass not recorded during surveys.	Excluded	Habitat degraded such that species is unlikely to occur

4.2.4 Candidate species requiring confirmation of presence or absence

The species listed in Table 4-4 are those that are considered to have habitats present at the development site. None of these species are assumed to be present on the site. Surveys have been conducted for the remaining species. The results are summarised in Table 4-4. Details of the survey methodologies and results are provided for each surveyed species are provided below. Targeted survey locations are mapped on Figure 4-1.

Species polygons have been defined for the species present on the site as mapped on Figure 4 1.

Table 4-4 Summary of species credit species requiring confirmation of presence or absence

Species Credit Species	Biodiversity risk weighting	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Bertya ingramii Narrow-leaved Bertya	3	Surveyed November 2019	No	NA
Boronia granitica Granite Boronia	2	Surveyed November 2019	No	NA
Burhinus grallarius Bush Stone-curlew	2	Surveyed November 2019	No	NA

Species Credit Species	Biodiversity risk weighting	Assumed to occur/survey/ expert report	Present on site?	Species polygon area or count
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	2	Surveyed August 2019	No	NA
Dichanthium setosum Bluegrass	2	Assumed to occur	Yes	120.1 ha
Eucalyptus magnificata Northern Blue Box	2	Surveyed August 2019	No	NA
Eucalyptus nicholli Narrow-leaved Black Peppermint	2	Surveyed August 2019	No	NA
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	2	Surveyed August 2019	No	NA
Hieraaetus morphnoides Little Eagle (Breeding)	1.5	Surveyed August 2019	No	NA
Hoplocephalus bitorquatus Pale-headed Snake	2	Assumed to occur	Yes	12.6 ha
Lophoictinia isura Square-tailed Kite (Breeding)	1.5	Surveyed November 2019	No	NA
Myotis macropus Southern Myotis	2	Surveyed November 2019. Recorded during survey.	Yes	57.2 ha
Ninox connivens Barking Owl (Breeding)	2	Surveyed August 2019	No	NA
Petaurus norfolcensis Squirrel Glider	2	Surveyed August and November 2019	No	NA
Phascolarctos cinereus Koala (Breeding)	2	Surveyed August and November 2019 Recorded during November 2019 survey	Yes, sections of the development site containing higher frequency of feed trees considered to constitute important habitat for breeding	12.6 ha
Tyto novaehollandiae Masked Owl (Breeding)	2	Surveyed August 2019	No	NA

Targeted surveys were undertaken over two visits to the development site from August 2019 to November 2019 inclusive. Prior, two site visits had taken place in August and November 2018 to stratify the development site and assess it for habitat values and constraints that would later be used to establish the list of candidate species to be targeted. A summary of the targeted surveys undertaken including weather conditions for survey dates from the Bureau of Meteorology (BOM) at the Tree Group Nursery (station 056037) and Armidale Airport AWS (station 056238) is provided in Table 4-5 below. Details regarding survey effort and methodology for candidate species requiring assessment follow. Bluegrass *Dichanthium setosum* is required to be surveyed for during November to May after effective rainfall. As these conditions could not be met, the species has been assumed to be present across all zones where potential habitat is deemed present, that is Zones 1, 2, 4, 5 and 6. Similarly, Pale-headed Snake *Hoplocephalus bitorquatus* is advised to be surveyed 1-2 days after rainfall and on humid nights, conditions that could not be satisfied. Pale-headed Snake has been assumed to occur across treed areas of PCT 704 (the species PCT associate) near water features for foraging and that have some connectivity and HBTs for sheltering. This includes Zone 5 and 6.

Table 4-5 Summary of targeted survey and weather conditions

Survey Date	Maximum temperature (ºC)	Minimum temperature (ºC)	Rainfall (mm) on survey date, preceding 14 days	Max wind gust (km/h)	Candidate species targeted
13th August 2019	-5.7	15.6	0, 7	30	Barking Owl, Masked Owl, Glossy Black-Cockatoo, White-bellied Sea Eagle, Little Eagle, Squirrel Glider, Koala, Northern Blue Box, Narrow-leaved Black Peppermint
14th August 2019	-5.5	16.6	0, 7	33	Barking Owl, Masked Owl, Glossy Black-Cockatoo, White-bellied Sea Eagle, Little Eagle, Squirrel Glider, Koala, Northern Blue Box, Narrow-leaved Black Peppermint
15th August 2019	-4.3	16.9	0, 7	44	Glossy Black-Cockatoo, White-bellied Sea Eagle, Little Eagle, Koala, Northern Blue Box, Narrow-leaved Black Peppermint
18th November 2019	27	8.4	0	39	Square-tailed Kite, Bush Stone-Curlew, Squirrel Glider, Koala, Southern Myotis
19th November 2019	30.4	5.4	0		Square-tailed Kite, Bush Stone-Curlew, Squirrel Glider, Koala, Southern Myotis
20th November 2019	34.6	6.8	0		Square-tailed Kite, Koala, Southern Myotis, Narrow-leaved Bertya, Granite Boronia
21st November 2019	32.6	10.7	0		Square-tailed Kite, Koala, Southern Myotis

Diurnal birds (Glossy Black Cockatoo, White-bellied Sea Eagle, Little Eagle and Square-tailed Kite)

SURVEY EFFORT

Opportunistic surveys were undertaken across 13th – 15th August and 18th – 21st November 2019 including traversing the site by car and on foot. Opportunistic sightings of birds were also recorded during all field surveys.

Surveys for large stick nests were undertaken during August for White-bellied Sea Eagle and Little Eagle, and again during November targeting Square-tailed Kite.

All trees within the development footprint were surveyed for the presence of hollows during the 14th and 15th August. The number, size and height of hollows were recorded for each tree along with any evidence of use to identify suitable breeding habitat for Glossy Black-Cockatoo. Hollows were categorised as small (< 10 cm), medium (10 – 20 cm), and large (> 20 cm).

SURVEY RESULTS

None of the targeted candidate diurnal avifauna species or evidence of breeding (i.e. large stick nests for raptors) were observed during the surveys.

Hollow-bearing trees were identified within the development footprint (APPENDIX D), however, none with suitable attributes (hollow greater than 15 cm an 5 m or more above the ground (DPIE 2019) displayed evidence of breeding by Glossy Black-Cockatoo.

A full list of bird species observed during the surveys is shown in APPENDIX B.

Nocturnal birds (Bush Stone-Curlew, Barking Owl and Masked Owl)

SURVEY EFFORT

Targeted surveys were conducted for nocturnal birds across the evenings of the 13th – 14th August (Barking Owl and Masked Owl) and 18th – 19th November (Bush Stone-Curlew). The owl species were targeted at two locations involving call-playback and spotlighting for three person hours per night. Similarly, Bush Stone-Curlew was targeted at two locations involving call-playback and spotlighting for three person hours per night. Call-playback was followed by a period of listening then spotlighting in all instances.

SURVEY RESULTS

No threatened birds were seen or heard during the survey. Generally, presence of nocturnal bird species was highly limited and with only a Tawny Frogmouth *Podargus strigoides*. It is not considered that breeding of the surveyed species occurs within the development site.

Nocturnal mammals (Squirrel Glider and Koala)

SURVEY EFFORT

Spotlighting surveys undertaken across the 13th and 14th August are considered to contribute to the survey effort for Squirrel Glider and Koala, with further survey, including call-playback for Squirrel Glider and Koala across the evenings of the 18th and 19th November for three person hours per night. Targeted searches for Koalas were undertaken during the day on the 13th -15th August (as HBTs were and catalogued) and again across the 18th - 21st November. Mature feed trees via Spot Assessment Technique (SAT) were searched for signs of Koalas such as scats and scratches at four locations.

SURVEY RESULTS

No Koalas were observed during the surveys; however, faecal pellets were found at SAT Site 2 as well as a possible call during one nights' survey. Therefore, Koala are considered to be present within the development site. Although faecal pellets were found at only one tree out of the 120 trees surveyed and that the quality of habitat is considered low overall, sections of PCT 704 that contain a higher frequency of primary and secondary feed trees (Ribbon Gum, Yellow Box and Blakely's Red Gum) are considered to constitute important habitat for Koala breeding in accordance with the Threatened Biodiversity Data Collection. A species polygon for Koala has been produced accordingly, as shown of Figure 4-1.

No Squirrel Gliders were heard or observed. During November 2019, only one nocturnal mammal was observed, that of a Brush-tailed Possum *Trichosurus vulpecula*. During the August 2019 surveys, a Greater Glider *Petauroides volans*, which has been recorded in Duval Nature Reserve as recently as 2009 (DPIE 2019), was recorded within Zone 1 in the west of the development site, outside the development footprint. Greater Glider are listed as Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) only. Impacts to this species are discussed in Section 7.5.

Threatened trees (Narrow-leaved Black Peppermint and Northern Blue Box)

SURVEY EFFORT

All trees within the development footprint were surveyed across the 13th – 15th August 2019 for the potential to be Narrow-leaved Black Peppermint or Northern Blue Box.

SURVEY RESULTS

Neither species were found to be present within the development footprint.

Southern Myotis

SURVEY EFFORT

The habitat constraint for Southern Myotis is HBTs or suitable artificial roosting structures within 200 m of a waterbody with pools/stretches 3 m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land (DPIE 2019). As Duval Creek was found to be dry during November 2019 surveys, the two farm dams that contained sufficient water were targeted using passive bat detectors (Anabat Swift from Titley Scientific) across the nights of the 18th – 20th November. Two nights at one location and one night at the other.

SURVEY RESULTS

Calls were downloaded and converted from full spectrum calls to Zero-crossing calls using Wildlife Acoustics Kaleidoscope software, then analysed through AnalookW. Analysis was undertaken and assessed with reference to Bat Calls of New South Wales (Pennay, Law and Reinhold 2004). Reference calls were used for comparison and species confirmation.

Analysis of data revealed the definite, probable, or possible presence of six microbat species:

- Lesser Long-eared Bat *Nyctophilus geoffroyi* (Probable) – non-threatened

- *Nyctophilus sp.* (Possible) – non-threatened
- Chocolate Wattled Bat *Chalinolobus morio* (Definite) – non-threatened
- Southern Myotis *Myotis macropus* (Probable) – Target Species Credit Species (Vulnerable)
- Greater Broad-nosed Bat *Scoteanax rueppellii* – Ecosystem Credit Species (Vulnerable)
- Little Forest Bat *Vespadelus vulturnus* (Definite) – non-threatened

A species polygon for Southern Myotis has been produced by buffering Duval Creek and all nine dams within the development site by 200 m as per the TBDC. This is shown on Figure 4-1. The area covered by the species polygon has been entered into the BAM-C for each affected zone to calculate species credits required to be offset for Southern Myotis.

Shrubs (Narrow-leaved Bertya and Granite Boronia)

SURVEY EFFORT

Areas of outcropping in the north-east of Zone 1 were searched via parallel field traverses in accordance with the NSW Guide for Surveying Threatened Plants during November 2019.

SURVEY RESULTS

Neither species were found to be present within the development footprint.

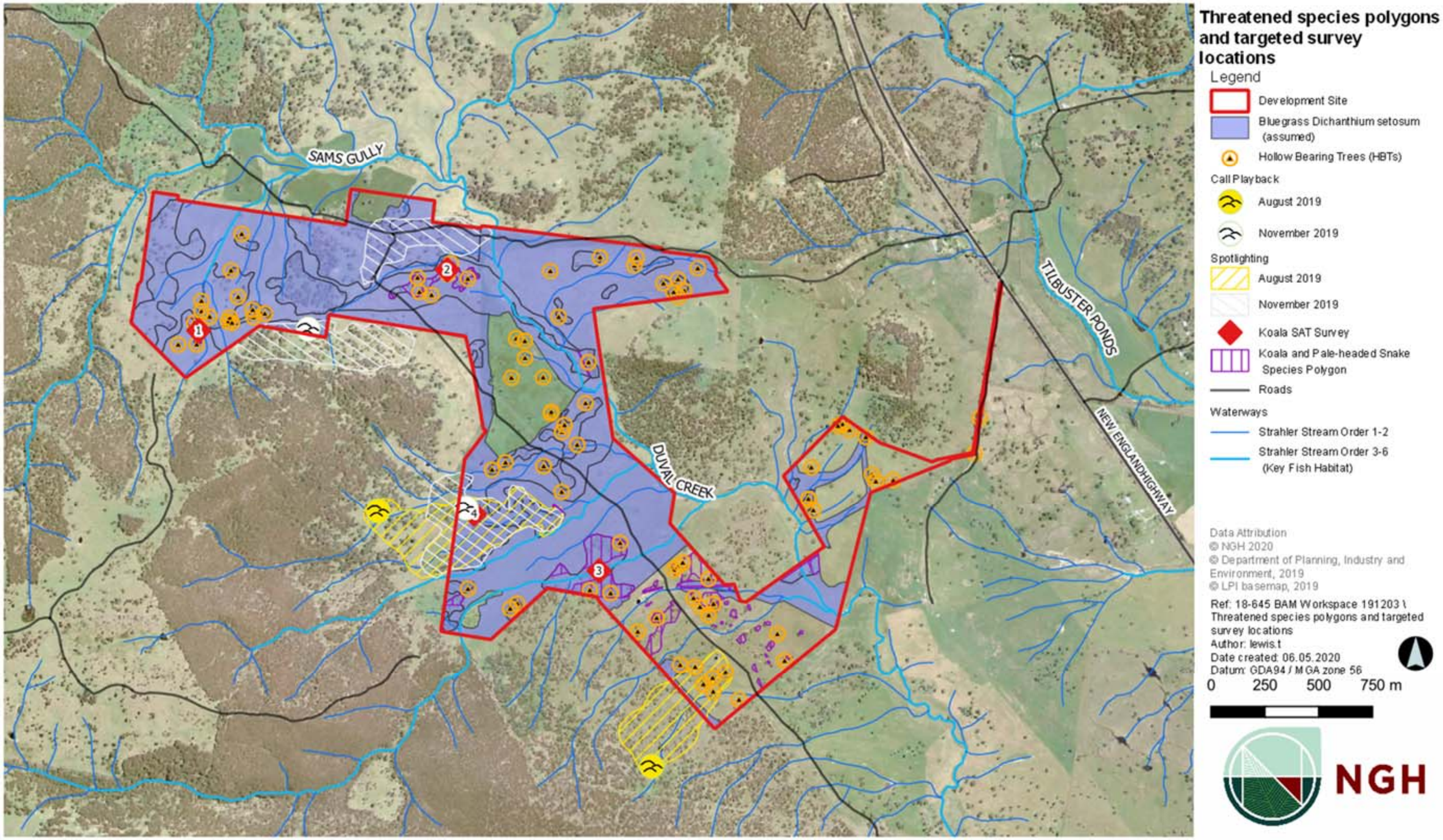
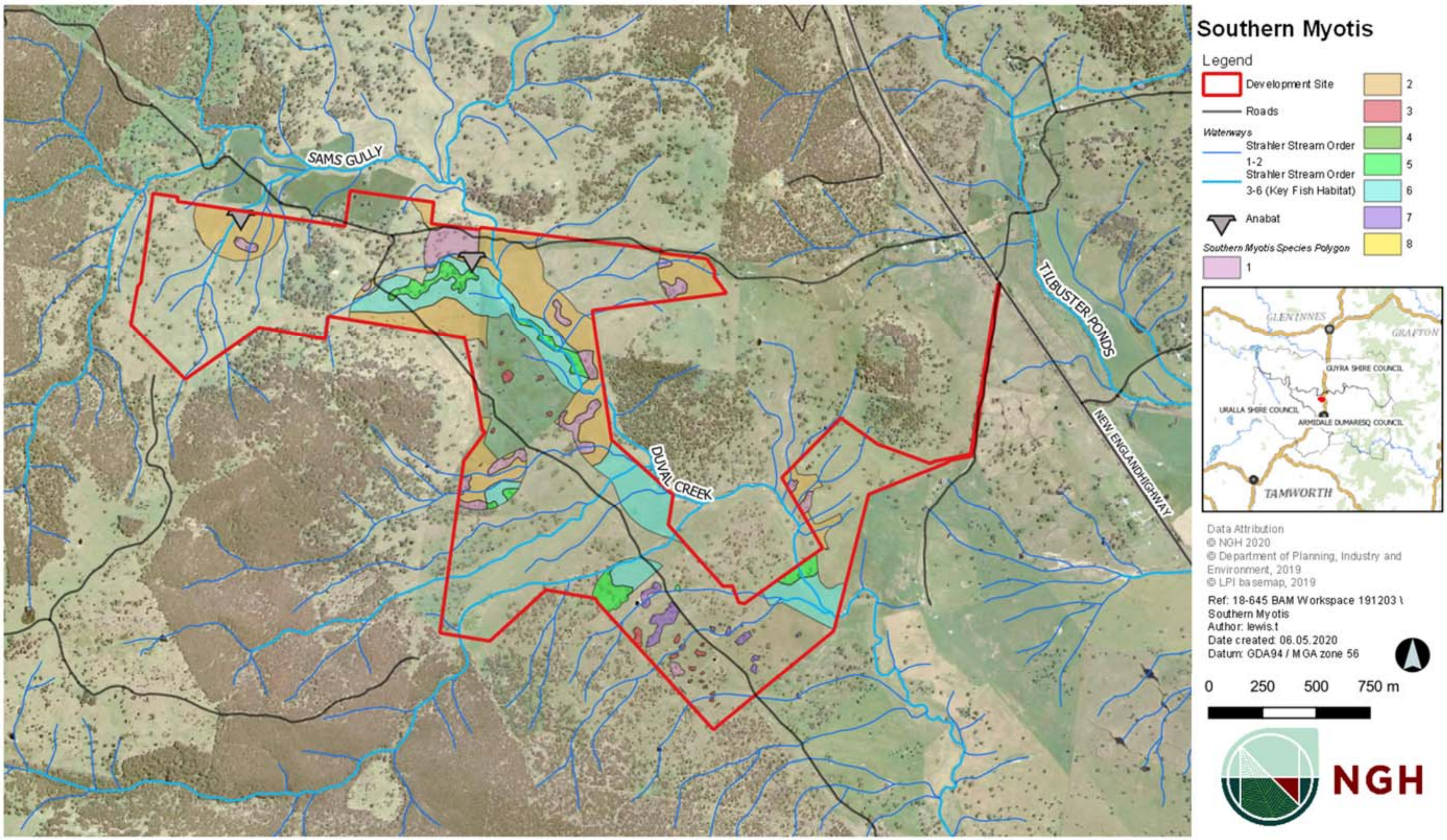


Figure 4-1 Threatened species polygons and targeted survey locations


Southern Myotis
Legend
Development Site
Roads
Waterways
Strahler Stream Order 1-2
Strahler Stream Order 3-6 (Key Fish Habitat)
Anabat
Southern Myotis Species Polygon
1
2
3
4
5
6
7
8
SAMS GULLY
DUVAL CREEK
TILBUSTER PONDS
NEW ENGLAND HIGHWAY
GLEN INNES
GRAFTON
GUYRA SHIRE COUNCIL
URALLA SHIRE COUNCIL
ARMIDALE DUMARESQ COUNCIL
TAMWORTH
Data Attribution
© NGH 2020
© Department of Planning, Industry and Environment, 2019
© LPI basemap, 2019
Ref: 18-645 BAM Workspace 191203 \ Southern Myotis
Author: lewis.t
Date created: 06.05.2020
Datum: GDA94 / MGA zone 56
0 250 500 750 m
NGH

4.3 ADDITIONAL HABITAT FEATURES RELEVANT TO PRESCRIBED BIODIVERSITY IMPACTS

4.3.1 Occurrences of karst, caves, crevices and cliffs

No karst, caves, crevices or cliffs occur within the development site.

4.3.2 Occurrences of rock

Isolated areas of rock outcrop were observed within Zone 1 in the north-east of the development site consisting of largely embedded rock and sporadic loose rock. They occur primarily in conjunction with small, isolated patches of remnant woodland (PCT 567). The groundcover in these locations, as with the majority of the development site, has been subject to heavy grazing.

Further to the above and as mentioned in Section 2.8, a formation known as 'Red Rock' occurs in the north-east of the development site.

Figure 4-2 Example of rock outcropping in the north-east of Zone 1

These outcrops are not considered potential habitat for species credit candidates such as Large-eyed Pied Bat or Brush-tailed Rock Wallaby. Species credit flora candidates associated with rock outcropping have all been surveyed for.

4.3.3 Occurrences of human made structures and non-native vegetation

No human-made structures that could be used by threatened species occur within the development site

Non-native vegetation within the development site consists of both cleared paddocks with improved pasture species such as *Vulpia* as well as a drainage line in the west of the development site that contains a *Salix* sp. No threatened species are considered to rely on the non-native vegetation within the development site, however, they may be used for forage of traversal for species such as Southern Myotis on occasion.

Figure 4-3 Exotic vegetation in the west of the development site

4.3.4 Hydrological processes that sustain and interact with the rivers, streams and wetlands

Duval Creek is a fifth order stream under the Strahler stream classification system (Strahler 1952) and is situated north to south within the development site. The riparian vegetation has been subject to modification due to historical agricultural land use such that little native canopy remains and a midstorey is absent. This historical clearing has caused the banks to erode significantly along its length within the development site. While Duval Creek was dry during August and November 2019, available moisture does collect in some places that generally creates mud rather than pooling. Cumbungi *Typha* sp. is generally associated with these damp areas.

Unnamed drainage lines, tributaries of Duval Creek, occur on occasion throughout the development site. Some are third and second order streams (Strahler 1952) but most are first order. These drainage lines are ephemeral and have been extensively modified through internal roads and surrounding land use. All were dry during the August and November 2019 site visits, though they would feed Duval Creek during periods of sufficient precipitation. Duval Creek represents Key Fish Habitat (Type 3 – minimally sensitive key fish habitat) (DPIE 2013 update). No waterway within the development site is mapped as threatened aquatic fauna habitat on Fisheries NSW Spatial Data Portal and Duval Creek has a Freshwater Fish Community Status of 'Poor'.

Although 11 water crossings are required, it is not anticipated that these drainage lines and Duval Creek would be significantly impacted or have broader impacts for environments that sustain and interact with the rivers, streams and wetlands either on or offsite.

Figure 4-4 Duval Creek during August 2019 site visit

5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC Act protected matters report was undertaken on 2 October 2019 (10 km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site (APPENDIX E). Relevant to Biodiversity these include:

- Wetlands of International Importance
- Threatened Ecological Communities
- Threatened species
- Migratory species

The potential for these MNES to occur at the site are discussed below.

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Four wetlands of international importance were returned from the protected matters report. The nearest of these (within 200 – 300 km upstream of the development site) is the Gwydir Wetlands. All other wetlands returned from the search are over 1000 km away. The Gwydir Wetlands occur approximately 344 km to the north-east north of the development site. There is no apparent connectivity between waters that feed this wetland and those within the development site.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Three threatened ecological communities were returned from the protected matters report. One of these, the critically endangered *White box - Yellow box - Blakely's red gum grassy woodlands and derived native grasslands* (Box-gum Woodland CEEC), has been found to occur within the development site, predominantly in the west and north where larger patches of PCTs 567 and 704 are present and where disturbed remnants within the development site adjoin bushland that is likely to represent the TEC outside the development site, such that they are considered part of the same patch.

Patches of bushland can be considered Box-gum Woodland CEEC in two ways:

- either they have a predominantly native understory of perennial species, be greater than 0.1 ha in size, and contain an important species, or
- either they have a predominantly native understory of perennial species, be greater than 2 ha in size, and contain an average of 20 or mature trees per hectare.

Patches of bushland within the development site qualify as Box-gum Woodland CEEC using either pathway. Areas in the north, that have been avoided by the development footprint meet the requirements of the first pathway, whereas more disturbed patches, typically along the western boundary of the development site, have qualified via the second. This is possible due to their connectivity to vegetation outside the development site that, on balance, are considered likely to contain a suitable understory, sufficient total patch size and frequency of mature trees.

5.3 THREATENED SPECIES

Twenty-nine threatened species were returned from the protected matters report, excluding marine and wetland migratory species. Of these, three are considered to have the potential to utilise the habitats at the development site (APPENDIX F):

- Greater Glider *Petaurus volans* – Vulnerable. Recorded during August 2019 surveys in Zone 1 outside the development footprint near the western boundary of the development site. Habitat for this species within the development site is generally limited to the ribbons of wooded vegetation that remain at this location. Given the disconnectedness and patchiness of the other wooded vegetation present within the development site, Greater Glider are considered unlikely to currently be able to traverse from one side of the development site to the other, given breaks in canopy cover.
- Koala *Phascolarctos cinereus* – Vulnerable. The majority of wooded vegetation within the development site contains foraging habitat in the form of known Koala feed trees, however, given the degree of clearing within the development site, this has reduced the quality of this habitat. Koala may still utilise the development site on occasion, as was evidenced by the presence of Koala scat at Sat Site 2 (Figure 4-1), for forage and traversal, though more vegetated areas surrounding the development site are likely to be preferred. It is possible that Koala utilise the development site for means of traversal across a home range.
- Bluegrass *Dichanthium setosum* – Vulnerable. Not detected incidentally and not likely to be detectable during the timing of the November 2019 survey due to drought conditions. Bluegrass has BioNet records within 10 km of the development site. Potential habitat is present given the soil landscape and the species ability to persist in highly disturbed pasture.

Impacts to Greater Glider, Koala, and Bluegrass are discussed in Section 7.5.

5.4 MIGRATORY SPECIES

Five listed migratory species were returned from the protected matters report. None of these species are considered likely to occur at the site on a regular basis or rely on the habitats present.

6 AVOID AND MINIMISE IMPACTS

6.1 AVOIDING AND MINIMISING IMPACTS ON NATIVE VEGETATION AND HABITAT

6.1.1 Site selection – consideration of alternative locations/routes

Enerparc reviewed a large number of sites on which to build a solar farm before selecting the Tilbuster Solar development site. While it would have been possible to construct and operate the solar farm at some of the sites investigated, Enerparc considers the development site to be the most suitable for the construction of a solar farm due to the following factors:

- Connection and capacity:
  - The site is located approximately 17 km from the Armidale 330 kV substation and as such, a suitable location for connecting new energy generation.
  - An existing 330 kV transmission line traverses the site which means the that the connection to the high voltage network can be made without the need to construct any transmission lines.
- Solar exposure:
  - The site has high solar exposure measuring 19-20 MJ/m^2.
  - Enerparc are monitoring relevant weather, including irradiance, with the aim of gathering one year of comprehensive data.
- Stakeholder interest:
  - Very few non-involved dwellings would be impacted by the development.
  - Substantial community support in the area for renewable projects.
- Land suitability:
  - The site has already been cleared and heavily disturbed by cultivation and grazing.
  - The terrain is relatively flat.

6.1.2 Proposal components – consideration of alternate modes or technologies

The Australian Government's Large-scale Renewable Energy Target (LRET) and NSW Government's Renewable Energy Action Plan (REAP) outline the commitment by both Australia and NSW more specifically to reducing GHG emissions and have set targets for increasing the supply of renewable energy. Other forms of largescale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depend on the availability of energy resources and grid capacity.

PV solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site. Unlike wind farms, which are installed on elevated topography, solar energy farms can be effectively screened by vegetation to reduce the impact of visual disturbance, which would also provide additional habitat for local fauna. Solar energy farms also have few moving parts and are less likely to interfere with bird flight patterns.

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

6.1.3 Proposal planning phase – detailed design

A preliminary constraints analysis was conducted by NGH (2018) which informed the site layout design. Vegetation constituting the highest ecological constraints such as forming components of TECs, providing threatened flora and fauna habitat and connectivity features were avoided and minimised as far as practical by:

- reducing the clearing footprint of the project by avoiding larger, more intact areas of wooded vegetation
- locating ancillary facilities in areas where there are no biodiversity values
- locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)
- locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)
- making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.

The final site layout and location has not been able to completely avoid all areas of biodiversity value as smaller areas of wooded vegetation would be removed. However, about 65% (or 54.7 ha) has been avoided.

The final design footprint is detailed in Figure 6 1.

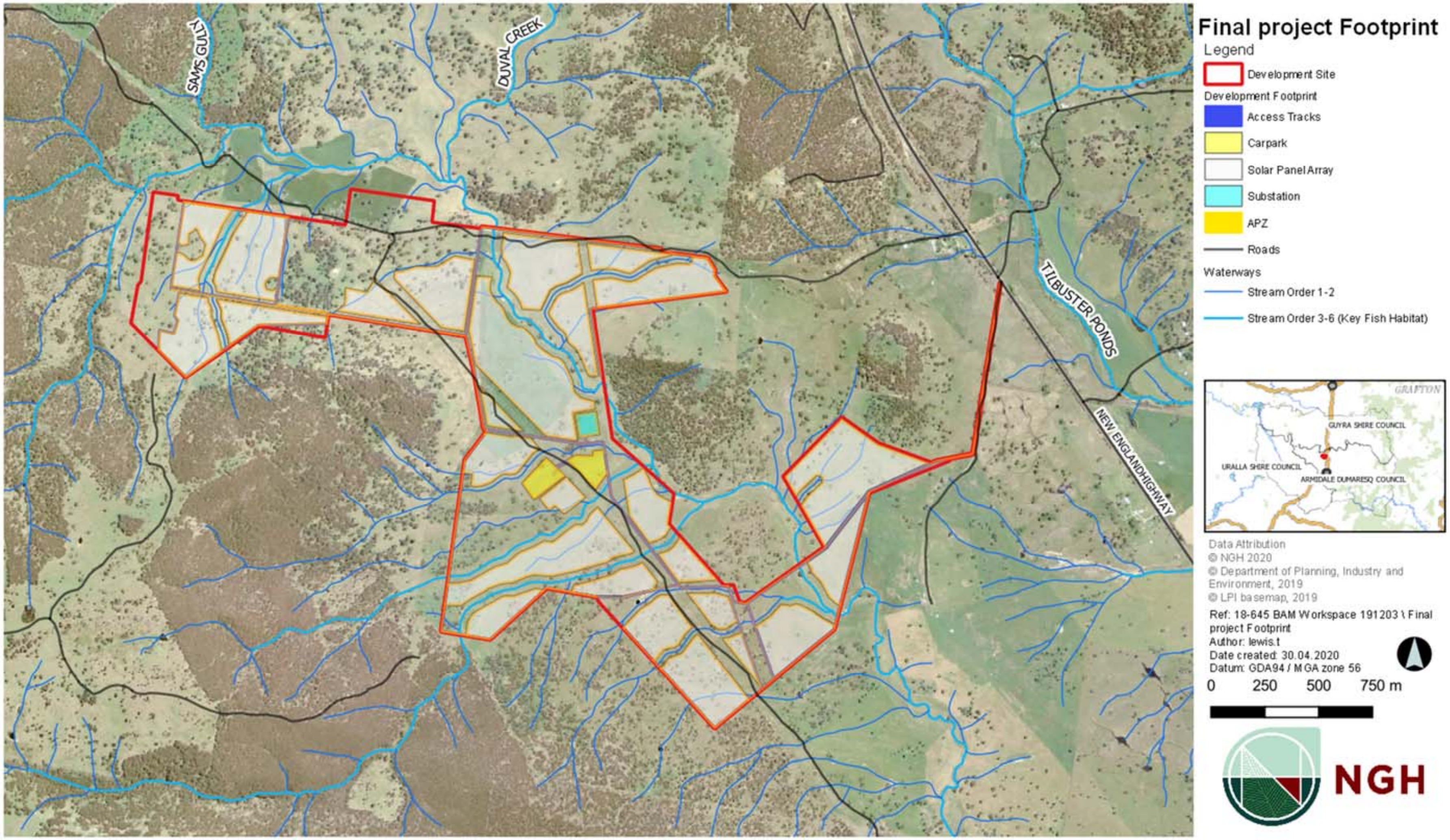


Figure 6-1 Final project footprint

6.2 AVOIDING AND MINIMISING PRESCRIBED BIODIVERSITY IMPACTS

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme:

a) Impacts of development on the habitat of threatened species or ecological communities associated with:
    - karst, caves, crevices, cliffs and other geological features of significance, or
    - rocks, or
    - human made structures, or
    - non-native vegetation
b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
c) Impacts of development on movement of threatened species that maintains their life cycle
d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
e) Impacts of wind turbine strikes on protected animals
f) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

The following prescribed impacts are relevant to the proposal:

a) Impacts of development on the habitat of threatened species or ecological communities associated with:
    - karst, caves, crevices, cliffs and other geological features of significance, or
    - rocks, or
    - non-native vegetation
b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
c) Impacts of development on movement of threatened species that maintains their life cycle
d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

How these prescribed impacts have been avoided and minimised by the proposal is detailed below.

6.2.1 Impacts of development on the habitat of threatened species or ecological communities associated with geological features of significance

An area of geological significance, known as 'Red Rock' occurs within the development footprint in the north-east of the development site. Whilst a feature in the landscape, this area is not considered to present potential habitat for any species credit species predicted to occur or for Box-gum Woodland EEC present within the development site.

6.2.2 Impacts of development on the habitat of threatened species or ecological communities associated with rocks

Isolated areas of rock outcrop occur within Zone 1 and 2 in the north-east of the development site consisting of largely embedded rock and sporadic loose rock. Some are associated with small, isolated patches of remnant woodland (Zone 1). The groundcover in these locations, as with the majority of the development site, has been subject to heavy grazing.

The rocky areas, on their own, are not considered to constitute habitat for any species credit species predicted to occur. A limited number of Yellow Box are present, which form part of Box-gum Woodland EEC.

6.2.3 Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation

The development site and footprint contains a patch of non-native vegetation near the western boundary. This area is dominated by *Salix* sp. Threatened species are unlikely to rely on this habitat, however, it may be used for traversal by highly mobile threatened fauna such as avifauna. As it is associated with a drainage line, much of this area has been avoided, however, 0.27 ha would be removed.

6.2.4 Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

As discussed in Section 2.7, connectivity of treed vegetation through the development site is poor. Where it is greatest, in the north of the development site, the development footprint has avoided and minimised vegetation removal, such the present state of connectivity in this area would be maintained. Avifauna would not be inhibited from moving through the development site. Threatened species that require a consistent canopy, such as arboreal mammals, are already unlikely to utilise the development site for traversal across their range given the current degree of disconnect between trees and patches of trees. The layout of the proposal has sought to maintain the current level of connectivity for such species in the north as stated, and also in the south.

Mitigation measures, including the use of fauna friendly fencing, would be implemented to assist the movement of fauna that utilise the ground, such as Koala, through the development site post construction in areas of greatest connectivity. Southern Myotis and Greater Broad-nosed Bat, given their manoeuvrability, are unlikely to be inhibited from moving across their range by the proposal.

6.2.5 Impacts of development on the movement of threatened species that maintains their life cycle

The development site is not a known migratory path for threatened species and as discussed in Section 6.2.4, present connectivity across the development site is poor for species that require consistent canopy for traversal. This limits the potential for the development site to act as a pathway for threatened species traversing the landscape to complete their lifecycle. Nevertheless, the development footprint has avoided where connectivity is as it greatest, maintaining the most likely area to be utilised by dispersing threatened species such as Koala. Given the nature of the proposal, avifauna would not be inhibited from moving through the development site.

Mitigation measures, including the use of fauna friendly fencing, would be implemented to assist the movement of fauna, such as Koala, through the development site post construction. Southern Myotis and Greater Broad-nosed Bat, given their manoeuvrability, are unlikely to be inhibited from conducting the movement required to complete their lifecycle by the proposal.

6.2.6 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

As mentioned in Sections 2.5 and 2.6, Duval Creek and a number of similarly ephemeral tributaries occur within the development site. In addition to this, nine farm dams are also present. During the August and November 2019 surveys, all water features within the development site, with the exception of two farm dams, were dry. Nevertheless, they may still play a role in sustaining threatened species that may utilise the development site such as Southern Myotis as well as the occurrence of *White box Yellow box Blakely's red gum woodland* (Box-gum Woodland EEC). Koala, long believed to not require the consumption of free water, during summer heatwaves and as present drought conditions intensify reduce moisture levels within eucalyptus leaves, may utilise such resources more readily.

Not all of the waterways and drainage lines within the development site can be avoided by the development footprint. Some crossings will be required for access tracks that would be used during construction and operation of the proposal. The indicative layout has identified the most likely crossings; eleven in total, three of which are across Duval Creek which are proposed to be bridges or fords to minimise any hydraulic impact. Two fords are already present across Duval Creek within the development site. No all dams have been avoided; five of the nine dams present would be filled which are potential foraging habitat for Southern Myotis.

A hydrological assessment (Footprint 2020) completed for the proposal, did not predict a significant impact on flood behaviour within the floodplain as a result of the proposal, as flood levels, depths, velocities and hazards remaining relatively would remain relatively unchanged. Sediment and erosion and pollution control measures will be put in place during construction to maintain water quality moving outside of the development site. No indirect impacts to the dams or rivers downstream are considered likely.

6.2.7 Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

Vehicle strikes on threatened species is limited presently as the development site is wholly farmland and situated over 700 m from the nearest major roadway, the New England Highway. The potential for vehicle strikes on threatened species, such as Koala, is largely restricted to the construction phase of the proposal. However, maintenance vehicles will also be present within the development site for the proposal's duration.

Avoiding vehicle strikes is action that takes place on a situational basis; however, the risk can be minimised. To increase the likelihood that vehicle strikes are avoided, mitigation measure such as warning signage, speed limits and education of construction personnel would be implemented.

7 IMPACTS UNABLE TO BE AVOIDED

7.1 DIRECT IMPACTS

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure.

Shading is also considered a direct impact. Most of the development footprint will be used to mount solar panels above the ground. The impacts of shading and of diversion of rainfall runoff from the panels on the groundcover beneath the panels is largely unknown. For the purpose of this BDAR, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial under panel areas are likely to be retained in fairly similar condition. It is likely that several perennial native species will persist underneath the solar arrays.

Certainly, only a minor proportion of the seed bank in the 113.7 ha affected by shading will be impacted, given the limited excavation proposed. This is therefore a 'worst case' conservative approach to the assessment of impacts. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact extent; such as the results of ground cover monitoring beneath solar arrays in a comparable situation (geographic location, species assemblage). Therefore, the costs associated with purchasing and retiring ecosystem and species credits or the need for offset areas is currently an 'over estimated result' of the impacts of this solar farm undertaken to address current uncertainty.

Table 7-1 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Direct impacts				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	14.9 ha (Zone 1) 61.4 ha (Zone 2) 1.7 ha (Zone 3) 0.2 ha (Zone 4) 8.3 ha (Zone 5) 35.9 ha (Zone 6) 4.3 ha (Zone 7) 0.7 ha (Zone 8) Total = 127.4 ha	Regular	Construction	• Direct loss of native flora and fauna habitat • Potential over-clearing of habitat outside proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock
Displacement of resident fauna	Unknown	Regular	Construction, operation	• Direct loss of native fauna • Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction	• Direct loss of native fauna • Decline in local fauna populations
Disruption to connectivity	Removal of 30.1 ha of wooded vegetation, permanent fencing	Regular	Construction, long-term	• Decline in local fauna populations
Removal of habitat features e.g. HBTs	86 HBTs	One-off	Construction, long-term	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	113.7 ha (70% of solar array)	Regular	Operational Phase: Long-term	• Modification of native fauna habitat

Nature of impact	Extent	Frequency	Duration and timing	Consequence
	across all zones			• Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent solar infrastructure	178.6 ha across the development site	Regular	Operational Phase: Long-term	• Modification of habitat beneath array • Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats (fencing).
Impact to geological features	Areas of rocky outcrops	One-off	Operational Phase: Long-term	• Loss of rocky outcrop habitat

7.1.1 Changes in vegetation integrity scores

The changes in vegetation integrity scores as a result of clearing are documented for each vegetation zone in Table 7-2 below.

Table 7-2 Current and future vegetation integrity scores for each vegetation zone within the development site

Zone ID	PCT	EEC and/or threatened species habitat?	Area development footprint (ha)	Current vegetation Integrity Score	Future vegetation Integrity Score
1	567_Woodland	Box-gum Woodland EEC	14.9	54.4	0
2	567_Grassland	Box-gum Woodland EEC	61.4	0.4	0
3	567_Scattered	Box-gum Woodland EEC	1.7	18.2	0
4	575_Forest	No	0.2	59.1	0
5	704_Woodland	Box-gum Woodland EEC	8.3	33.7	0
6	704_Grassland	Box-gum Woodland EEC	35.9	0.5	0
7	704_Scattered	Box-gum Woodland EEC	4.3	21.4	0
8	575_Scattered	No	0.7	37.6	0

7.1.2 Loss of species credit species habitat or individuals

The loss of species credit species habitat or individuals as a result of clearing is documented in Table 7-3 below.

Table 7-3 Summary of species credit species loss at the development site

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost (ha)

Bluegrass *Dichanthium setosum*	2	120.1
Southern Myotis *Myotis macropus*	2	57.2
Pale-headed Snake *Hoplocephalus bitorquatus*	2	12.6
Koala *Phascolarctos cinereus*	2	12.6

7.1.3 Loss of hollow-bearing trees

HBT surveys were focused on areas within the development footprint, as such the total number of HBTs within the development site is unknown. Nevertheless, 108 were recorded, 86 of which are within the development footprint as detailed below.

Table 7-4 Hollow-bearing trees impacted by the proposal

Zone	PCT ID	HBTs impacted
1	567_Woodland	39
2	567_Grassland	0
3	567_Scattered	13
4	575_Forest	0
5	704_Woodland	13
6	704_Grassland	0
7	704_Scattered	9
8	575_Scattered	2
Cat 1 Exempt Land		10

7.2 INDIRECT IMPACTS

Indirect impacts of the proposal include soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise. Table 7-5 below details the type, frequency, intensity, duration and consequence of the direct and indirect impacts of the proposal. Indirect impact zones are mapped on Figure 7-1.

Table 7-5 Potential impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Indirect impacts (those listed below are included in the BAM)					
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short-term	• Box-gum Woodland EEC • Koala • Southern Myotis • Greater Broad-nosed Bat • Bluegrass	• Minor direct loss of native flora and fauna habitat • Low potential for injury and mortality of fauna during clearing of fauna habitat and habitat trees • Minor disturbance to stags, fallen timber, and bush rock • Increased edge effects The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	• Box-gum Woodland EEC • Koala • Southern Myotis • Greater Broad-nosed Bat • Bluegrass	• Degradation of Box-gum Woodland EEC • Minor loss of native flora and fauna habitat The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operational Phase: Short-term	• Koala • Southern Myotis • Greater Broad-nosed Bat • Bluegrass	• May alter fauna activities and/or movements • Minor loss of foraging or breeding habitat The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Transport of weeds and pathogens from	Unknown	Irregular	Construction & Operational	• Box-gum Woodland EEC • Bluegrass	• Degradation of Box-gum Woodland EEC through weed encroachment

the site to adjacent vegetation			Phase: Long-term		• Minor loss of native flora and fauna habitat. The combined impacts are likely to be minor in nature if they occur at all and would result in a negligible consequence for bioregional persistence
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction & Operational Phase: Long-term	• Koala • Southern Myotis • Greater Broad-nosed Bat	• Loss of foraging habitat
Loss of breeding habitats	86 HBTs, trees within wooded Zones that may be used for nesting/roosting	Constant	Construction Phase: Long-Term	• Southern Myotis • Greater Broad-nosed Bat	• Loss of potential breeding habitat including fallen and hollow logs at height; • Loss of vegetation close to water; and • Increased pressure and competition for remaining HBT resources from native and exotic hollow dependent fauna.
Rubbish dumping	Unknown	Regular	Construction & Operational Phase: Long term	• Box-gum Woodland EEC • Bluegrass	• Degradation of Box-gum Woodland EEC
Earthworks and mobilisation of sediments	Unknown	Regular	Construction phase: Short term	• Box-gum Woodland EEC • Bluegrass	• Erosion and sedimentation and/or pollution of soils, dams and downstream habitats. • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Increase risk of fire	Unknown	Regular	Operational Phase: Long term	• Box-gum Woodland EEC • Koala • Southern Myotis • Greater Broad-nosed Bat • Bluegrass	• Slight increase in the unlikely event componentry failure or damage results in a bushfire resulting in biodiversity impacts

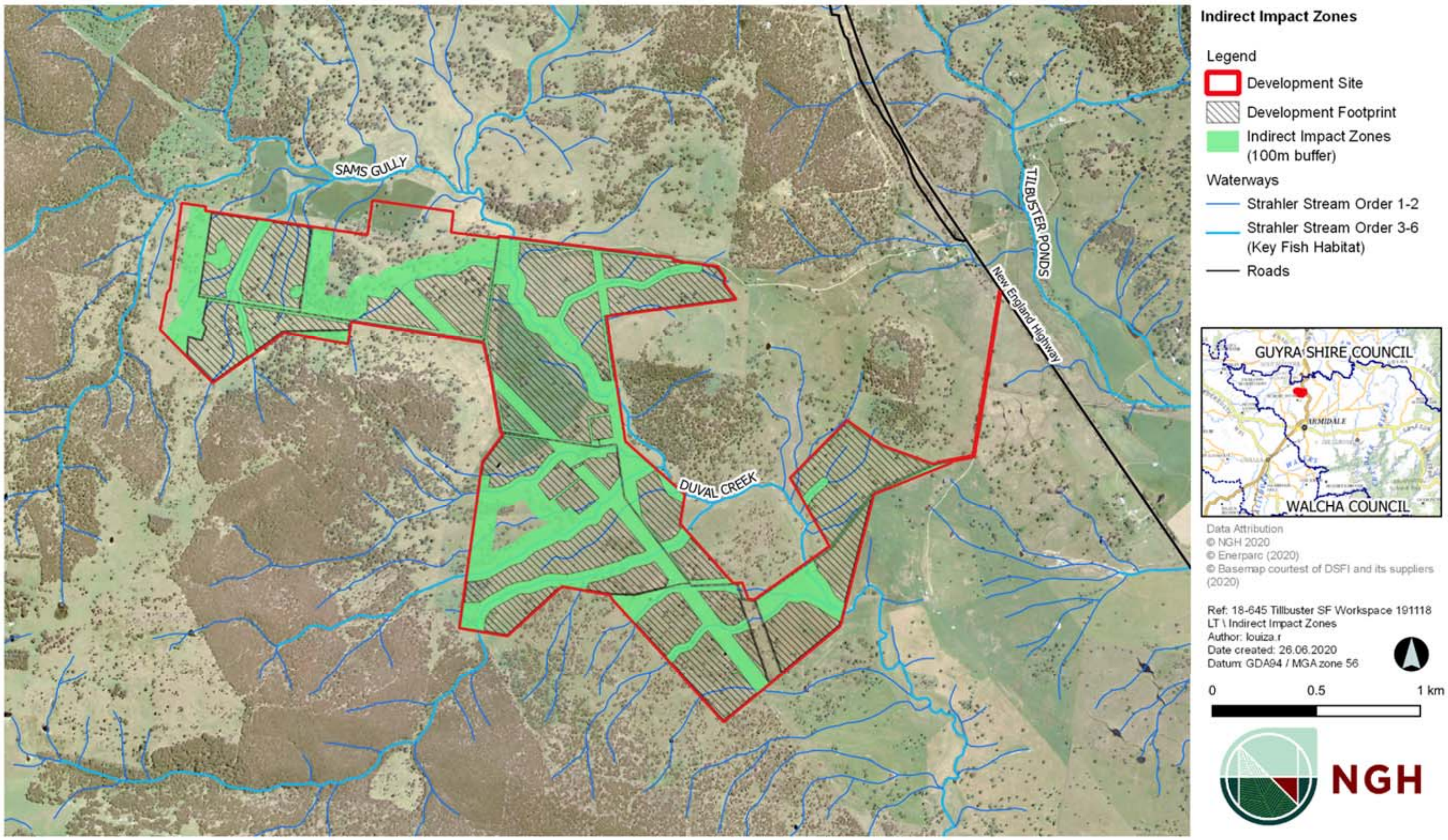


Figure 7-1 Indirect Impact Zones

7.3 PRESCRIBED IMPACTS

The following prescribed biodiversity impacts are relevant to the proposal:

a) Impacts of development on the habitat of threatened species or ecological communities associated with:
    - karst, caves, crevices, cliffs and other geological features of significance, or
    - rocks, or
    - non-native vegetation

b) Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

c) Impacts of development on movement of threatened species that maintains their life cycle

d) Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)

e) Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

These are discussed in detail below and the necessary information required by Section 9.2 of the BAM provided.

7.3.1 Impacts to karst, caves, crevices, cliffs and other features of geological significance

The rock formation known as Red Rock, which is within the development footprint, represents potential habitat for two candidate species associated with rock outcropping; Granite Boronia and Narrow-leaved Bertya. Both species were surveyed for at this location during November 2019 and neither were observed. Given this survey result and the level of habitat degradation, neither species are considered likely to use this habitat.

The removal of Red Rock is not considered to impact the persistence of any threatened species or communities as none are considered likely to utilise this habitat or rely on it.

7.3.2 Impacts of development on the habitat of threatened species or ecological communities associated with rocks

Areas of rock within Zones 1 and 2 in the north-east of the development footprint, represent potential habitat for two candidate species associated with rock outcropping; Granite Boronia and Narrow-leaved Bertya. Both species were surveyed for at this location during November 2019 and neither were observed. Given this survey result and the level of habitat degradation, neither species are considered likely to use this habitat.

The removal of rocky areas is not considered to impact the persistence of any threatened species or communities as none are considered likely to utilise this habitat or rely on it.

7.3.3 Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation

An area of 0.27 ha of non-native vegetation occurs with the development footprint near the western boundary. This vegetation does not provide key foraging or breeding habitat for any candidate species and given its small size and location; its removal would not impact upon habitat connectivity for any candidate species. Similarly, this vegetation is of little value to surrounding areas of Box-gum Woodland EEC.

7.3.4 Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

As discussed in Section 2.7, connectivity of treed vegetation through the development site is generally poor due to clearing and thinning of native vegetation to facilitate farming of livestock. The area of greatest connectivity located in the north of the development site, which is likely to benefit candidate species such as Koala, has been avoided by the development footprint. The treed areas that would be impacted by the proposal generally have inconsistent canopies which fail to connect areas of habitat surrounding, and that encroach on the development site. As such, these patches are unlikely to be utilised for movement across arrange by threatened species that require a contiguous canopy for traversal such as gliders. For these species, consistently treed areas surrounding that development site are more likely to be used. Therefore, the removal of treed areas proposed, whilst constituting a reduction in habitat varyingly connected to higher quality habitat outside the development site, is considered unlikely to encumber threatened species such as arboreal mammals from moving across their range.

As the development site would be fenced by 2 m high chain wire fencing, threatened species that may utilise the ground for traversal such as Koala, would be hindered from doing so. Mitigation measures proposed, including Koala friendly fencing, would mitigate this impact. However, some disruption to the present movement of individuals, whose home ranges may intersect with the development site, is unavoidable.

The proposal is not considered likely to prevent highly mobile threatened species such as avifauna and microbats from moving across their range.

7.3.5 Impacts of the development on movement of threatened species that maintains their life cycle

The development site is not a known migratory path for threatened species and as discussed above, present connectivity across the development site is poor that require consistent canopy of traversal. For highly mobile threatened species such as birds and microbats, the degree of vegetation removal proposed is considered unlikely to impede such species from undertaking any movement that maintains their life cycle.

Several individual Koala may have home ranges that overlap with the development site. Females, or a dominant male, may move through the development site during breeding season. Though this movement would be hindered via fencing generally, Koala friendly fencing would mean that this movement would not be prevented absolutely. It is considered unlikely that movement of Koala would be impeded to such a degree that the bioregional persistence of the species is impacted.

The proposal is not considered likely to prevent highly mobile threatened species such as avifauna and microbats from carrying out the movement that is required to complete their life cycle.

7.3.6 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Not all aquatic features would be avoided by the proposal as outlined in Section 6.2.6; five dams would be filled and 11 water crossings are proposed.

Southern Myotis, as a species credit species recorded during targeted surveys, may utilise the farm dams and Duval Creek dams for foraging when sufficient water level is present. Whether the individual or individuals recorded rely on these resources perennially, or were simply investigating foraging opportunities, is unknown.

Outside of drought conditions, the five small farm dams that would be impacted are unlikely to be a vital or even preferential foraging resource for the residing population of Southern Myotis. However, as the present drought conditions continue, these small areas of habitat may become increasingly important for persistence of the species in the bioregion. Whether the proposal would lead to a situation where there is mortalities of individuals due to malnutrition, is uncertain, but considered unlikely given the other viable foraging resources within the development site that would not be impacted.

Although the construction and operation of the proposal would involve a range of activities that would disturb soils and potentially impact surface water quality. Appropriate drainage features would be constructed along internal access roads to minimise the risk of dirty water leaving the site or entering waterways. With the exception of internal roads, parking areas and areas around site offices, the site would be largely vegetated with grass cover (specifically, ground cover would be maintained beneath the solar array). There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

A hydrological assessment completed for the proposal (Footprint 2020), showed no significant impact on flood behaviour within the floodplain is predicted as a result of the proposal, as flood levels, depths, velocities and hazards would be relatively unchanged. Nevertheless, there is be some small change in the hydrology of the development site, however, this is considered unlikely to greatly detriment the threatened species and ecological community present.

7.3.7 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Vehicle strikes on threatened species that are part of a TEC, such as Koala, is an impact that is most likely to occur during the construction phase of the proposal. While the likelihood of enacting this impact can be minimised, it cannot be reduced to zero.

Vehicle strikes, to threatened species such as Koala, are not considered to be a likely occurrence. Should they occur in isolation as a worst case scenario, they are unlikely to have substantive consequences on the local and bioregional persistence of Koala.

7.4 IMPACTS TO BIODIVERSITY VALUES THAT ARE UNCERTAIN

Impacts to biodiversity values, such as the removal of foraging habitat or HBTs, are readily quantifiable. However, impacts such as vehicle strikes, as discussed in Section 7.3.7, are uncertain.

7.5 IMPACTS TO MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Two EPBC Act listed species, Greater Glider (Vulnerable) and Koala (Vulnerable) were recorded during surveys. A single Greater Glider was recorded in vegetation in the west of the development site during August 2019 spotlighting and Koala faecal pellets were found at Koala SAT Site 2 during November 2019.

Vegetation within the development site and footprint contains foraging habitat of lesser quality for both species, however, it may still form part of an individual of either species' home range.

Bluegrass (Vulnerable), was not detected incidentally or within BAM plots during any of the August 2018, November 2018 November 2019 surveys. However, the species is unlikely to have been detectable during November 2019 and potential habitat, although sub-optimal, is considered present.

In the case of Greater Glider, given the species low dispersal ability (DoE 2012) to move between fragments through cleared areas, habitat within the development site is restricted to treed areas that have some connectivity to areas outside the development site. Primarily this occurs along and adjacent to the western boundary. Koala, however, as they are able to traverse cleared areas, may utilise any part of the development site, but are most likely to visit denser wooded areas where food and shelter trees are more frequent.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 7-6 Koala habitat assessment tool for inland areas (DoE 2014) below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 7 5 resulted in a score of 8 and as such habitat within the development site is considered to be critical to the survival of the Koala and an assessment of significant impact according to the EPBC Act significant impact criteria is required.

Table 7-6 Koala habitat assessment tool for inland areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	✓ Recorded during the surveys
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	
	0 (low)	None of the above.	
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	✓ No areas containing emerging trees would be impacted. However, woodland areas contain several Koala feed tree species including Ribbon Gum *Eucalyptus viminalis*, Blakely's Red Gum and Yellow Box.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	✓ Some areas that would be impacted are connected to outside bushland that exceeds 1000 ha.

Attribute	Score	Inland	Applicable to the proposal?
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	
	0 (low)	None of the above.	✓
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	✓ No Koala mortality observed during the survey
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓ Development site is not considered a habitat refuge nor does it provide important connectivity to large areas surrounding a habitat refuge

Attribute	Score	Inland	Applicable to the proposal?
Total	**8**	**Decision: Habitat critical to the survival of the Koala—assessment of significance required**	

An assessment of significant impact was completed for Koala, Greater Glider and Bluegrass (APPENDIX G). Based on these characterisations of the significance of the proposal's impacts to these species, in the cases of Koala and Greater Glider, the proposal is considered to have the potential to generate a significant impact. Therefore, EPBC Act referral was undertaken for both species. The proposed Tilbuster Solar Farm was determined to be a controlled action and will be assessed by NSW under an accredited assessment in accordance with section 87 of the EPBC Act. Supplementary SEARs for this proposal have been addressed in this BDAR.

A significant impact to Bluegrass was not concluded to be likely, based on the assessment undertaken pursuant to the EPBC Act. Further surveys will be undertaken to verify our assumptions and an offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.

7.6 LIMITATIONS TO DATA, ASSUMPTIONS AND PREDICTIONS

Vegetation integrity plot surveys were undertaken across November 2018 and November 2019. Therefore, the flora species recorded are reflective of these timeframes. Across the 12 month gap in surveys, drought conditions across NSW generally and the Armidale Plateau IBRA Sub-region worsened. BoM climate data (BOM 2019) indicates that in this 12 month period, rainfall totalled 33.9.2 ml, 45.5% of the annual average recorded since 1997. This lack of rainfall, coupled with grazing pressure exacerbated by the drought, has had the effect of lowering structure condition scores for sub-canopy growth forms for vegetation zones where plot data has been collected during November 2019. Primarily, this has influenced vegetation integrity scores for grassland vegetation zones (3 and 6) due to survey timing. While the degree of influence of the drought is not able to be quantified, under more favourable conditions, grassland vegetation zones may have sufficient structure condition (% cover of native species) resulting in a vegetation integrity score that would require offsetting. However, at the time of November 2019 data collection, they do not and are considered highly degraded.

Climatic conditions may influence the species present at any one time. The drought conditions described above also have the effect of limiting habitat suitability within the development site for candidate species credit species where water is a key limiting factor.

Where survey has been undertaken for candidate species requiring confirmation of presence or absence, this has been done employing appropriate methods and timing. Nevertheless, it is an unavoidable limitation that not all species that utilise an area will be detected. This is generally due to their mobility and unpredictable movement throughout their habitat.

Where survey for candidate species requiring confirmation of presence or absence was not undertaken, this is stated explicitly in the assessment and measures identified to address the limitation; i.e. assumption of occurrence of the species. This is the case for Bluegrass.

The calculation of HBTs, in particular the size and number of hollows, was made from ground level. It is possible that some hollows are present that were not visible from ground level, which may result in underestimates of the number of hollows (Gibbons and Lindenmayer 2000).

8 MITIGATING AND MANAGING IMPACTS

8.1 MITIGATION MEASURES

A general summary of the key measures required to mitigate the impacts of the proposal are provided below. Mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency, responsibility for implementing each measure, risk of failure and an analysis of the consequences of any residual impacts are provided in Table 8 1.

8.1.1 Impacts from the clearing of vegetation and habitats

1. Time works to avoid critical life cycle events
2. Implement clearing protocols during tree clearing works, including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or wildlife handler
3. Relocate habitat features (fallen timber, hollow logs) from within the development site to an adjacent area.

8.1.2 Indirect impacts

1. Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed
2. Adaptive dust monitoring programs to control air quality
3. Temporary fencing to protect significant environmental features and threatened species habitat
4. Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas
5. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented

8.1.3 Prescribed impacts

1. Sediment barriers and spill management protocols to control the quality of water runoff from the site into the receiving environment
2. Enforce speed limits and install signage during construction to reduce impacts of vehicle strikes on threatened fauna.
3. Clearly survey and mark environmental no-go areas during construction to prevent clearing within unauthorised areas and where threatened species habitat occurs
4. Fencing to deter Koala from entering the development site during construction
5. Use of non-barbed wire fencing for permanent fencing
6. Installation of artificial connectivity measures to allow traversal of species such as Koala between areas of habitat surrounding the habitat site post construction
7. Staff training and site briefing to communicate environmental features to be protected and measures to be implemented

Table 8-1 Mitigation measures proposed to avoid and minimise impacts on native vegetation and habitat

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Displacement of resident fauna through vegetation clearing and habitat removal						
timing works to avoid critical life cycle events such as breeding or nursing	• Where practicable, hollow-bearing trees would not be removed during breeding and hibernation season (June to January) to mitigate impacts • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	• Pre-clearing checklist • Tree clearing procedure • Staged habitat removal • Unexpected threatened species finds procedure	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
relocation of habitat features (fallen timber, hollow logs) from within the development site the development footprint to retained areas within the development site	• Tree-clearing procedure including relocation of habitat features to adjacent area for habitat enhancement	Construction	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
Indirect impacts on native vegetation and habitat						
clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chainsaw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	• Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees • In areas to clear adjacent to areas to be retained, chainsaws would be used rather than heavy machinery to minimise risk of unauthorised disturbance	Construction	Regular	Contractor	Low	None
noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	Construction	Regular	Contractor	Low	None
light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	• Avoid Night Works • Direct lights away from vegetation	Construction /Operation	Regular	Contractor	Low	None

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
adaptive dust monitoring programs to control air quality	• Daily monitoring of dust generated by construction and operation activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	Construction	Regularly	Contractor	Moderate	None
programming construction activities to avoid impacts; 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	• Where practicable, time construction activities outside Koala breeding season • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken by an ecologist or suitably qualified person to ensure no impacts to fauna would occur	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.
temporary fencing to protect significant environmental features such as riparian zones	• Fencing from buffer of riparian zones and drainage lines	Construction	Regular	Contractor	Low	None
hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	• A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: o Management protocol for declared priority weeds under the *Biosecurity Act 2015* during and after construction	Construction , Operation	Regular	Contractor	Moderate	Weed encroachment

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	o Weed hygiene protocol in relation to plant, machinery, and fill • The weed management procedure would be incorporated into the Biodiversity Management Plan.					
staff training and site briefing to communicate environmental features to be protected and measures to be implemented	• Site induction • Toolbox talks	Construction	Regular	Contractor	Moderate	Impacts to native vegetation or threatened species for Staff training not being followed
preparation of a Biodiversity Management Plan (BMP)	• Preparation of a Biodiversity Management Plan that would include the following management actions and protocols at a minimum: o Protection of native vegetation to be retained o Best practice removal and disposal of vegetation o Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist o Avoiding the removal of hollow-bearing trees during spring, where practicable, to avoid the main breeding period for hollow-dependent fauna o	Construction	One-off	Contractor	Moderate	Impacts to native vegetation or threatened species from Construction Flora and Fauna Management Plan not being followed.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
	o Unexpected threatened species finds procedure o Rehabilitation of disturbed areas with flora species that are characteristic of the PCTs that would be impacted (PCTs 567 and 704) o Installation of next boxes or hollow augmentation at a 2:1 ratio to mitigate removal of HBTs that are potential Greater Glider den sites o Controlling weeds, feral pests and pathogens.					
Prescribed biodiversity impacts						
instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events for rocks, human made structures and non-native vegetation	• Pre-clearing checklist • Tree clearing procedure • Staged habitat removal • Unexpected threatened species finds procedure	Construction	Regular	Contractor	Moderate	Species not detected during pre-clearing surveys may be impacted.

Mitigation measure	Proposed techniques	Timing	Frequency	Responsibility	Risk of failure	Risk and consequences of residual impacts
installing artificial connectivity measures to re-establish connections between habitat and favoured movement pathways, e.g. glider poles, rope crossings, habitat bridges	• No use of barbed wire fencing as it provides a hazard to fauna such as Koala, Greater Glider and microbats • Fencing adjacent to areas of the development site that are connected to areas of bushland outside the development site are to include Koala friendly structures to aid traversal of Koala across their range	Post construction	One-off	Contractor	Low	Koala hindered from moving across their range. Alternate routes are present that would likely to be utilised instead.
temporary fencing to protect significant environmental features such as karst/caves, rocks and water bodies	• Fencing from buffer of riparian zones, drainage lines and farm dams to be retained	Construction	Regular	Contractor	Low	None
sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	• An erosion and sediment control plan would be prepared in conjunction with the final design and implemented • Spill management procedures would be implemented.	Construction	Regular	Contractor	Moderate	Indirect impacts may occur to waterways if erosion and sedimentation control plan not implemented.
staff training and site briefing to communicate environmental features to be protected and measures to be implemented	• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles
fencing or other measures to control animal and vehicle interactions	• Development site to be fenced entirely during construction and operation	Construction and Operation	Regular	Contractor	Moderate	Fauna strikes from vehicles

8.2 ADAPTIVE MANAGEMENT STRATEGY

A Biodiversity Management Plan (BMP) would be prepared demonstrating adaptive management strategies to ensure key milestones are achieved including:

- Requirements for additional and ongoing surveys to better ascertain Koala and Greater Glider presence, and associated impacts to use as for baseline monitoring;
- Fauna monitoring and management protocol including identification and reporting of fauna mortalities to the relevant Biodiversity Conservation Division office;
- Protecting vegetation and fauna habitat outside the approved disturbance areas and managing the remaining remnant vegetation and fauna habitat within the Proposal toward a benchmark state;
- Next box monitoring and reporting;
- Monitoring criteria;
- Clear performance targets;
- Corrective actions
- Timing and responsibilities.

A recommended outline of the BMP is provided below:

- Introduction
  - Purpose and objectivities
  - Description of the proposal
- Planning Requirements
- Existing environments
  - Flora and fauna values
  - Soils
  - Weeds and pests
- Environmental Impacts
- Construction and Operational activities
- Management Zones
  - Protocols, actions, and procedures
- Performance criteria, triggers, and responses
- Compliance Management
- Review and Improvement

9 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

9.1 POTENTIAL SERIOUS AND IRREVERSIBLE IMPACT ENTITIES

9.1.1 Threatened ecological communities

One threatened ecological community listed as a potential SAII entity in the Guidance to assist a decision-maker to determine a serious and irreversible impact would be impacted by the proposal;

- White Box-Yellow Box- Blakely's Red Gum Woodland (Box-gum Woodland EEC)

9.1.2 Threatened species

There are no SAII candidate species recorded at the development site.

9.1.3 Additional potential entities

No further species were considered to be potential SAII entities.

9.2 ASSESSMENT OF SERIOUS AND IRREVERSIBLE IMPACTS

9.2.1 White Box-Yellow Box- Blakely's Red Gum Woodland (Box-gum Woodland EEC)

a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

Up to 235.2 ha of Box-gum Woodland occurs EEC within the development site. This occurs as three condition states:

- areas with canopy over mixed native and exotic grazed understory (71.2 ha),
- areas of mixed native and exotic understory only (156.5 ha),
- and areas of scattered canopy over cropped understory (7.6 ha).

Areas containing canopy are considered to be of highest ecological and conservation value, of which 49.5 ha (or 63%) has been avoided. The measures outlined in Section 8.1.2 detail how indirect impacts would be mitigated.

b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

Up to 126.5 ha of Box-gum Woodland EEC would be impacted by the proposal as follows:

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score
1	567_Woodland	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	14.9	54.4
2	567_Grassland	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	61.4	0.4
3	567_Scattered	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	1.7	18.2
5	704_Woodland	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	8.3	33.7
6	704_Grassland	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	35.9	0.5
7	704_Scattered	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	4.3	21.4

c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

No threshold has yet been defined by DPIE for the extent of Box-gum Woodland EEC to be removed that constitutes a serious and irreversible impact.

d) the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint

Box-gum Woodland EEC, in the context of the broader locality surrounding the development site, is likely to have be heavily modified due to human land use. More so on valley floors where the land is arguably more fertile and accessible. Areas of Box-gum Woodland EEC that grade into PCTs of higher elevations, may be in better condition due to less historical clearing and ongoing grazing pressure.

Using a combination of State Vegetation Mapping available through the NSW Government's SEED data portal, as well as interpreting aerial imagery via GIS, it is estimated that 622 ha of Box-gum Woodland EEC occurs within an area of 1000 ha surrounding the proposed development footprint and 4618 ha of Box-gum Woodland EEC occurs within an area of 10000 ha surrounding the proposed development footprint.

e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

Detailed state vegetation type mapping is not available for the Armidale Plateau IBRA Subregion and New England Tablelands IBRA Bioregion. However, mapping of the Border Rivers Gwydir / Namoi Region, covers the western portion of the IBRA Region from Nundle in the south to the Queensland border in the north, approximately 55% of the IBRA Region. Reference to this mapping (DPIE 2015) indicates that over 115868 ha of Box-Gum Woodland EEC could occur within the mapped area, with a further 162000 ha mapped as derived grasslands, some of which are likely to represent Box-gum Woodland EEC in an understory form as allowed by the NSW Scientific Communities final determination (NSWSC 2011). The 119.6 ha that would be removed for the proposal, largely as disturbed grassland, equates to just over 0.1% of the lower estimate above.

DPIE (2015) marginally enters the Armidale Plateau Subregion in the west, as such, it is not able to estimate the cover of Box-gum Woodland EEC on the Armidale Plateau. However, the Subregion comprises approximately 10% of the Bioregion. A conservative estimate would be that 2% of the Box-gum Woodland EEC within the Bioregion occurs within the Subregion. Meaning that about 5% of that within the Subregion would be impacted by the proposal. This estimate is considered to be considerably higher than the reality given the assumptions made.

f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

Detailed state vegetation type mapping is not available for the entire New England Tablelands IBRA Bioregion and 90% of the Armidale Plateau Subregion. It is likely that less than 10% of Box-Gum Woodland EEC that occurs in the Subregion is in the reserve system such as in Oxley Wild Rivers National Park. However, a credible estimate of area cannot be given due to data limitations.

g) the development, clearing or biodiversity certification proposal’s impact on:

- **abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns**

Groundwater supplies and levels are unlikely to be affected by the proposal plant and no groundwater is anticipated to be intercepted or extracted. During construction, the proposal would have a short term gross impact upon soils and possibly surface water flow, within discreet areas. These impacts are manageable with the implementation of erosion and sediment controls and would be unlikely to impact on abiotic factors critical to the long-term survival of Box-gum Woodland EEC.

- **characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants**

No characteristic or functionally important species would be lost through the removal of the Box-gum Woodland EEC. The vast majority of Box-gum Woodland EEC within the development site has been modified or degraded due to historical land use and edge effects. No impacts to the remaining Box-gum Woodland EEC are anticipated. No introduced fire or flooding regimes would occur and no increase of natural occurrences of these events is anticipated from the development.

- **the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC**

It is likely the remaining 108.7 of Box-gum Woodland EEC within the development site avoided by the development footprint would remain unchanged from the current existing condition.

h) direct or indirect fragmentation and isolation of an important area of the potential TEC

As noted in Section 2.7, connectivity of treed areas within the development site is poor and the occurrence of Box-gum Woodland EEC within the development site and immediate surrounding landscape has been subject to clearing for historical land use. Higher condition areas have been avoided by the development footprint and connectivity of more intact areas has been maintained. The proposal is not considered to fragment or isolate an important area of the TEC.

i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

The 126.5 ha of Box-gum Woodland EEC to be removed by the proposal would be offset by the retiring of 607 ecosystem credits, to provide perpetuity management and improvement of Box-gum Woodland EEC, ensuring no net loss.

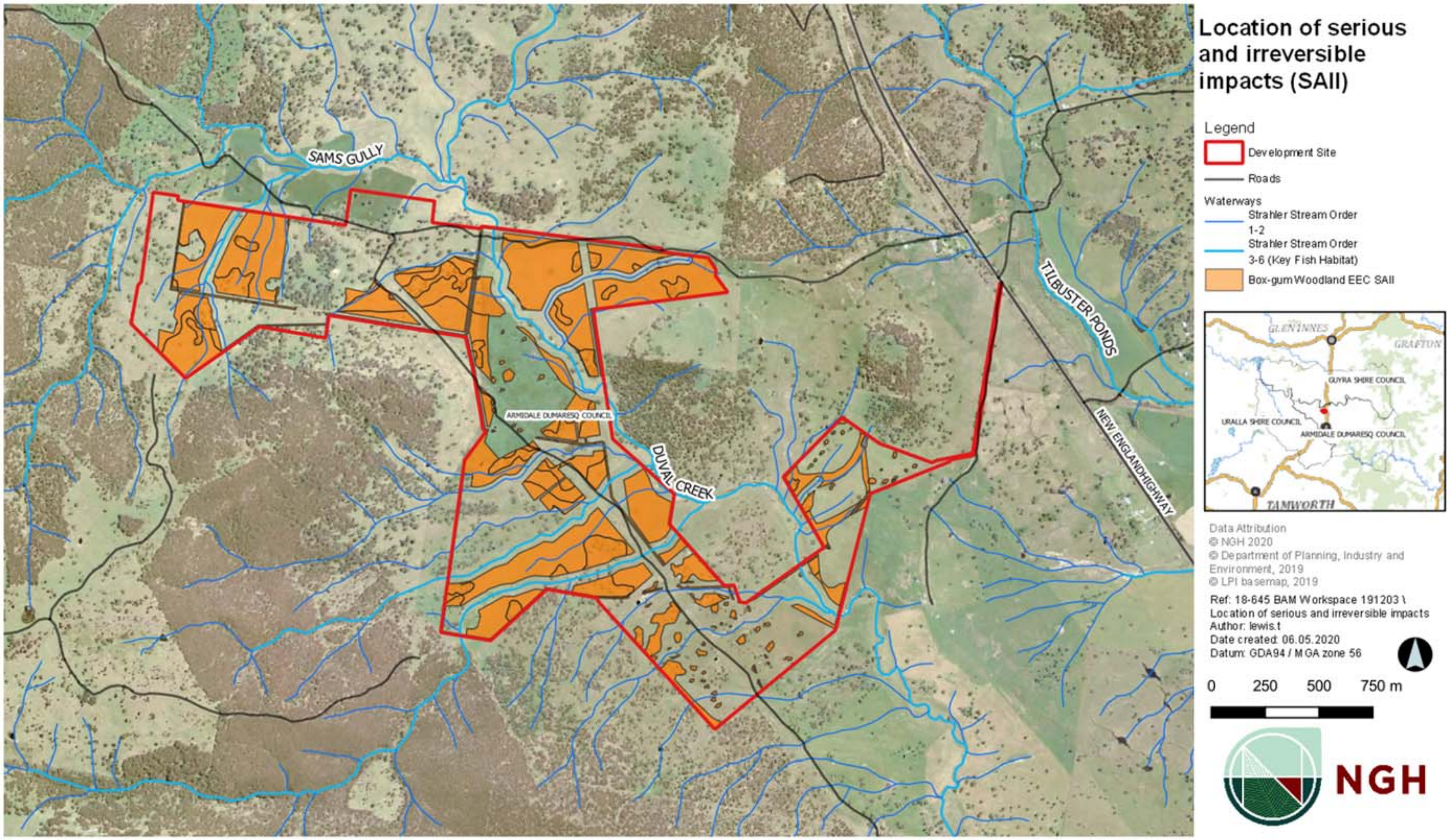


Figure 9-1 Location of serious and irreversible impacts

10 REQUIREMENT TO OFFSET

10.1 IMPACTS REQUIRING AN OFFSET

10.1.1 Ecosystem credits

An offset is required for all impacts of development on PCTs that are associated with:

a) a vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or

b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or

c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 10 1 and mapped on Figure 10 1.

Table 10-1 PCTs and vegetation zones that require offsets

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score	Ecosystem credits required
1	567_Woodland	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	14.9	54.4	406
3	567_Scattered	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	1.7	18.2	16
4	575_Forest	Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion	0.2	59.1	5
5	704_Woodland	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	8.3	33.7	139
7	704_Scattered	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	4.3	21.4	46
8	575_Scattered	Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion	0.7	37.6	9

The full Biodiversity Credit Report generated by the BAM Calculator is provided in Appendix1.1.1:APPENDIX A.

10.1.2 Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 10 2 and are included in map on Figure 10 1. Note, areas that require offsets are comprised of areas that generate ecosystem credits, species credits or both.

Table 10-2 Species credit species that require offsets

Species Credit Species	Biodiversity risk weighting	Area of habitat or count of individuals lost (ha)	Species credits required
Bluegrass *Dichanthium setosum*	**2**	**120.1**	**564**
Southern Myotis *Myotis macropus*	**2**	**57.2**	**228**
Pale-headed Snake *Hoplocephalus bitorquatus*	**2**	**12.6**	**185**
Koala *Phascolarctos cinereus*	**2**	**12.6**	**185**

The full Biodiversity Credit Report generated by the BAM-C is provided in G.3.

10.1.3 Offsets required under the EPBC Act

Assessments of Significance for the Koala and Greater Glider determined the potential for these species to be significantly impacted by the proposal, or where the determination is uncertain, referral is recommended (APPENDIX G). As such, referrals have been made to the Federal Minister for Agriculture, Water and Environment. The proposed Tilbuster Solar Farm was determined to be a controlled action and will be assessed by NSW under an accredited assessment in accordance with section 87 of the EPBC Act. Supplementary SEARs for this proposal have been addressed in this BDAR. The requirement to settle an EPBC offset obligations will be undertaken in accordance with the NSW offset rules where applicable to do so consistent with the endorsed bilateral agreement. An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.

10.2 IMPACTS NOT REQUIRING AN OFFSET

Impacts to PCTs that do not meet the thresholds identified in Section 10.1.1 do not require offsets. These PCTs and vegetation zones are identified in Table 10 3 and mapped on Figure 10 1.

Table 10-3 PCTs and vegetation zones that do not require offsets

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation integrity score

2	567_Grassland	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	61.4	0.4
6	704_Grassland	Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion	35.9	0.5

10.3 AREAS NOT REQUIRING ASSESSMENT

Areas not requiring assessment are lands that have been deemed to be Category 1 Exempt Lands. These areas are mapped on Figure 10 1.

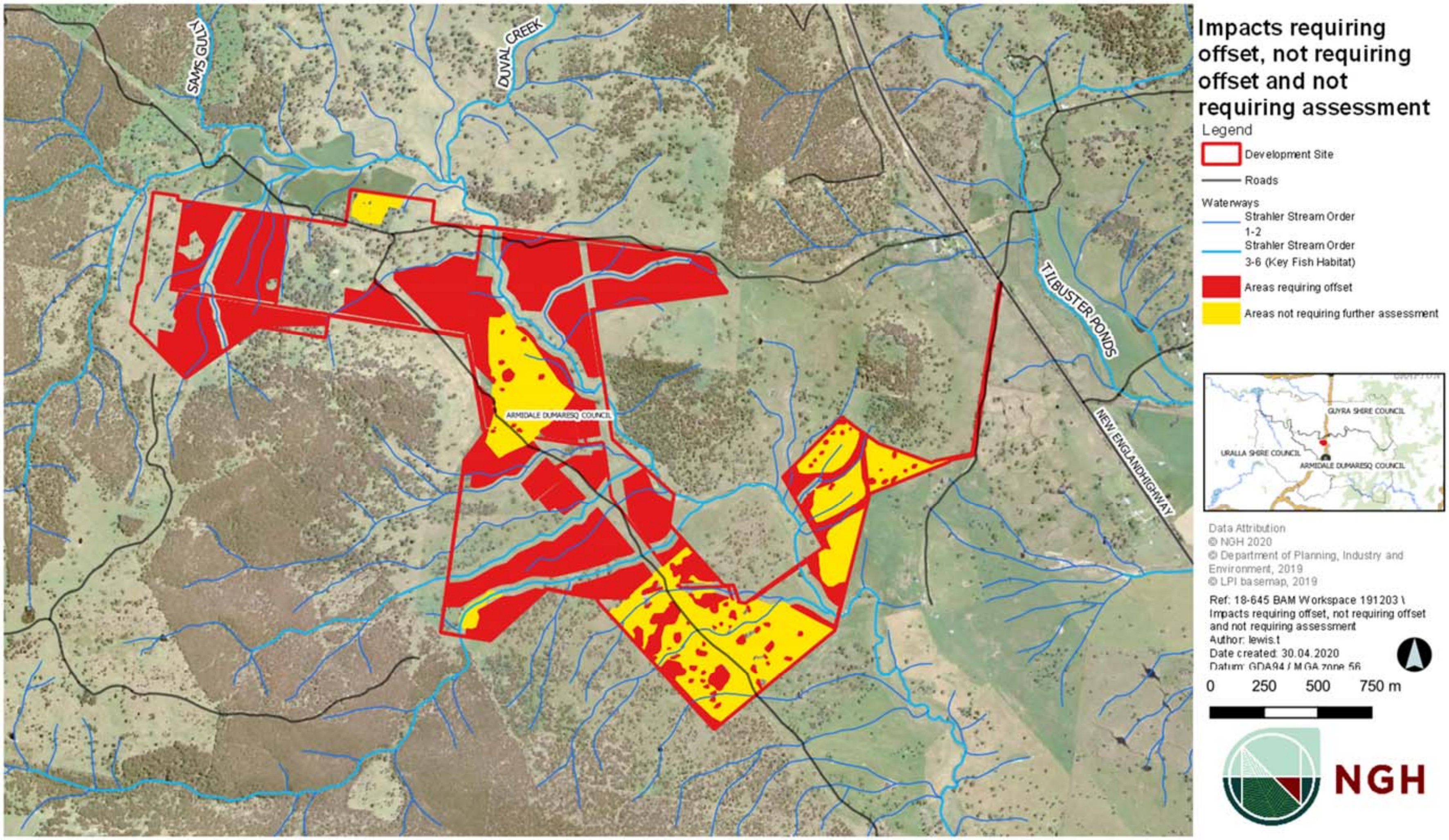


Figure 10-1 Impacts requiring offsets and areas not requiring assessment (Category 1 Land)

11 CONCLUSION

NGH has prepared this BDAR on behalf of Enerpac on for the Tilbuster Solar Farm in Tilbuster, NSW. The purpose of this BDAR was to address the requirements of the BAM, and to address the biodiversity matters raised in the SEARs and Supplementary SEARs. In this BDAR:

- Biodiversity impacts have been assessed through comprehensive mapping and assessment completed in accordance with the BAM
- Biodiversity impacts have been assessed at a worst-case scenario, based on an indicative easement (development site) which will be reduced upon final design
- Mitigation measures have been outlined to reduce impacts to biodiversity
- The credit requirement has been defined as:
  - 422 Ecosystem Credits for impacts to PCT 567-Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion
  - 14 Ecosystem Credits for impacts to PCT 575-Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion
  - 185 Ecosystem Credits for impacts to 704-Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion
  - 564 species credits for Bluegrass that is assumed within the development site
  - 185 species credits for Pale-headed Snake that is assumed within the development site
  - 185 species credits for Koala recorded within the development site
  - 228 species credits for Southern Myotis that was recorded within the development site

The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Scheme, and will be achieved by:

- acquiring or retiring credits under the Biodiversity Offsets Scheme
- making payments into the Biodiversity Conservation Fund using the offsets payment calculator, or
- funding a biodiversity action that benefits the threatened entity(ies) impacted by the development.

An offset strategy addressing Federal requirements will be developed based on further investigations, prior to approval.

12 REFERENCE LIST

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APPENDIX A LAND CATEGORY ASSESSMENT

(begins next page)

9th December 2019

Nicky Owner
Senior Conservation Planning Officer,
North East Branch
Department of Planning, Industry and Environment
24 Moonee Street
Coffs Harbour NSW 2450

Nicky.owner@environment.nsw.gov.au

Dear Nicky,

Re: 18-645 Tilbuster Solar Farm

NGH has been engaged to prepare a Biodiversity Development Assessment Report (BDAR) for the proposed Tilbuster Solar Farm, located approximately 15kms north of Armidale. The development site includes Lot 1 DP225170, Lot 4 DP800611 (Figure 1).

Section 6.8(3) of the *Biodiversity Conservation Act 2016* determines that the Biodiversity Assessment Method (BAM) is to exclude the assessment of the impacts of clearing of native vegetation on Category 1-exempt land (within the meaning of Part 5A of the *Local Land Services Act 2013*) with exception to any impacts prescribed by the regulations under section 6.3 . Boundaries mapping Category 1-exempt land on the Native Vegetation Regulatory Mapping are not yet publicly available however, during the transitional period, accredited assessors may establish the categorisation of land for the agency head to consider, following the method utilised to develop the Native Vegetation Regulatory Map (NVR).

Category 1-exempt land is defined under the LLS act as;

- Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 2019
- Low Conservation Grasslands (following commencement of the new framework on 25th August 2017
- Land (not being grasslands) containing only low conservation groundcover (following commencement of the new framework on 25th August 2017)
- Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed Native Vegetation Act 2003
- Land biodiversity certified under the *Biodiversity Conservation Act 2016*.

This letter report establishes the methodology, results and conclusions to evaluate the land categorisation for the development site. It is anticipated that the Department of Planning, Industry and Environment (DPIE) (Biodiversity and Conservation Division) would support this approach and provide endorsement for the land categorisation of the development site for Tilbuster Solar Farm.

If you have any questions, please contact me on the number below. I would be pleased to discuss this matter with you further.

Yours sincerely,
NGH Pty Ltd

Mitch Palmer
Technical Lead
Accredited Assessor BAAS 17051
Ph: 6923 1534

Attachment 1

Methodology

An initial desktop assessment and subsequent field assessments were undertaken over the development site to determine the ecological constraints and native vegetation communities on site. Assessment of the development site as Category 1-Exempt and Category 2- Regulated Land was undertaken using the following data sources:

- Aerial imagery of historical land use (Sourced from Google Earth and Spatial Services unit Department of Finance, Services and Innovation);
- 2017 Land Use Dataset (Australian Land Use and Management (ALUM) Classification Version 7 (OEH, 2017);
- NSW Woody vegetation extent and FPC 2011 (OEH, 2015);
- Sensitive regulated and vulnerable regulated lands on the Native Vegetation Regulatory Map portal
- Relevant vegetation mapping layers available from the SEED portal.

The potential of land legally cleared at or since 1 Jan 1990 (Woody vegetation only) and/or land significantly disturbed or modified since 1990 (Non-woody vegetation) was assessed. Where there was any doubt, or where data was conflicting, the precautionary principle was applied, and deferred to Category 2 – Regulated Land.

Results

The analysis of the above sources identified in conjunction with aerial imagery that obvious portions of the land within the development site has been used continuously for cropping and grazing prior to and post 1990. Although smaller areas of past cropping are clearly evident, the vast majority of the development site is identified as having modified pastures in the relevant land use layers, however, conclusive evidence within the supporting historical imagery could not determine the significance of groundcover modification and therefore a precautionary approach was applied, with exception of more recent areas of cropping evident during the field surveys (for example being the most south eastern portion of the development site). The following table (Table 1) demonstrates how the above-mentioned layers were used in determining land category:

Table 1 – Summary of date sources and interpretation

Data Sources	Category 1 – Exempt Land	Category 2– Regulated Land	Excluded Land
Aerial Imagery Tilbuster Locality • 1990 • 2001 • 2015	• Clear evidence of cropping • Clear evidence of significant groundcover modification	• Woody vegetation present at 1990 in conjunction with woody vegetation extent layer	N/A
2017 Land Use Dataset	Land use identified as; • Grazing modified pastures (excluding woody vegetation) where clear evidence of significant groundcover modification has occurred post 1990 • Cropping • Manufacturing and industrial • Residential and farm infrastructure • Transport and communication	Land use identified as; • Managed resource protection • Grazing native vegetation • Grazing modified pastures where evidence of significant groundcover modification is absent	N/A

		(precautionary principle applied)	
NSW Woody vegetation extent	• Areas of woody vegetation regrowth that has occurred post 1990 following previous clearing events	• Woody vegetation present as at 1990 in conjunction with historic aerial imagery	N/A
Native regulatory map • Sensitive regulated land • Vulnerable regulated land • Excluded land	N/A	• All areas identified as vulnerable regulated land • All areas identified as sensitive regulated land	N/A

Another determining feature of constant agricultural use is a lack of woody vegetation regrowth in the majority of areas, as represented in the aerial images. The 2011 Woody Vegetation extent does however demonstrate scattered patches and isolated paddock trees in the development site which has been mapped as Category 2 Regulated Land. In areas where it is not 100% conclusive whether the grassland areas have been previously cropped or significantly modified, a precautionary approach has been applied and mapped as Category 2 – Regulated Land.

The NVR Map identifies areas of both Vulnerable Regulated Land and Sensitive Regulated Land occurring within the development site, and therefore has mapped at Category 2 – Regulated land.

PCTs in various conditions states within the development site that have been recorded during the field surveys undertaken thus far include;

- PCT 704 - *Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion;*
- PCT 567 - *Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion;* and
- PCT 575 - *Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion*.

Conclusion

Based on the above data sources, there is evidence to suggest that portions of Lot 1 DP225170 and Lot 4 DP800611 within the Armidale Local Government Area (LGA), has been under regular rotational cropping or significantly modified since 1990. This primarily consists of ploughing and sowing of improved pasture species such as *Vulpia sp*.

The 2017 Land Use Mapping data supports primary land use within the identified areas within these lots as cropping or modified pastures, will smaller areas of grazing native vegetation. The 2017 Land Use map shows the majority of the site to be 'Grazing modified pastures', with site surveys identifying evidence of cropping in these areas to the east of the development site (Figure1 and Table 2). These areas are considered to meet the definition of Category 1- Exempt Land. Woody vegetation and areas identified as 'Grazing native vegetation' have been included as Category 2 - Regulated land. Where in doubt, or where data sources are conflicting, a precautionary approach has been implemented to areas deemed inconclusive in terms of determining historical land use.

A draft map of areas considered to be Category 1 Exempt Land and Category 2 Regulated Land and has been produced and shown in Figure 1 to Figure 8.

Figures

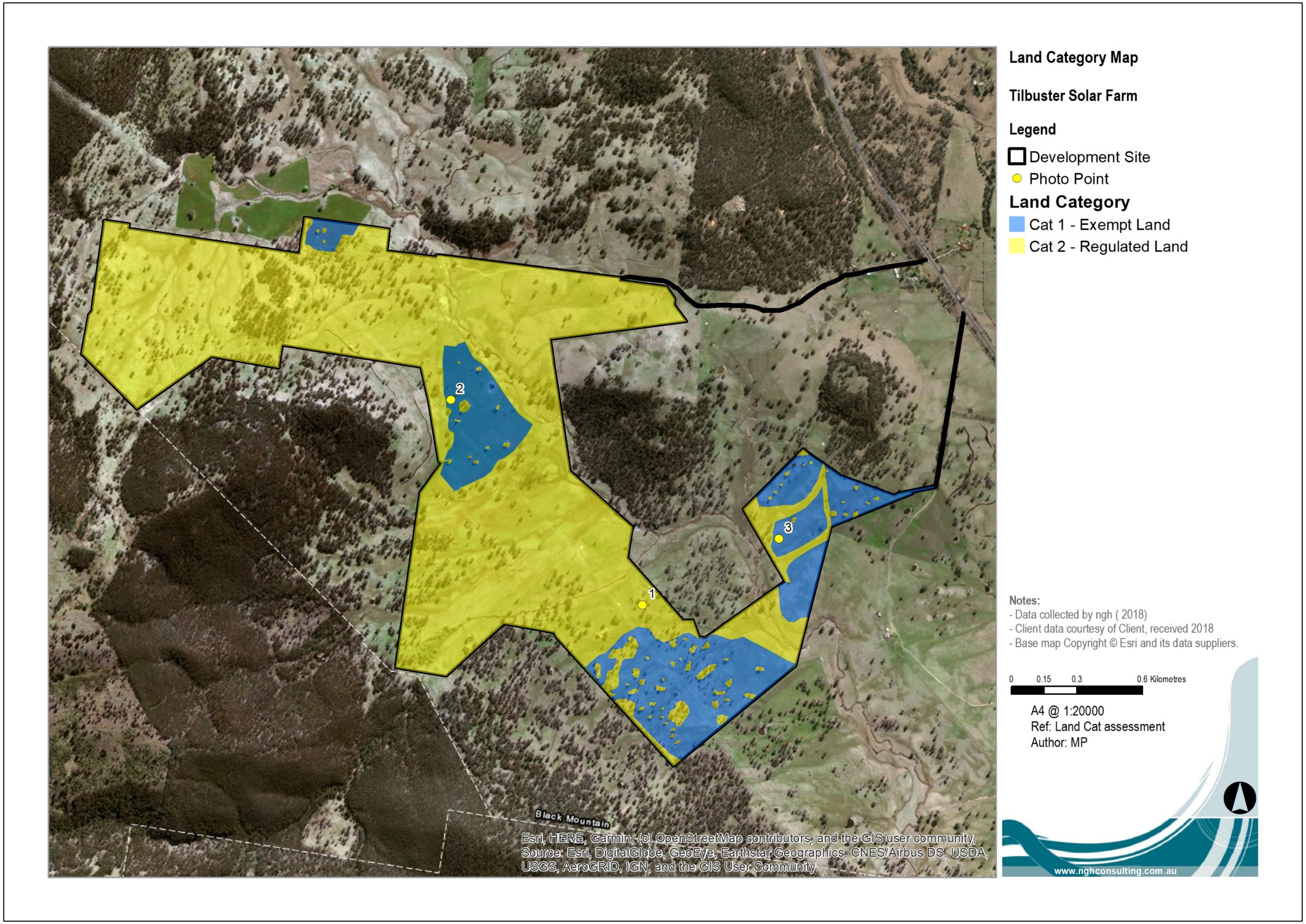


Figure 1 Proposal area and land categorisation 2015 Image (Source ESRI)

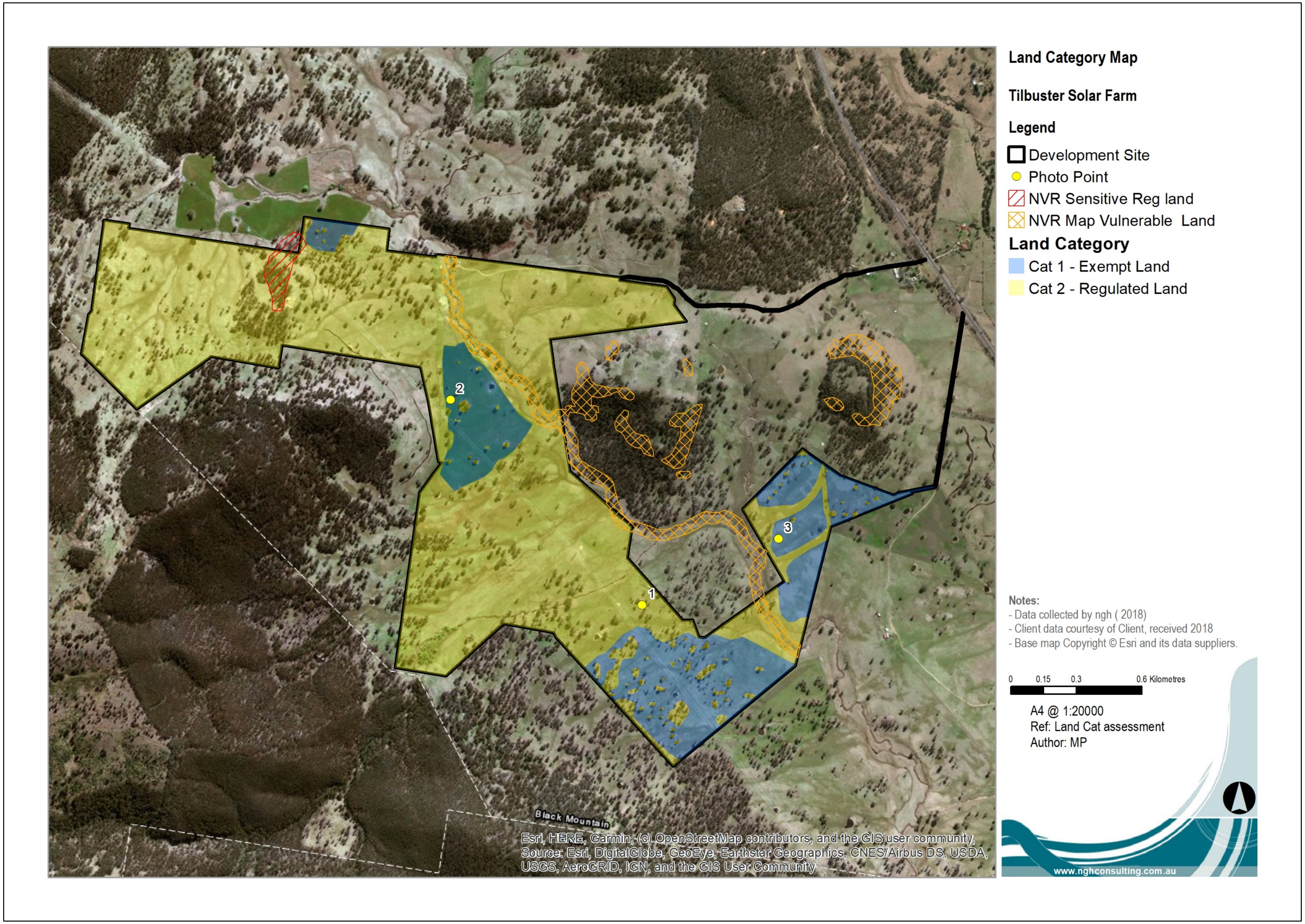


Figure 2 Land categorisation, Vulnerable regulated land and Sensitive regulated land (Source ESRI)

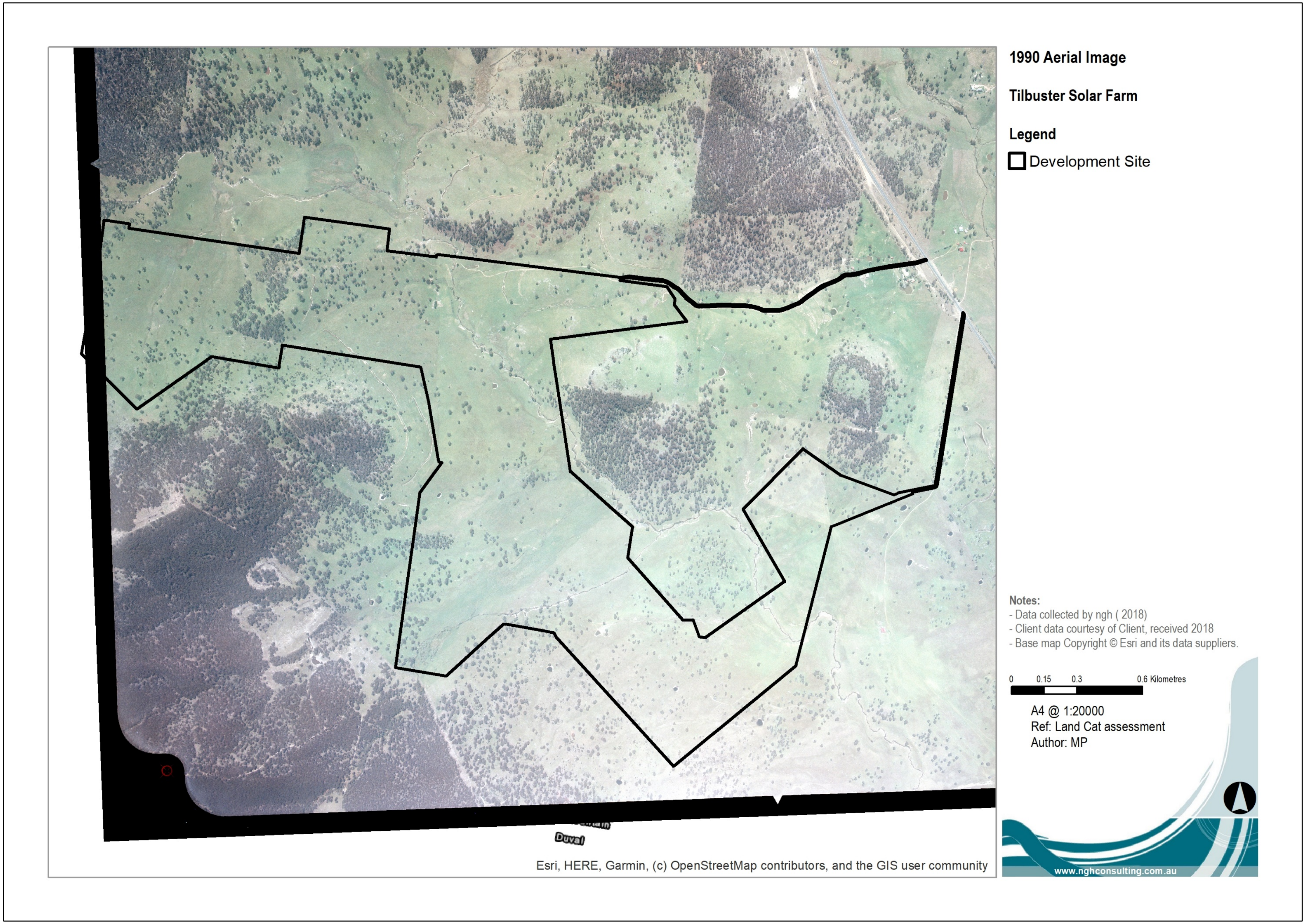


Figure 3 Aerial Imagery 1990 (Source: Dept. Spatial Services delivery)

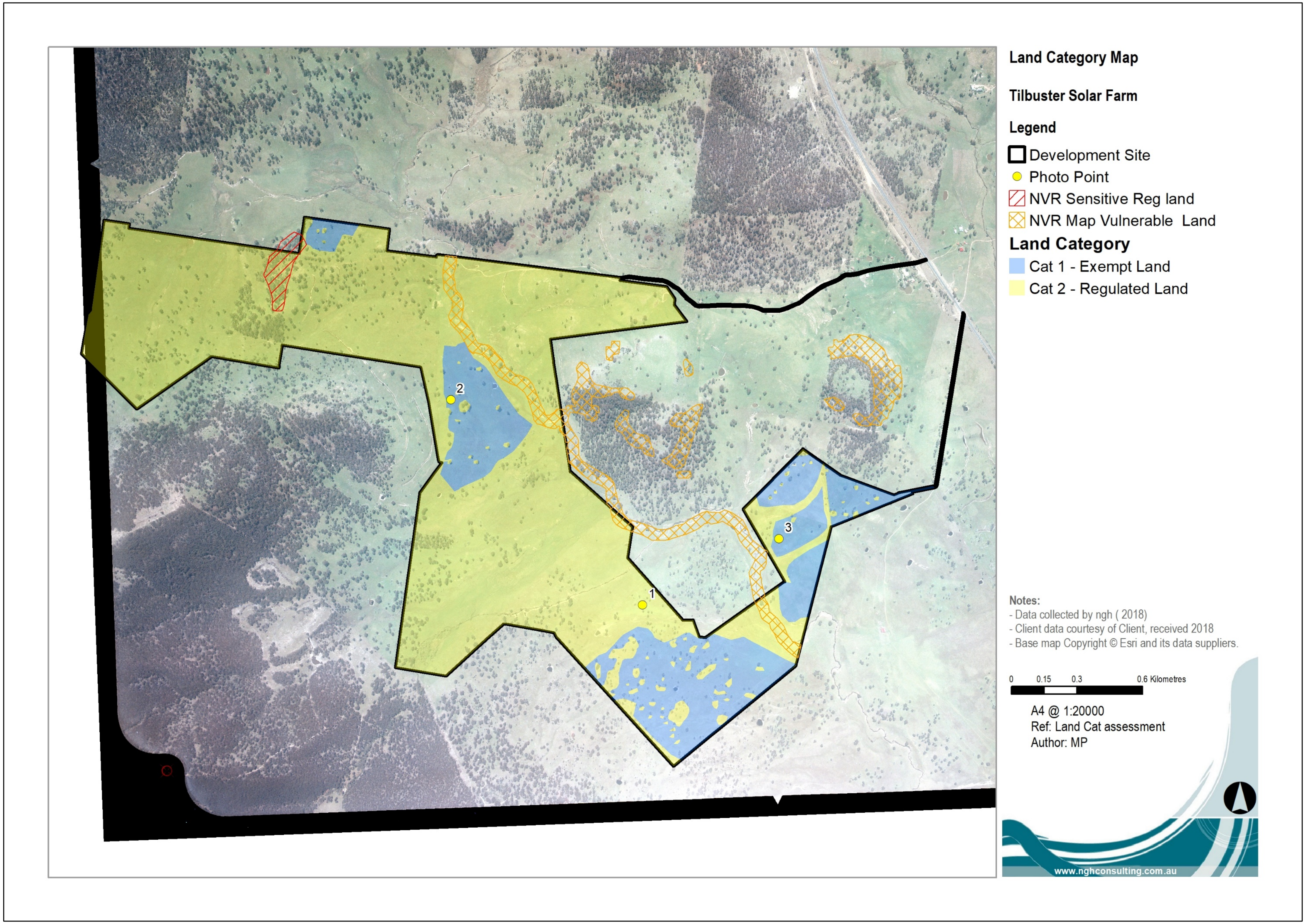


Figure 4 Aerial Imagery 1990 with Land categorisation (Source: Dept. Spatial Services delivery)

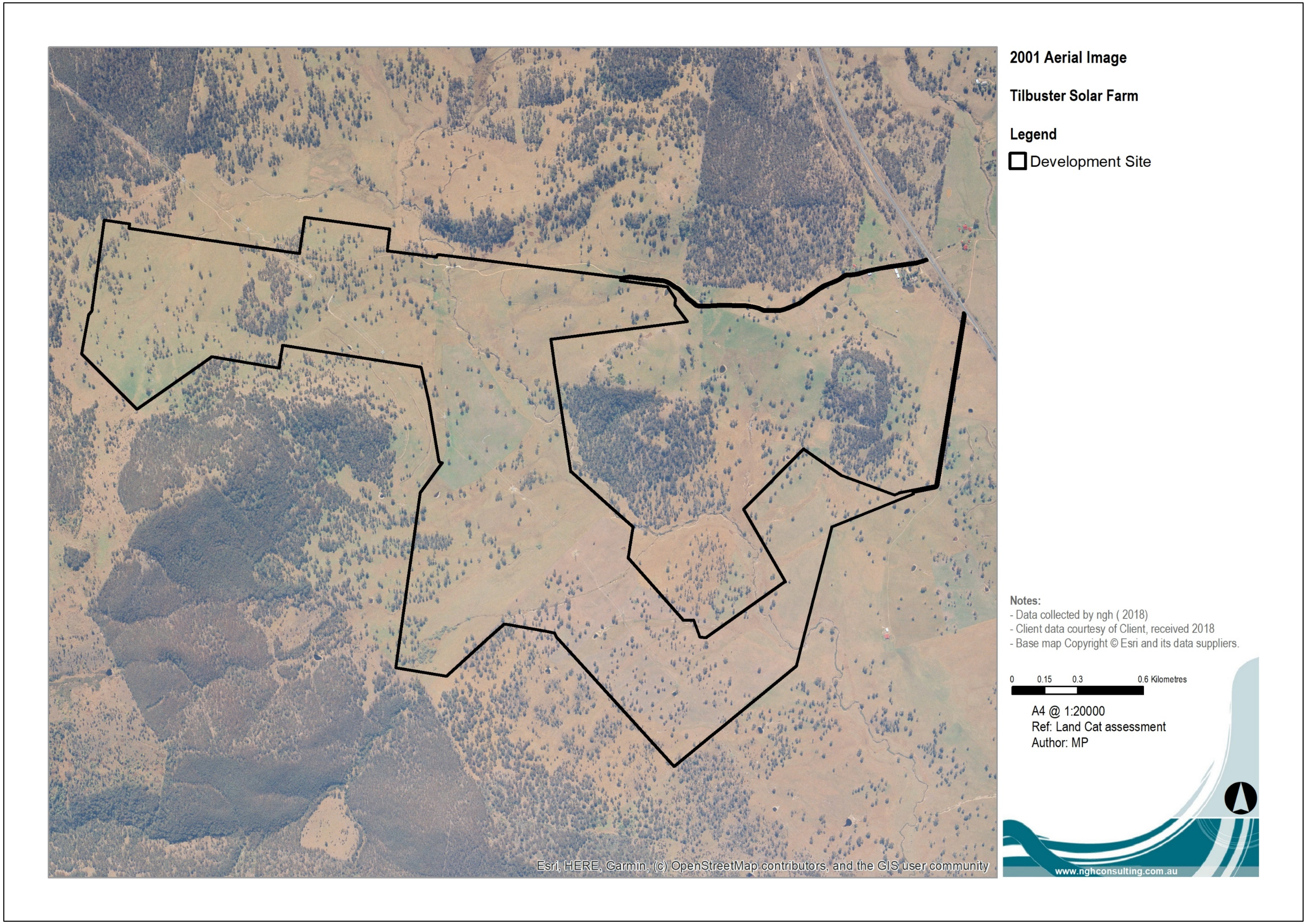


Figure 5 Aerial Imagery 2001 (Source: Dept. Spatial Services delivery)

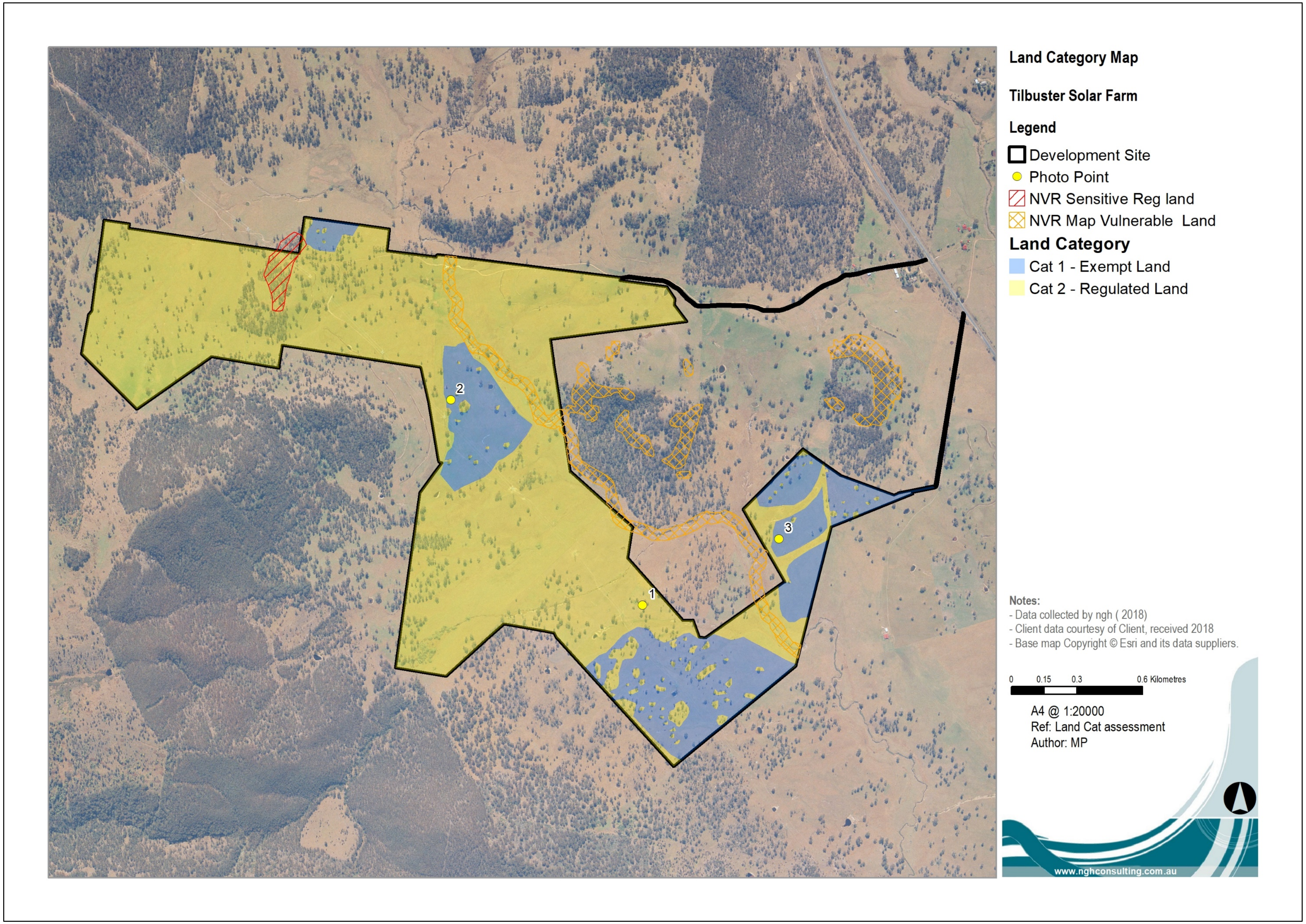


Figure 6 Aerial Imagery 2001 with Land categorisation (Source: Dept. Spatial Services delivery)

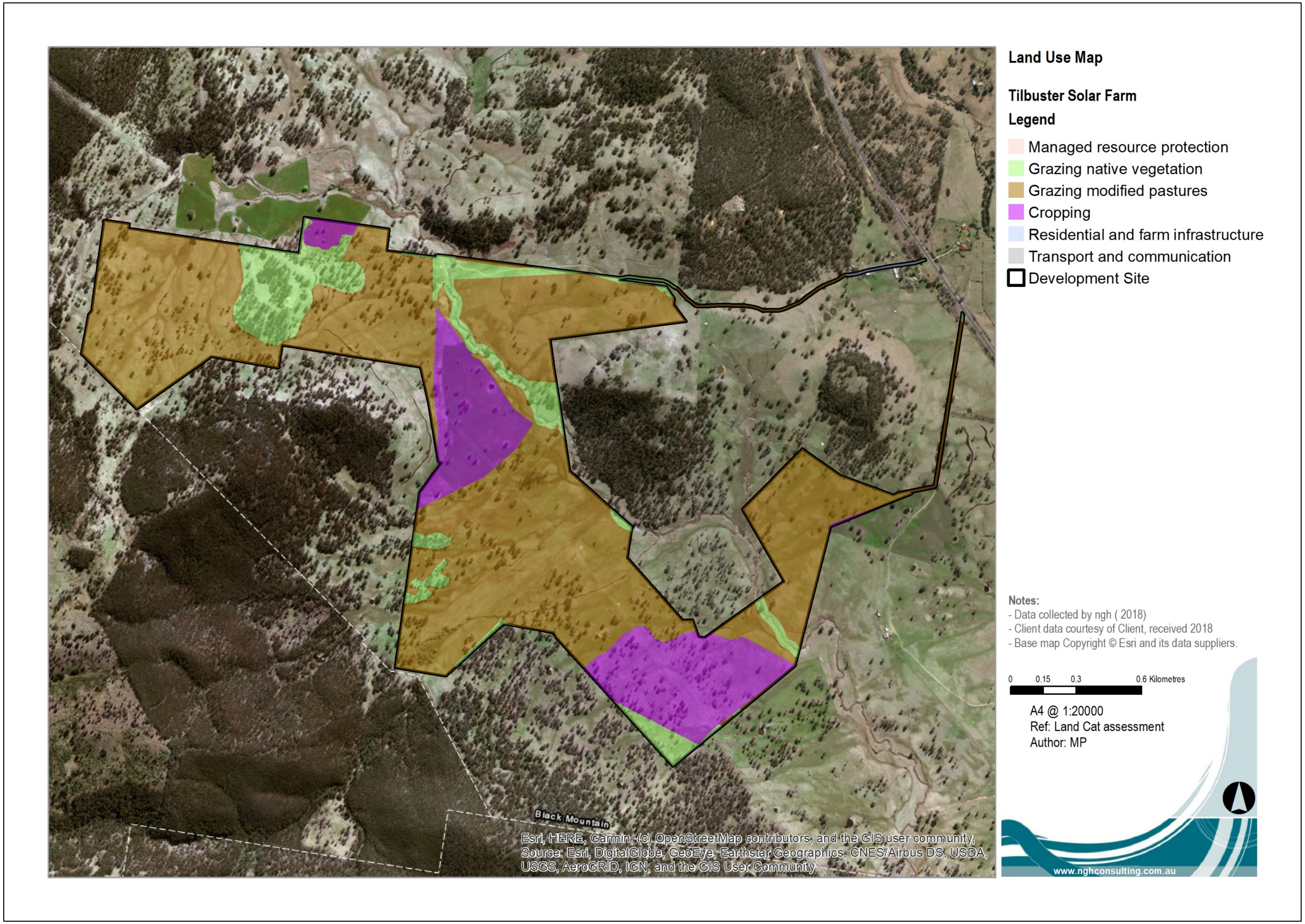


Figure 7 2017 Land Use Dataset

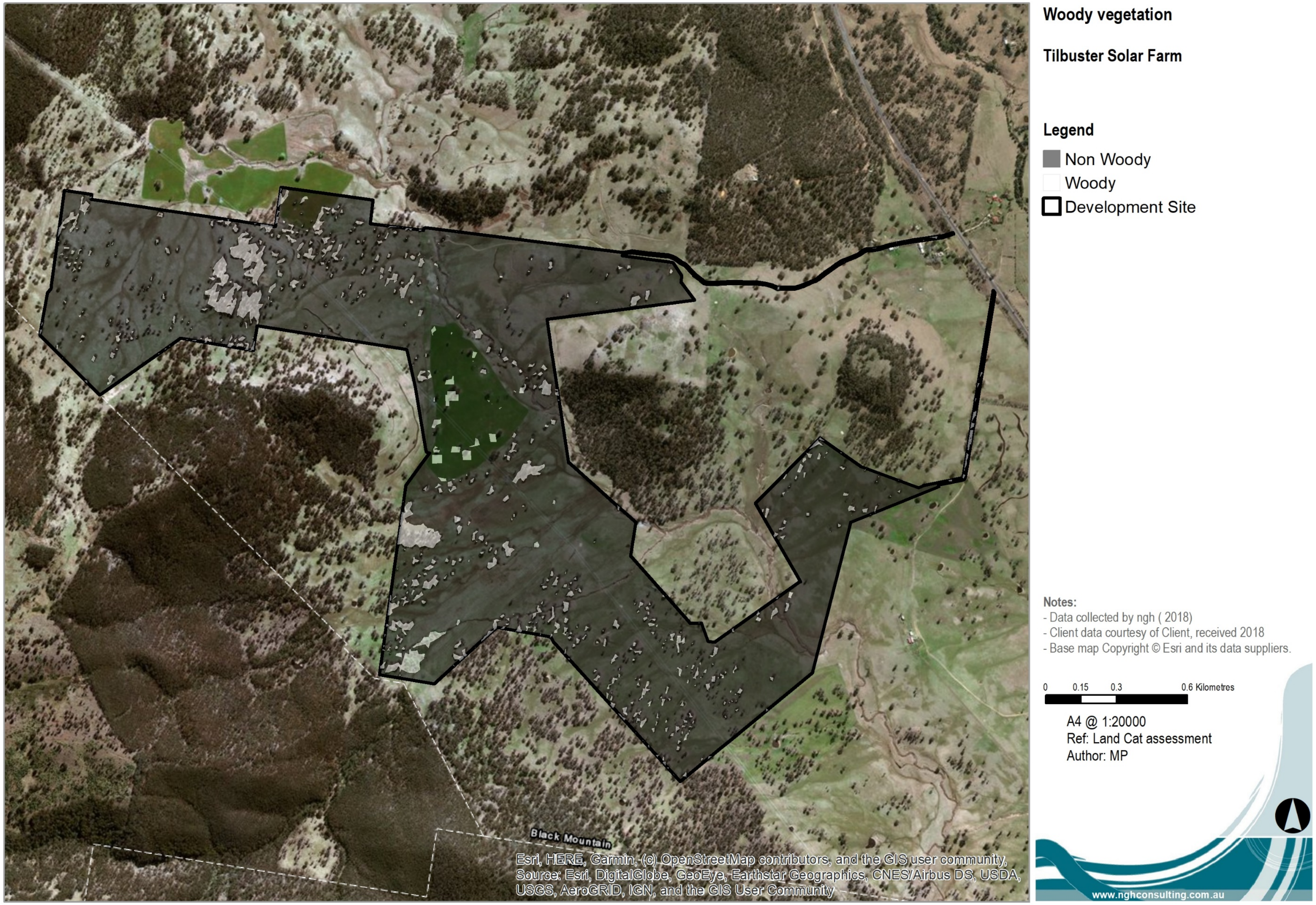


Figure 8 NSW Woody vegetation extent and FPC 2011

Table 2 – Supporting photographic evidence of current cropping

Photo point	Summary	Image
Photo Point 1	Evidence of cropping within the development site with sown *Vulpia* sp. surrounding category 2 vegetation	
Photo Point 2	Ploughed paddock beyond fence line	

Photo Point 3	Stag located within ploughed paddock (16th August 2019)	

APPENDIX B PLOT FIELD DATA

Plot 1

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**2**	**Litter Cover**	5m	80%	**71.25%**
	Shrub (SG)	**1**		15m	75%	
	Forb (FG)	**4**		25m	70%	
	Grass & grasslike (GG)	**11**		35m	60%	
	Fern (EG)	**0**		45m		
	Other (OG)	**0**	**Bare ground cover**	5m	2%	**4%**
	TOTAL	**18**		15m	10%	
BAM Attribute (20x20m plot) Structure				25m	2%	
	Stratum	**Sum**		35m	3%	
Count of cover abundance (<u>native</u> vascular plants)	**Tree (TG)**	**7**		45m		
	Shrub (SG)	**0.1**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.4**		15m	0%	
	Grass & grasslike (GG)	**63.8**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m		
	TOTAL Native	**71.3**	**Rock Cover**	5m	1%	**1%**
	TOTAL 'HTE'	**0.2**		15m	3%	
				25m	1%	
				35m	0%	
				45m		

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79			
30-49	1		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		5	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Cynodon dactylon	Common Couch	Poaceae	50			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	10			Grass & grasslike (GG)	No		
Austrostipa scabra	Speargrass	Poaceae	2	500		Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	1	300		Grass & grasslike (GG)	No		
Eragrostis leptocarpa	Drooping Lovegrass	Poaceae	0.2	100		Grass & grasslike (GG)	No		
Poa sieberiana	Snowgrass	Poaceae	0.1	100		Grass & grasslike (GG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	100		Grass & grasslike (GG)	No		
Urtica incisa	Stinging Nettle	Urticaceae	0.1	50		Forb (FG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	6		Forb (FG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Crassula sieberiana	Australian Stonecrop	Crassulaceae	0.1	20		Forb (FG)	No		
Dichelachne micrantha	Shorthair Plumegrass	Poaceae	0.1	100		Grass & grasslike (GG)	No		
Bothriochloa macra	Red Grass	Poaceae	0.1	100		Grass & grasslike (GG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	4		Shrub (SG)	No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	3		Grass & grasslike (GG)	No		
Calotis cuneata	Mountain Burr-Daisy	Asteraceae	0.1	10		Forb (FG)	No		
Panicum effusum	Hairy Panic	Poaceae	0.1	100		Grass & grasslike (GG)	No		

Plot 2

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**2**	**Litter Cover**	5m	60%	**17.00%**
	Shrub (SG)	**1**		15m	5%	
	Forb (FG)	**2**		25m	5%	
	Grass & grasslike (GG)	**5**		35m	5%	
	Fern (EG)	**0**		45m	10%	
	Other (OG)	**0**	**Bare ground cover**	5m	2%	**70%**
	TOTAL	**10**		15m	90%	
BAM Attribute (20x20m plot) Structure				25m	85%	
	Stratum	**Sum**		35m	95%	
Count of cover abundance (<u>native</u> vascular plants)	**Tree (TG)**	**50**		45m	80%	
	Shrub (SG)	**0.1**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**2.1**		15m	0%	
	Grass & grasslike (GG)	**6.2**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**58.4**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	1%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79	1		
30-49	1		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	3	1		Tree (TG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	2	1		Tree (TG)	No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	60		*		No		
Calotis cuneata	Mountain Burr-Daisy	Asteraceae	2	300		Forb (FG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	1	100		Grass & grasslike (GG)	No		
Eragrostis leptocarpa	Drooping Lovegrass	Poaceae	2	300		Grass & grasslike (GG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	7		Grass & grasslike (GG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	1		Shrub (SG)	No		
Lolium perenne	Perennial Ryegrass	Poaceae	1	400	*		No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	100		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.2	300	*		No		
Bromus hordeaceus	Soft Brome	Poaceae	1	300	*		No		
Urtica incisa	Stinging Nettle	Urticaceae	0.1	30		Forb (FG)	No		
Elymus scaber	Common Wheatgrass	Poaceae	3			Grass & grasslike (GG)	No		

Plot 3

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum	Litter Cover	Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	2		5m	50%	56.00%
	Shrub (SG)	1		15m	40%	
	Forb (FG)	3		25m	80%	
	Grass & grasslike (GG)	7		35m	70%	
	Fern (EG)	1		45m	40%	
	Other (OG)	0	Bare ground cover	5m	10%	22%
	TOTAL	14		15m	40%	
BAM Attribute (20x20m plot) Structure				25m	10%	
	Stratum	Sum		35m	10%	
Count of cover abundance (native vascular plants)	Tree (TG)	18		45m	40%	
	Shrub (SG)	0.1	Cryptogam cover	5m	0%	1%
	Forb (FG)	1.3		15m	5%	
	Grass & grasslike (GG)	25.4		25m	0%	
	Fern (EG)	0.2		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	45	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	2		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	3		
50-79			
30-49	3		
20-29	3		
10-19	1		
5-9			
<5			N/A
Length of logs (m)		17	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	8			Tree (TG)	No		
Eucalyptus banksii	Tenterfield Woollybutt	Myrtaceae	10			Tree (TG)	No		
Calotis cuneata	Mountain Burr-Daisy	Asteraceae	1	400		Forb (FG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	3		Shrub (SG)	No		
Lachnagrostis filiformis		Poaceae	0.1	1		Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	10			Grass & grasslike (GG)	No		
Panicum effusum	Hairy Panic	Poaceae	0.1	20		Grass & grasslike (GG)	No		
Cheilanthes sieberi	Rock Fern	Pteridaceae	0.2	20		Fern (EG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	10		Forb (FG)	No		
Urtica incisa	Stinging Nettle	Urticaceae	0.2	6		Forb (FG)	No		
Rytidosperma tenuius	A Wallaby Grass	Poaceae	0.1	100			No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	10			Grass & grasslike (GG)	No		
Echinopogon caespitosus	Bushy Hedgehog-grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	1		Grass & grasslike (GG)	No		

Plot 4

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**2**	**Litter Cover**	5m	40%	**53.00%**
	Shrub (SG)	**2**		15m	30%	
	Forb (FG)	**9**		25m	50%	
	Grass & grasslike (GG)	**8**		35m	65%	
	Fern (EG)	**0**		45m	80%	
	Other (OG)	**0**	**Bare ground cover**	5m	50%	**26%**
	TOTAL	**21**		15m	20%	
BAM Attribute (20x20m plot)				25m	20%	
	Stratum	**Sum**		35m	20%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**11**		45m	20%	
	Shrub (SG)	**0.3**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**3.6**		15m	0%	
	Grass & grasslike (GG)	**55.4**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**70.3**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	1%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	1		
50-79	2		
30-49			
20-29	2		
10-19			
5-9			
<5			N/A
Length of logs (m)		7	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eragrostis leptocarpa	Drooping Lovegrass	Poaceae	20			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	15			Grass & grasslike (GG)	No		
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	10			Tree (TG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	10			Grass & grasslike (GG)	No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	10		*		No		
Lachnagrostis filiformis		Poaceae	10			Grass & grasslike (GG)	No		
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	2	500		Forb (FG)	No		
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	1	1		Tree (TG)	No		
Cotula australis	Common Cotula	Asteraceae	0.5	300		Forb (FG)	No		
Dichondra repens	Kidney Weed	Convolvulaceae	0.5	500		Forb (FG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.2	6		Shrub (SG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	0.1	1	*		No		
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae	0.1	100	*		No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Daviesia genistifolia	Broom Bitter Pea	Fabaceae (Faboideae)	0.1	1		Shrub (SG)	No		
Geranium solanderi	Native Geranium	Geraniaceae	0.1	50		Forb (FG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	20	*		No		
Crassula sieberiana	Australian Stonecrop	Crassulaceae	0.1	10		Forb (FG)	No		
Elymus scaber	Common Wheatgrass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
Aristida ramosa	Purple Wiregrass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	5		Grass & grasslike (GG)	No		
Carex inversa	Knob Sedge	Cyperaceae	0.1	50		Grass & grasslike (GG)	No		
Urtica incisa	Stinging Nettle	Urticaceae	0.1	6		Forb (FG)	No		
Asperula conferta	Common Woodruff	Rubiaceae	0.1	1		Forb (FG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	10		Forb (FG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	5	*		No		

Plot 5

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	2	Litter Cover	5m	35%	25.00%
	Shrub (SG)	3		15m	35%	
	Forb (FG)	8		25m	19%	
	Grass & grasslike (GG)	7		35m	20%	
	Fern (EG)	0		45m	16%	
	Other (OG)	2	Bare ground cover	5m	10%	5%
	TOTAL	22		15m	5%	
BAM Attribute (20x20m plot) Structure				25m	1%	
	Stratum	Sum		35m	5%	
Count of cover abundance (native vascular plants)	Tree (TG)	12		45m	2%	
	Shrub (SG)	0.3	Cryptogam cover	5m	5%	6%
	Forb (FG)	0.9		15m	10%	
	Grass & grasslike (GG)	61.7		25m	10%	
	Fern (EG)	0		35m	2%	
	Other (OG)	5.1		45m	2%	
	TOTAL Native	80	Rock Cover	5m	50%	51%
	TOTAL 'HTE'	0.1		15m	50%	
				25m	70%	
				35m	5%	
				45m	80%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79			
30-49	2		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		7	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Cynodon dactylon	Common Couch	Poaceae	40			Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	15			Grass & grasslike (GG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	7			Tree (TG)	No		
Clematis aristata	Old Man's Beard	Ranunculaceae	5			Other (OG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		
Eucalyptus laevopinea	Silver-top Stringybark	Myrtaceae	5			Tree (TG)	No		
Phytolacca octandra	Inkweed	Phytolaccaceae	1		*		No		
Poa sieberiana	Snowgrass	Poaceae	1			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.5	200		Grass & grasslike (GG)	No		
Geranium solanderi	Native Geranium	Geraniaceae	0.2	200		Forb (FG)	No		
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae	0.2	200	*		No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	100		Forb (FG)	No		
Oxalis perennans		Oxalidaceae	0.1	50		Forb (FG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0.1	50		Forb (FG)	No		
Wahlenbergia luteola	Bluebell	Campanulaceae	0.1	20		Forb (FG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	20		Forb (FG)	No		
Cassinia quinquefaria		Asteraceae	0.1	1		Shrub (SG)	No		
Ageratum houstonianum		Asteraceae	0.1	1	*		No		
Bothriochloa macra	Red Grass	Poaceae	0.1	20		Grass & grasslike (GG)	No		
Desmodium varians	Slender Tick-trefoil	Fabaceae (Faboideae)	0.1	20		Other (OG)	No		
Rubus parvifolius	Native Raspberry	Rosaceae	0.1	10		Shrub (SG)	No		
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	Lomandraceae	0.1	2		Grass & grasslike (GG)	No		
Dichondra repens	Kidney Weed	Convolvulaceae	0.1	20		Forb (FG)	No		
Vittadinia muelleri	A Fuzzweed	Asteraceae	0.1	10		Forb (FG)	No		
Acetosella vulgaris	Sheep Sorrel	Polygonaceae	0.1	5	*		HTE		
Trifolium repens	White Clover	Fabaceae (Faboideae)	0.1	1	*		No		
Olearia elliptica	Sticky Daisy-bush	Asteraceae	0.1	1		Shrub (SG)	No		

Plot 6

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	2	Litter Cover	5m	70%	73.00%
	Shrub (SG)	1		15m	55%	
	Forb (FG)	3		25m	85%	
	Grass & grasslike (GG)	9		35m	85%	
	Fern (EG)	0		45m	70%	
	Other (OG)	0	Bare ground cover	5m	5%	15%
	TOTAL	15		15m	35%	
BAM Attribute (20x20m plot) Structure				25m	5%	
	Stratum	Sum		35m	5%	
Count of cover abundance (native vascular plants)	Tree (TG)	13		45m	25%	
	Shrub (SG)	0.1	Cryptogam cover	5m	0%	0%
	Forb (FG)	0.3		15m	0%	
	Grass & grasslike (GG)	53.2		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	66.6	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	0		15m	0%	
				25m	1%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	3		
50-79	1		1
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Vulpia myuros	Rat's Tail Fescue	Poaceae	25		*		No		
Cynodon dactylon	Common Couch	Poaceae	25			Grass & grasslike (GG)	No		
Eucalyptus bridgesiana	Apple Box	Myrtaceae	10			Tree (TG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	10			Grass & grasslike (GG)	No		
Bothriochloa macra	Red Grass	Poaceae	5			Grass & grasslike (GG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	5			Grass & grasslike (GG)	No		
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	3	1		Tree (TG)	No		
Aristida ramosa	Purple Wiregrass	Poaceae	2	300		Grass & grasslike (GG)	No		
Poa sieberiana	Snowgrass	Poaceae	1	20		Grass & grasslike (GG)	No		
Austrostipa scabra	Speargrass	Poaceae	0.1	3		Grass & grasslike (GG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0.1	50		Forb (FG)	No		
Cymbonotus lawsonianus	Bear's Ear	Asteraceae	0.1	6		Forb (FG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	50		Grass & grasslike (GG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	2		Shrub (SG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	20	*		No		
Oxalis perennans		Oxalidaceae	0.1	50		Forb (FG)	No		
Lolium perenne	Perennial Ryegrass	Poaceae	0.1	1	*		No		

Plot 7

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**4**	**Litter Cover**	5m	95%	**41.00%**
	Shrub (SG)	**2**		15m	50%	
	Forb (FG)	**8**		25m	30%	
	Grass & grasslike (GG)	**7**		35m	20%	
	Fern (EG)	**0**		45m	10%	
	Other (OG)	**0**	**Bare ground cover**	5m	0%	**4%**
	TOTAL	**21**		15m	5%	
BAM Attribute (20x20m plot) Structure				25m	10%	
	Stratum	**Sum**		35m	5%	
Count of cover abundance (<u>native</u> vascular plants)	**Tree (TG)**	**15**		45m	2%	
	Shrub (SG)	**0.3**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**2.6**		15m	0%	
	Grass & grasslike (GG)	**40.6**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**58.5**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	0%	
				35m	0%	
				45m	2%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79	1		
30-49	3		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		2	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Aristida ramosa	Purple Wiregrass	Poaceae	0.5	300		Grass & grasslike (GG)	No		
Asperula conferta	Common Woodruff	Rubiaceae	0.1	5		Forb (FG)	No		
Austrostipa scabra	Speargrass	Poaceae	0.1	50		Grass & grasslike (GG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0.1	10		Forb (FG)	No		
Crassula sieberiana	Australian Stonecrop	Crassulaceae	0.1	300		Forb (FG)	No		
Cynodon dactylon	Common Couch	Poaceae	5			Grass & grasslike (GG)	No		
Dichondra repens	Kidney Weed	Convolvulaceae	1	200		Forb (FG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	10			Grass & grasslike (GG)	No		
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	2	1		Tree (TG)	No		
Eucalyptus bridgesiana	Apple Box	Myrtaceae	2	1		Tree (TG)	No		
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	3	1		Tree (TG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	8			Tree (TG)	No		
Hibbertia obtusifolia	Hoary Guinea Flower	Dilleniaceae	0.1	1		Shrub (SG)	No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Hydrocotyle laxiflora	Stinking Pennywort	Apiaceae	1	200		Forb (FG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	15			Grass & grasslike (GG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.2	3		Shrub (SG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	50	*		No		
Poa sieberiana	Snowgrass	Poaceae	5			Grass & grasslike (GG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	10		Forb (FG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	5			Grass & grasslike (GG)	No		
Tricoryne elatior	Yellow Autumn-lily	Anthericaceae	0.1	1		Forb (FG)	No		
Trifolium repens	White Clover	Fabaceae (Faboideae)	1	2	*		No		
Urtica incisa	Stinging Nettle	Urticaceae	0.1	6		Forb (FG)	No		

Plot 8

BAM Attribute (20x20m plot) Composition		
	Stratum	Sum
Count of Native Richness	Tree (TG)	3
	Shrub (SG)	1
	Forb (FG)	10
	Grass & grasslike (GG)	5
	Fern (EG)	0
	Other (OG)	1
	TOTAL	20
BAM Attribute (20x20m plot) Structure		
	Stratum	Sum
Count of cover abundance (native vascular plants)	Tree (TG)	19
	Shrub (SG)	0.1
	Forb (FG)	2.6
	Grass & grasslike (GG)	60.3
	Fern (EG)	0
	Other (OG)	0.1
	TOTAL Native	82.1
	TOTAL 'HTE'	0

BAM Attributes (1 x 1m Plots) Function			
	Tape length	% cover	Average %
Litter Cover	5m	30%	63.00%
	15m	75%	
	25m	70%	
	35m	70%	
	45m	70%	
Bare ground cover	5m	30%	12%
	15m	5%	
	25m	2%	
	35m	20%	
	45m	2%	
Cryptogam cover	5m	0%	0%
	15m	0%	
	25m	0%	
	35m	0%	
	45m	0%	
Rock Cover	5m	0%	0%
	15m	0%	
	25m	0%	
	35m	0%	
	45m	1%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79	4		
30-49	2		1
20-29	2		
10-19			
5-9			
<5			N/A
Length of logs (m)		83	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Microlaena stipoides	Weeping Grass	Poaceae	40			Grass & grasslike (GG)	No		
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	15	10		Tree (TG)	No		
Cynodon dactylon	Common Couch	Poaceae	10			Grass & grasslike (GG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	10			Grass & grasslike (GG)	No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	5		*		No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		
Eucalyptus banksii	Tenterfield Woollybutt	Myrtaceae	2	1		Tree (TG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	2	2		Tree (TG)	No		
Dichondra repens	Kidney Weed	Convolvulaceae	1	500		Forb (FG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.5	500		Forb (FG)	No		
Mentha satureioides	Native Pennyroyal	Lamiaceae	0.2	200		Forb (FG)	No		
Geranium solanderi	Native Geranium	Geraniaceae	0.2	200		Forb (FG)	No		
Oxalis perennans		Oxalidaceae	0.2	100		Forb (FG)	No		
Lachnagrostis filiformis		Poaceae	0.2	200		Grass & grasslike (GG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	1	*		No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	10	*		No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Vittadinia muelleri	A Fuzzweed	Asteraceae	0.1	3		Forb (FG)	No		
Crassula sieberiana	Australian Stonecrop	Crassulaceae	0.1	50		Forb (FG)	No		
Cymbonotus lawsonianus	Bear's Ear	Asteraceae	0.1	10		Forb (FG)	No		
Poa sieberiana	Snowgrass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae	0.1	100	*		No		
Desmodium varians	Slender Tick-trefoil	Fabaceae (Faboideae)	0.1	1		Other (OG)	No		
Calotis cunefolia	Purple Burr-daisy	Asteraceae	0.1	2			No		
Cassinia uncata	Sticky Cassinia	Asteraceae	0.1	1		Shrub (SG)	No		
Wahlenbergia luteola	Bluebell	Campanulaceae	0.1	1		Forb (FG)	No		
Ageratum houstonianum		Asteraceae	0.1	1	*		No		
Cotula australis	Common Cotula	Asteraceae	0.1	1		Forb (FG)	No		

Plot 9

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**3**	**Litter Cover**	5m	50%	**43.00%**
	Shrub (SG)	**0**		15m	25%	
	Forb (FG)	**4**		25m	50%	
	Grass & grasslike (GG)	**3**		35m	50%	
	Fern (EG)	**0**		45m	40%	
	Other (OG)	**0**	**Bare ground cover**	5m	5%	**24%**
	TOTAL	**10**		15m	70%	
BAM Attribute (20x20m plot) Structure				25m	40%	
	Stratum	**Sum**		35m	1%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**28**		45m	5%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**20.3**		15m	0%	
	Grass & grasslike (GG)	**60**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**108.3**	**Rock Cover**	5m	0%	**1%**
	TOTAL 'HTE'	**0**		15m	5%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79	2		
30-49	1		
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		3	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus melliodora	Yellow Box	Myrtaceae	15			Tree (TG)	No		
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	10			Tree (TG)	No		
Eucalyptus bridgesiana	Apple Box	Myrtaceae	3	1		Tree (TG)	No		
Urtica incisa	Stinging Nettle	Urticaceae	20			Forb (FG)	No		
Cynodon dactylon	Common Couch	Poaceae	50			Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	5			Grass & grasslike (GG)	No		
Oxalis perennans		Oxalidaceae	0.1	10		Forb (FG)	No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	5		*		No		
Calotis cuneifolia	Purple Burr Daisy	Asteraceae	0.1	6		Forb (FG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	20		Forb (FG)	No		
Eragrostis leptocarpa	Drooping Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Caryophyllaceae	0.1	50	*		No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		

Plot 10

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**3**	**Litter Cover**	5m	85%	**67.00%**
	Shrub (SG)	**0**		15m	50%	
	Forb (FG)	**5**		25m	60%	
	Grass & grasslike (GG)	**6**		35m	60%	
	Fern (EG)	**0**		45m	80%	
	Other (OG)	**0**	**Bare ground cover**	5m	2%	**9%**
	TOTAL	**14**		15m	2%	
BAM Attribute (20x20m plot) Structure				25m	40%	
	Stratum	**Sum**		35m	1%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**17**		45m	0%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.5**		15m	0%	
	Grass & grasslike (GG)	**17.1**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**34.6**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0.1**		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80	1		
50-79	1		
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus melliodora	Yellow Box	Myrtaceae	8			Tree (TG)	No		
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	6			Tree (TG)	No		
Eucalyptus bridgesiana	Apple Box	Myrtaceae	3	1		Tree (TG)	No		
Juncus subsecundus	Finger Rush	Juncaceae	5			Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	5			Grass & grasslike (GG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	9	*		No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	50		*		No		
Bothriochloa macra	Red Grass	Poaceae	1	500		Grass & grasslike (GG)	No		
Poa sieberiana	Snowgrass	Poaceae	1	100		Grass & grasslike (GG)	No		
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0.1	10		Forb (FG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	5		*		No		

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Cynodon dactylon	Common Couch	Poaceae	5			Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	3	*		No		
Plantago debilis	Shade Plantain	Plantaginaceae	0.1	1		Forb (FG)	No		
Cymbonotus lawsonianus	Bear's Ear	Asteraceae	0.1	1		Forb (FG)	No		
Urtica incisa	Stinging Nettle	Urticaceae	0.1	50		Forb (FG)	No		
Einadia hastata	Berry Saltbush	Chenopodiaceae	0.1	20		Forb (FG)	No		
Rosa rubiginosa	Sweet Briar	Rosaceae	0.1	2	*		HTE		
Carex inversa	Knob Sedge	Cyperaceae	0.1	50		Grass & grasslike (GG)	No		

Plot 11

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**2**	**Litter Cover**	5m	50%	**52.00%**
	Shrub (SG)	**0**		15m	70%	
	Forb (FG)	**3**		25m	60%	
	Grass & grasslike (GG)	**7**		35m	40%	
	Fern (EG)	**0**		45m	40%	
	Other (OG)	**0**	**Bare ground cover**	5m	0%	**4%**
	TOTAL	**12**		15m	0%	
BAM Attribute (20x20m plot) Structure				25m	10%	
	Stratum	**Sum**		35m	1%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**13**		45m	10%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.7**		15m	0%	
	Grass & grasslike (GG)	**21.3**		25m	1%	
	Fern (EG)	**0**		35m	1%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**35**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	1		
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Anthoxanthum odoratum	Sweet Vernal Grass	Poaceae	25		*		No		
Aristida ramosa	Purple Wiregrass	Poaceae	0.1	3		Grass & grasslike (GG)	No		
Bothriochloa macra	Red Grass	Poaceae	0.1	50		Grass & grasslike (GG)	No		
Calotis cuneifolia	Purple Burr-daisy	Asteraceae	0.5	200		Forb (FG)	No		
Eragrostis brownii	Brown's Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Eragrostis leptocarpa	Drooping Lovegrass	Poaceae	5			Grass & grasslike (GG)	No		
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	8			Tree (TG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	5			Tree (TG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	50	*		No		
Juncus subsecundus	Finger Rush	Juncaceae	0.1	10		Grass & grasslike (GG)	No		
Microlaena stipoides	Weeping Grass	Poaceae	10			Grass & grasslike (GG)	No		
Oxalis perennans		Oxalidaceae	0.1	50		Forb (FG)	No		
Poa sieberiana	Snowgrass	Poaceae	1			Grass & grasslike (GG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	1		Forb (FG)	No		
Vulpia myuros	Rat's Tail Fescue	Poaceae	45		*		No		

Plot 12

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**0**	**Litter Cover**	5m	1%	**28.40%**
	Shrub (SG)	**0**		15m	1%	
	Forb (FG)	**0**		25m	55%	
	Grass & grasslike (GG)	**4**		35m	75%	
	Fern (EG)	**0**		45m	10%	
	Other (OG)	**0**	**Bare ground cover**	5m	59%	**49%**
	TOTAL	**4**		15m	40%	
BAM Attribute (20x20m plot) Structure				25m	45%	
	Stratum	**Sum**		35m	25%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**0**		45m	75%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0**		15m	0%	
	Grass & grasslike (GG)	**0.4**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**0.4**	**Rock Cover**	5m	40%	**20%**
	TOTAL 'HTE'	**0**		15m	44%	
				25m	0%	
				35m	0%	
				45m	15%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Juncus spp.	A Rush	Juncaceae	0.1	50		Grass & grasslike (GG)	No		
Aristida ramosa	Purple Wiregrass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
Carex spp.		Cyperaceae	0.1	100		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	20	*		No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	3	*		No		
Cynodon dactylon	Common Couch	Poaceae	0.1	200		Grass & grasslike (GG)	No		

Plot 13

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Fucntion			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**0**	**Litter Cover**	5m	25%	**21.00%**
	Shrub (SG)	**0**		15m	30%	
	Forb (FG)	**1**		25m	25%	
	Grass & grasslike (GG)	**2**		35m	10%	
	Fern (EG)	**0**		45m	15%	
	Other (OG)	**0**	**Bare ground cover**	5m	75%	**75%**
	TOTAL	**3**		15m	50%	
BAM Attribute (20x20m plot) Structure				25m	75%	
	Stratum	**Sum**		35m	90%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**0**		45m	85%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.1**		15m	0%	
	Grass & grasslike (GG)	**0.3**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**0.4**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Carex spp.		Cyperaceae	0.1	500		Grass & grasslike (GG)	No		
Cynodon dactylon	Common Couch	Poaceae	0.2	1000		Grass & grasslike (GG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	100		Forb (FG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	6	*		No		

Plot 14

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	0	Litter Cover	5m	25%	36.00%
	Shrub (SG)	0		15m	35%	
	Forb (FG)	1		25m	55%	
	Grass & grasslike (GG)	4		35m	50%	
	Fern (EG)	0		45m	15%	
	Other (OG)	0	Bare ground cover	5m	75%	64%
	TOTAL	5		15m	65%	
BAM Attribute (20x20m plot) Structure				25m	45%	
	Stratum	Sum		35m	50%	
Count of cover abundance (native vascular plants)	Tree (TG)	0		45m	85%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	0.1		15m	0%	
	Grass & grasslike (GG)	0.5		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	0.6	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	0		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Rumex brownii	Swamp Dock	Polygonaceae	0.1	40		Forb (FG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Cynodon dactylon	Common Couch	Poaceae	0.2	400		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	50	*		No		
Juncus spp.	A Rush	Juncaceae	0.1	1		Grass & grasslike (GG)	No		
Carex spp.		Cyperaceae	0.1	100		Grass & grasslike (GG)	No		

Plot 15

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	0	Litter Cover	5m	60%	43.00%
	Shrub (SG)	0		15m	35%	
	Forb (FG)	1		25m	40%	
	Grass & grasslike (GG)	2		35m	25%	
	Fern (EG)	0		45m	55%	
	Other (OG)	0	Bare ground cover	5m	40%	57%
	TOTAL	3		15m	65%	
BAM Attribute (20x20m plot) Structure				25m	60%	
	Stratum	Sum		35m	75%	
Count of cover abundance (native vascular plants)	Tree (TG)	0		45m	45%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	0.1		15m	0%	
	Grass & grasslike (GG)	0.4		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	0.5	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	0		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Hypochaeris radicata	Catsear	Asteraceae	0.2	500	*		No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	9		Forb (FG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.3	1000		Grass & grasslike (GG)	No		
Juncus spp.	A Rush	Juncaceae	0.1	1		Grass & grasslike (GG)	No		

Plot 16

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	0	Litter Cover	5m	15%	20.00%
	Shrub (SG)	0		15m	20%	
	Forb (FG)	1		25m	30%	
	Grass & grasslike (GG)	3		35m	25%	
	Fern (EG)	0		45m	10%	
	Other (OG)	0	Bare ground cover	5m	85%	80%
	TOTAL	4		15m	80%	
BAM Attribute (20x20m plot) Structure				25m	70%	
	Stratum	Sum		35m	75%	
Count of cover abundance (native vascular plants)	Tree (TG)	0		45m	90%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	0.1		15m	0%	
	Grass & grasslike (GG)	0.3		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	0.4	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	0		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Hypochaeris radicata	Catsear	Asteraceae	0.1	50	*		No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Juncus spp.	A Rush	Juncaceae	0.1	20		Grass & grasslike (GG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	7		Forb (FG)	No		
Carex spp.		Cyperaceae	0.1	100		Grass & grasslike (GG)	No		

Plot 17

<table>
<tr><td colspan="3">BAM Attribute (20x20m plot) Composition</td><td colspan="4">BAM Attributes (1 x 1m Plots) Function</td></tr>
<tr><td></td><td>Stratum</td><td>Sum</td><td></td><td>Tape length</td><td>% cover</td><td>Average %</td></tr>
<tr><td rowspan="7">Count of Native Richness</td><td>Tree (TG)</td><td>1</td><td rowspan="5">Litter Cover</td><td>5m</td><td>1%</td><td rowspan="5">28.40%</td></tr>
<tr><td>Shrub (SG)</td><td>2</td><td>15m</td><td>1%</td></tr>
<tr><td>Forb (FG)</td><td>0</td><td>25m</td><td>55%</td></tr>
<tr><td>Grass & grasslike (GG)</td><td>0</td><td>35m</td><td>75%</td></tr>
<tr><td>Fern (EG)</td><td>0</td><td>45m</td><td>10%</td></tr>
<tr><td>Other (OG)</td><td>0</td><td rowspan="5">Bare ground cover</td><td>5m</td><td>59%</td><td rowspan="5">49%</td></tr>
<tr><td>TOTAL</td><td>3</td><td>15m</td><td>40%</td></tr>
<tr><td colspan="3">BAM Attribute (20x20m plot) Structure</td><td>25m</td><td>45%</td></tr>
<tr><td></td><td>Stratum</td><td>Sum</td><td>35m</td><td>25%</td></tr>
<tr><td rowspan="8">Count of cover abundance (<u>native</u> vascular plants)</td><td>Tree (TG)</td><td>65</td><td>45m</td><td>75%</td></tr>
<tr><td>Shrub (SG)</td><td>0.2</td><td rowspan="5">Cryptogam cover</td><td>5m</td><td>0%</td><td rowspan="5">0%</td></tr>
<tr><td>Forb (FG)</td><td>0</td><td>15m</td><td>0%</td></tr>
<tr><td>Grass & grasslike (GG)</td><td>0</td><td>25m</td><td>0%</td></tr>
<tr><td>Fern (EG)</td><td>0</td><td>35m</td><td>0%</td></tr>
<tr><td>Other (OG)</td><td>0</td><td>45m</td><td>0%</td></tr>
<tr><td>TOTAL Native</td><td>65.2</td><td rowspan="5">Rock Cover</td><td>5m</td><td>40%</td><td rowspan="5">20%</td></tr>
<tr><td>TOTAL 'HTE'</td><td>0</td><td>15m</td><td>44%</td></tr>
<tr><td></td><td></td><td></td><td>25m</td><td>0%</td></tr>
<tr><td></td><td></td><td></td><td>35m</td><td>0%</td></tr>
<tr><td></td><td></td><td></td><td>45m</td><td>15%</td></tr>
</table>

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79	1		
30-49	4		
20-29	1		
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	65			Tree (TG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	3		Shrub (SG)	No		
Bursaria spinosa	Native Blackthorn	Pittosporaceae	0.1	1		Shrub (SG)	No		

Plot 18

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	2	Litter Cover	5m	90%	55.00%
	Shrub (SG)	1		15m	75%	
	Forb (FG)	0		25m	65%	
	Grass & grasslike (GG)	2		35m	20%	
	Fern (EG)	0		45m	25%	
	Other (OG)	0	Bare ground cover	5m	10%	44%
	TOTAL	5		15m	20%	
BAM Attribute (20x20m plot) Structure				25m	35%	
	Stratum	Sum		35m	80%	
Count of cover abundance (native vascular plants)	Tree (TG)	15		45m	75%	
	Shrub (SG)	0.1	Cryptogam cover	5m	0%	0%
	Forb (FG)	0		15m	0%	
	Grass & grasslike (GG)	0.2		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	15.3	Rock Cover	5m	0%	1%
	TOTAL 'HTE'	0		15m	5%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80	2		
50-79	1		
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)		28.5	

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	10			Tree (TG)	No		
Eucalyptus melliodora	Yellow Box	Myrtaceae	5			Tree (TG)	No		
Bursaria spinosa	Native Blackthorn	Pittosporaceae	0.1	1		Shrub (SG)	No		
Juncus spp.	A Rush	Juncaceae	0.1	50		Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		

Plot 19

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Junction			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**0**	**Litter Cover**	5m	65%	**29.00%**
	Shrub (SG)	**0**		15m	20%	
	Forb (FG)	**1**		25m	20%	
	Grass & grasslike (GG)	**4**		35m	30%	
	Fern (EG)	**0**		45m	10%	
	Other (OG)	**0**	**Bare ground cover**	5m	35%	**71%**
	TOTAL	**5**		15m	80%	
BAM Attribute (20x20m plot) Structure				25m	80%	
	Stratum	**Sum**		35m	70%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**0**		45m	90%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.1**		15m	0%	
	Grass & grasslike (GG)	**0.5**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**0.6**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Carex spp.		Cyperaceae	0.2	300		Grass & grasslike (GG)	No		
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	0.1	200	*		No		
Cirsium vulgare	Spear Thistle	Asteraceae	0.1	50	*		No		
Aristida ramosa	Purple Wiregrass	Poaceae	0.1	10		Grass & grasslike (GG)	No		
Bromus hordeaceus	Soft Brome	Poaceae	0.1	1	*		No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.1	1		Grass & grasslike (GG)	No		
Dysphania spp.		Chenopodiaceae	0.1	6		Forb (FG)	No		
Juncus spp.	A Rush	Juncaceae	0.1	50		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.2	500	*		No		

Plot 20

<table>
<tr><th colspan="3">BAM Attribute (20x20m plot) Composition</th><th colspan="4">BAM Attributes (1 x 1m Plots) Function</th></tr>
<tr><th></th><th>Stratum</th><th>Sum</th><th></th><th>Tape length</th><th>% cover</th><th>Average %</th></tr>
<tr><td rowspan="7">Count of Native Richness</td><td>Tree (TG)</td><td>0</td><td rowspan="5">Litter Cover</td><td>5m</td><td>75%</td><td rowspan="5">79.00%</td></tr>
<tr><td>Shrub (SG)</td><td>0</td><td>15m</td><td>80%</td></tr>
<tr><td>Forb (FG)</td><td>1</td><td>25m</td><td>85%</td></tr>
<tr><td>Grass & grasslike (GG)</td><td>3</td><td>35m</td><td>85%</td></tr>
<tr><td>Fern (EG)</td><td>0</td><td>45m</td><td>70%</td></tr>
<tr><td>Other (OG)</td><td>0</td><td rowspan="5">Bare ground cover</td><td>5m</td><td>25%</td><td rowspan="5">21%</td></tr>
<tr><td>TOTAL</td><td>4</td><td>15m</td><td>20%</td></tr>
<tr><td colspan="3">BAM Attribute (20x20m plot) Structure</td><td>25m</td><td>15%</td></tr>
<tr><td></td><td>Stratum</td><td>Sum</td><td>35m</td><td>15%</td></tr>
<tr><td rowspan="8">Count of cover abundance (native vascular plants)</td><td>Tree (TG)</td><td>0</td><td>45m</td><td>30%</td></tr>
<tr><td>Shrub (SG)</td><td>0</td><td rowspan="5">Cryptogam cover</td><td>5m</td><td>0%</td><td rowspan="5">0%</td></tr>
<tr><td>Forb (FG)</td><td>0.1</td><td>15m</td><td>0%</td></tr>
<tr><td>Grass & grasslike (GG)</td><td>0.4</td><td>25m</td><td>0%</td></tr>
<tr><td>Fern (EG)</td><td>0</td><td>35m</td><td>0%</td></tr>
<tr><td>Other (OG)</td><td>0</td><td>45m</td><td>0%</td></tr>
<tr><td>TOTAL Native</td><td>0.5</td><td rowspan="5">Rock Cover</td><td>5m</td><td>0%</td><td rowspan="5">0%</td></tr>
<tr><td>TOTAL 'HTE'</td><td>0</td><td>15m</td><td>0%</td></tr>
<tr><td></td><td></td><td>25m</td><td>0%</td></tr>
<tr><td></td><td></td><td></td><td>35m</td><td>0%</td></tr>
<tr><td></td><td></td><td></td><td>45m</td><td>0%</td></tr>
</table>

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	Euc	Non Euc	Hollows
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.2	200		Grass & grasslike (GG)	No		
Carex spp.		Cyperaceae	0.1	100		Grass & grasslike (GG)	No		
Juncus spp.	A Rush	Juncaceae	0.1	20		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	50	*		No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	5		Forb (FG)	No		

Plot 21

BAM Attribute (20x20m plot) Compistion			BAM Attributes (1 x 1m Plots) Function			
	Stratum	Sum		Tape length	% cover	Average %
Count of Native Richness	Tree (TG)	0	Litter Cover	5m	55%	61.00%
	Shrub (SG)	0		15m	80%	
	Forb (FG)	1		25m	45%	
	Grass & grasslike (GG)	1		35m	40%	
	Fern (EG)	0		45m	85%	
	Other (OG)	0	Bare ground cover	5m	45%	39%
	TOTAL	2		15m	20%	
BAM Attribute (20x20m plot) Structure				25m	55%	
	Stratum	Sum		35m	60%	
Count of cover abundance (native vascular plants)	Tree (TG)	0		45m	15%	
	Shrub (SG)	0	Cryptogam cover	5m	0%	0%
	Forb (FG)	0.1		15m	0%	
	Grass & grasslike (GG)	1		25m	0%	
	Fern (EG)	0		35m	0%	
	Other (OG)	0		45m	0%	
	TOTAL Native	1.1	Rock Cover	5m	0%	0%
	TOTAL 'HTE'	0		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Hypochaeris radicata	Catsear	Asteraceae	0.1	100	*		No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	1	1000		Grass & grasslike (GG)	No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	10		Forb (FG)	No		

Plot 22

BAM Attribute (20x20m plot) Composition			BAM Attributes (1 x 1m Plots) Function			
	Stratum	**Sum**		**Tape length**	**% cover**	**Average %**
Count of Native Richness	**Tree (TG)**	**0**	**Litter Cover**	5m	45%	**38.00%**
	Shrub (SG)	**0**		15m	35%	
	Forb (FG)	**3**		25m	30%	
	Grass & grasslike (GG)	**3**		35m	30%	
	Fern (EG)	**0**		45m	50%	
	Other (OG)	**0**	**Bare ground cover**	5m	55%	**62%**
	TOTAL	**6**		15m	65%	
BAM Attribute (20x20m plot) Structure				25m	70%	
	Stratum	**Sum**		35m	70%	
Count of cover abundance (native vascular plants)	**Tree (TG)**	**0**		45m	50%	
	Shrub (SG)	**0**	**Cryptogam cover**	5m	0%	**0%**
	Forb (FG)	**0.3**		15m	0%	
	Grass & grasslike (GG)	**0.5**		25m	0%	
	Fern (EG)	**0**		35m	0%	
	Other (OG)	**0**		45m	0%	
	TOTAL Native	**0.8**	**Rock Cover**	5m	0%	**0%**
	TOTAL 'HTE'	**0**		15m	0%	
				25m	0%	
				35m	0%	
				45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79			
30-49			
20-29			
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Juncus spp.	A Rush	Juncaceae	0.1	10		Grass & grasslike (GG)	No		
Sporobolus creber	Slender Rat's Tail Grass	Poaceae	0.3	300		Grass & grasslike (GG)	No		
Hypochaeris radicata	Catsear	Asteraceae	0.1	10	*		No		
Rumex brownii	Swamp Dock	Polygonaceae	0.1	3		Forb (FG)	No		
Carex spp.		Cyperaceae	0.1	100		Grass & grasslike (GG)	No		
Calotis cuneifolia	Purple Burr-Daisy	Asteraceae	0.1	1		Forb (FG)	No		
Oxalis perennans		Oxalidaceae	0.1	1		Forb (FG)	No		

Plot 23

BAM Attribute (20x20m plot) Composition		
	Stratum	**Sum**
Count of Native Richness	**Tree (TG)**	**2**
	Shrub (SG)	**1**
	Forb (FG)	**0**
	Grass & grasslike (GG)	**0**
	Fern (EG)	**0**
	Other (OG)	**0**
	TOTAL	**3**
BAM Attribute (20x20m plot) Structure		
	Stratum	**Sum**
Count of cover abundance (native vascular plants)	**Tree (TG)**	**23**
	Shrub (SG)	**0.1**
	Forb (FG)	**0**
	Grass & grasslike (GG)	**0**
	Fern (EG)	**0**
	Other (OG)	**0**
	TOTAL Native	**23.1**
	TOTAL 'HTE'	**0**

BAM Attributes (1 x 1m Plots) Function			
	Tape length	**% cover**	**Average %**
Litter Cover	5m	75%	**25.80%**
	15m	35%	
	25m	10%	
	35m	4%	
	45m	5%	
Bare ground cover	5m	25%	**74%**
	15m	65%	
	25m	90%	
	35m	95%	
	45m	95%	
Cryptogam cover	5m	0%	**0%**
	15m	0%	
	25m	0%	
	35m	0%	
	45m	0%	
Rock Cover	5m	0%	**0%**
	15m	0%	
	25m	0%	
	35m	1%	
	45m	0%	

BAM Attribute (20 x 50m plot) Tree Stem Counts			
DBH (cm)	**Euc**	**Non Euc**	**Hollows**
>80			
50-79	1		
30-49	1		
20-29	2		
10-19			
5-9			
<5			N/A
Length of logs (m)			

Scientific Name	Common Name	Family	% Cover	Abundance	Exotic	Growth Form	High Threat?	EPBC Status	BCA Status
Eucalyptus caliginosa	Broad-leaved Stringybark	Myrtaceae	8			Tree (TG)	No		
Eucalyptus blakelyi	Blakely's Red Gum	Myrtaceae	15			Tree (TG)	No		
Lissanthe strigosa	Peach Heath	Ericaceae	0.1	20		Shrub (SG)	No		

B.1 PLOT PHOTOS

Plot 1	**PCT 567 Woodland**
	
Plot 2	**PCT 704 Scattered**
	

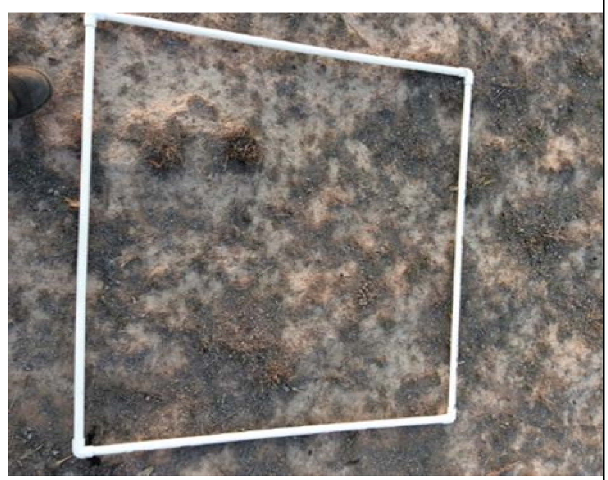
Plot 3	**PCT 575 Scattered**
	
Plot 4	**PCT 567 Woodland**
	

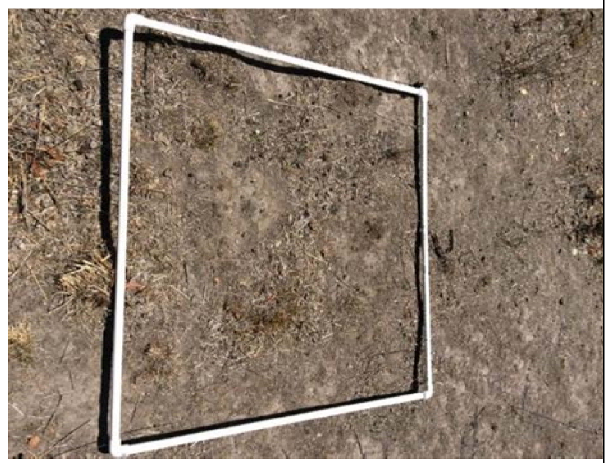
Plot 5	**PCT 567 Woodland**
	
Plot 6	**PCT 567 Woodland**
	

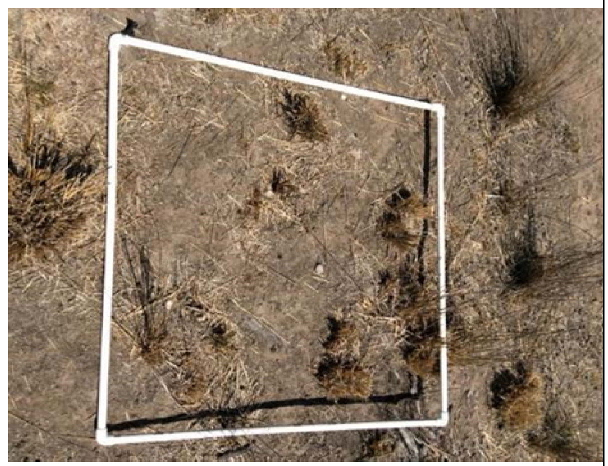
Plot 7	**PCT 567 Woodland**
	
Plot 8	**PCT 575 Forest**
	

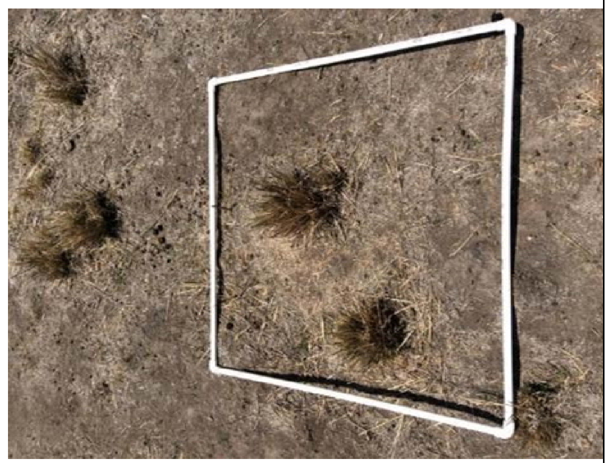
Plot 9	**PCT 704 Woodland**
	
Plot 10	**PCT 567 Woodland**
	

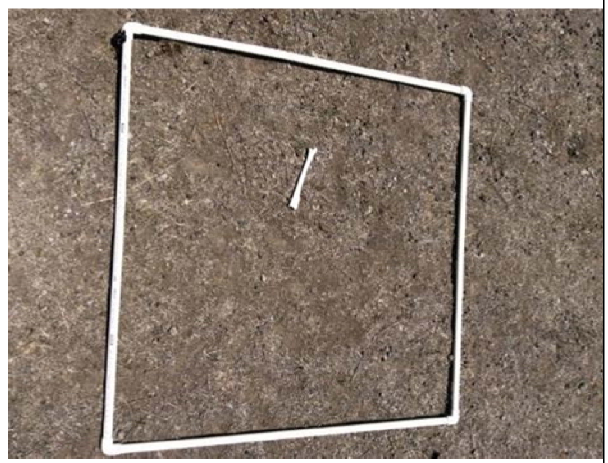
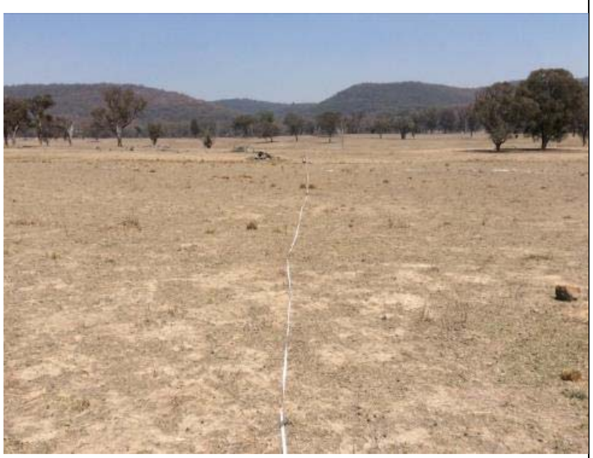
Plot 11	PCT 704 Woodland
	
Plot 12	PCT 567 Grassland
	

Plot 13	PCT 567 Grassland
	
Plot 14	PCT 704 Grassland
	

Plot 15	PCT 704 Grassland
	
Plot 16	PCT 567 Grassland
	

Plot 17	PCT 567 Scattered
	
Plot 18	PCT 704 Woodland
	

Plot 19	PCT 704 Grassland
	
Plot 20	PCT 704 Grassland
	

Plot 21	PCT 704 Grassland
	
Plot 22	PCT 567 Grassland
	

Plot 23	PCT 704 Scattered
	

B.2 FAUNA SURVEY RESULTS

			Survey Timing and Type					
			Aug-19		Nov-19			
Class	**Common name**	**Scientific Name**	**Incidental**	**Spotlighting/Call playback**	**Incidental**	**Spotlighting/Call playback**	**SAT**	**Anabat**
Aves	Australian Magpie	*Cracticus tibicen*	X		X			
Aves	Australian Raven	*Corvus coronoides*	X		X			
Aves	Australian Wood Duck	*Chenonetta jubata*	X		X			
Aves	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			X			
Aves	Crested Pigeon	*Ocyphaps lophotes*	X					
Aves	Crimson Rosella	*Platycercus elegans*	X		X			
Aves	Eastern Rosella	*Platycercus eximius*	X		X			
Aves	Galah	*Eolophus roseicapilla*	X					
Aves	Grey Butcherbird	*Cracticus torquatus*	X		X			
Aves	Grey Teal	*Anas gracilis*	X					
Aves	King Parrot	*Alisterus scapularis*	X					
Aves	Laughing Kookaburra	*Dacelo novaeguineae*	X		X			
Aves	Magpie-lark	*Grallina cyanoleuca*	X		X			
Aves	Nankeen Kestrel	*Falco cenchroides*	X		X			
Aves	Noisy Miner	*Manorina melanocephala*	X		X			

			Survey Timing and Type					
			Aug-19		Nov-19			
Class	**Common name**	**Scientific Name**	**Incidental**	**Spotlighting/Call playback**	**Incidental**	**Spotlighting/Call playback**	**SAT**	**Anabat**
Aves	Peaceful Dove	*Geopelia placida*			X			
Aves	Pied Currawong	*Strepera graculina*	X		X			
Aves	Red-rumped Parrot	*Psephotus haematonotus*	X		X			
Aves	Spangled Drongo	*Dicrurus bracteatus*			X			
Aves	Spotted Dove	*Spilopelia chinensis*			X			
Aves	Straw-necked Ibis	*Threskiornis spinicollis*	X		X			
Aves	Striated Pardalote	*Pardalotus striatus*	X		X			
Aves	Superb Fairy-wren	*Malurus cyaneus*	X					
Aves	Tawny Frogmouth	*Podargus strigoides*	X			X		
Aves	Wedge-tailed Eagle	*Aquila audax*	X					
Aves	Welcome Swallow	*Hirundo neoxena*	X		X			
Aves	White-necked Heron	*Ardea pacifica*			X			
Aves	White-winged Chough	*Corcorax melanorhamphos*	X					
Aves	Willy Wagtail	*Rhipidura leucophrys*			X			
Mammals	Chocolate Wattled Bat	*Chalinolobus morio*						X
Mammals	Common Brushtail Possum	*Trichosurus vulpecula*				X		
Mammals	Eastern Grey Kangaroo	*Macropus giganteus*			X			

			Survey Timing and Type					
			Aug-19		Nov-19			
Class	Common name	Scientific Name	Incidental	Spotlighting/Call playback	Incidental	Spotlighting/Call playback	SAT	Anabat
Mammals	Greater Broad-nosed Bat	*Scoteanax rueppellii*						X
Mammals	Greater Glider	*Petaurus australis*		X				
Mammals	Koala	*Phascolarctos cinereus*					X	
Mammals	Lesser Long-eared Bat	*Nyctophilus geoffroyi*						X
Mammals	Little Forest Bat	*Vespadelus vulturnus*						X
Mammals	Sheep	*Ovis aries*	X					
Mammals	Southern Myotis	*Myotis macropus*						X
Mammals		*Nyctophilus sp.*						X

APPENDIX C PERSONNEL

Name	Title	Qualifications	Role
Brendon True	Ecologist	• BAM Accredited Assessor #BAAS18155 • B. Science (Ecology and Biodiversity) • Masters Conservation Biology	Fieldwork, data analysis, GIS mapping, lead author
Mitch Palmer	Acting Principal Ecologist	• BAM Accredited Assessor #BAAS17051) • B.Science (Geology and Geography)	Direction in BAM Assessment, Land Category Assessment, Approval of BDAR, BDAR review.
Martin Kim	Graduate Environmental Consultant/Ecologist	• B.EnvSc (Hons)	Fieldwork, data analysis
Lewis Tinley	Environmental Consultant	• BEnvScMgt	GIS mapping
Zoe Quaas	Environmental Consultant	• BEnvScMgt (Hons1)	Fieldwork

APPENDIX D HOLLOW-BEARING TREE INVENTORY

The table below contains the hollow-bearing trees that would be removed as a result of the proposal.

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
1	*Eucalyptus calignosa*	0	4	3	0	0	1	0				
5	*Stag*	500	4	0	0	0	0	0	Yes			
6	*Eucalyptus calignosa*	900	1	0	0	0	0	0				
8	*Eucalyptus calignosa*	1100	1	0	0	0	0	0				
10	*Eucalyptus calignosa*	600	0	0	0	1	0	0				
11	*Eucalyptus calignosa*	600	1	0	0	0	0	0				
12	*Eucalyptus bridgesiana*	1500	2	0	0	0	0	0				
13	*Eucalyptus melliodora*	0	0	0	0	0	0	0	On limb			

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
14	*Eucalyptus calignosa*	500	0	0	0	3	0	0	Yes			Hollow trunk and dead limbs
15	*Eucalyptus calignosa*	800	1	0	0	0	0	0				
17	*Eucalyptus calignosa*	800	1	0	0	1	0	0				
18	*Eucalyptus calignosa*	1200	2	0	0	0	0	0				
19	*Stag*	1000	3	1	0	2	0	0				
20	*Eucalyptus calignosa*	1000	0	1	0	0	0	0				
21	*Eucalyptus calignosa*	1100	1	1	0	0	0	0				
22	*Eucalyptus calignosa*	900	2	0	0	0	0	0	On trunk			
25	*Eucalyptus bridgesiana*	1500	1	0	0	0	0	0				
26	*Eucalyptus melliodora*	400	0	0	0	0	0	0	Yes	Yes		Hollow trunk
27	*Stag*	300	1	0	0	0	0	0				Entrance to hollow trunk

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
28	*Eucalyptus bridgesiana*	900	3	0	0	0	0	0				
29	*Eucalyptus bridgesiana*	1250	0	0	0	0	1	0				
30	*Eucalyptus bridgesiana*	0	0	1	0	0	1	0				
31	*Stag*	0	0	0	0	0	0	0	Yes	Yes		Small openings
32	*Stag*	0	2	0	0	0	0	0	Yes			Hollow trunk
35	*Eucalyptus melliodora*	700	0	0	0	1	0	0				
36	*Eucalyptus dalrympleana subsp. heptantha*	1000	0	0	0	0	1	0				
37	*Eucalyptus dalrympleana subsp. heptantha*	140	0	0	0	0	0	0				Small stick nest

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
38	*Eucalyptus melliodora*	600	1	0	0	1	0	0				Small trunk hollow enters hollow side of trunk
39	*Eucalyptus melliodora*	800	1	1	0	0	0	0	Yes			Spout
40	*Eucalyptus melliodora*	0	0	0	0	0	0	0				
41	*Eucalyptus bridgesiana*	800	4	2	0	0	0	0				Hollow limb
42	*Stag*	400	0	0	0	1	0	0				Small opening to hollow trunk
43	*Stag*	1100	2	2	0	0	1	0				
46	*Stag*	400	0	0	0	1	1	0				Hollow trunk
47	*Eucalyptus bridgesiana*	300	1	0	0	0	0	0				Hollow half trunk
48	*Eucalyptus calignosa*	700	2	0	0	0	0	0				

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
50	*Stag*	400	2	1	0	0	0	0				
52	*Eucalyptus calignosa*	400	0	0	0	2	0	0				
53	*Eucalyptus calignosa*	700	1	1	0	0	0	0				
54	*Eucalyptus calignosa*	600	0	2	0	0	0	0				
55	*Eucalyptus laevopinea*	650	1	0	0	0	1	0				Half of trunk hollowed out
56	*Eucalyptus calignosa*	500	0	0	0	0	2	0				
57	*Stag*	600	0	0	0	0	0	0	Yes			
58	*Stag*	1000	2	2	0	0	0	0				
59	*Stag*	0	2	0	0	1	0	0				
60	*Eucalyptus melliodora*	600	4	0	0	0	0	0				
61	*Eucalyptus melliodora*	700	2	2	0	2	1	1				
62	*Eucalyptus melliodora*	1000	2	0	0	0	0	0				

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
63	*Eucalyptus calignosa*	700	2	0	0	0	0	0	Yes			Hollow middle trunk
64	*Eucalyptus calignosa*	600	0	0	0	1	1	0	Yes			Hollow central trunk
67	*Stag*	400	1	1	0	0	0	0				
68	*Stag*	400	0	0	0	1	0	0	Yes			
69	*Eucalyptus calignosa*	400	1	0	0	1	0	0				
70	*Eucalyptus calignosa*	400	0	0	0	1	0	0				
71	*Eucalyptus calignosa*	350	1	0	0	0	0	0				
72	*Eucalyptus calignosa*	550	1	0	0	0	0	0				
73	*Eucalyptus calignosa*	600	0	1	0	0	0	0				
74	*Eucalyptus calignosa*	550	2	0	0	0	0	0				
75	*Eucalyptus melliodora*	500	0	0	0	1	0	0				

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
76	*Eucalyptus calignosa*	400	0	0	0	1	0	0				Leads to dead portion of trunk.
77	*Eucalyptus calignosa*	400	3	1	0	0	0	0				
78	*Stag*	400	2	0	0	0	0	0				
80	*Eucalyptus calignosa*	650	2	0	0	0	0	0				
81	*Eucalyptus calignosa*	700	0	0	0	0	1	0				
82	*Eucalyptus bridgesiana*	600	1	0	0	0	0	0				
83	*Stag*	450	0	0	0	0	0	0		Yes		
84	*Eucalyptus calignosa*	700	2	0	0	0	0	0		Yes		
85	*Eucalyptus calignosa*	450	1	0	0	0	0	0				
86	*Eucalyptus youmanii*	600	2	0	0	0	0	0				
87	*Eucalyptus bridgesiana*	800	1	0	0	0	0	0				

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
88	*Stag*	250	0	0	0	1	0	0				
89	*Eucalyptus calignosa*	300	1	0	0	0	0	0				
90	*Eucalyptus calignosa*	900	2	0	0	0	0	0				
95	*Stag*	400	1	0	0	1	0	0				
98	*Eucalyptus bridgesiana*	400	0	0	0	0	0	0		Yes		
100	*Eucalyptus calignosa*	800	1	0	0	0	0	0		Yes		
102	*Eucalyptus bridgesiana*	1000	2	0	0	0	0	0		Yes		
103	*Stag*	300	1	0	0	1	0	0				
104	*Eucalyptus bridgesiana*	0	2	0	0	0	0	0				
105	*Eucalyptus calignosa*	500	1	0	0	0	0	0				
106	*Eucalyptus calignosa*	550	0	0	0	0	1	0				
108	*Stag*	1300	0	0	0	2	0	0				

ID	Species	DBH (mm)	Small Hollow Limb	Medium Hollow Limb	Large Hollow Limb	Small Hollow Trunk	Medium Hollow Trunk	Large Hollow Trunk	Fissuring	Decorticated Bark	Fauna Present	Notes
109	*Eucalyptus calignosa*	600	3	0	0	0	0	0				Medium stick nests
110	*Eucalyptus bridgesiana*	1400	2	0	0	0	0	0				
111	*Eucalyptus calignosa*	900	1	0	0	0	0	0				
112	*Stag*	400	2	0	0	0	0	0				

APPENDIX E EPBC PROTECTED MATTERS SEARCH

Australian Government

Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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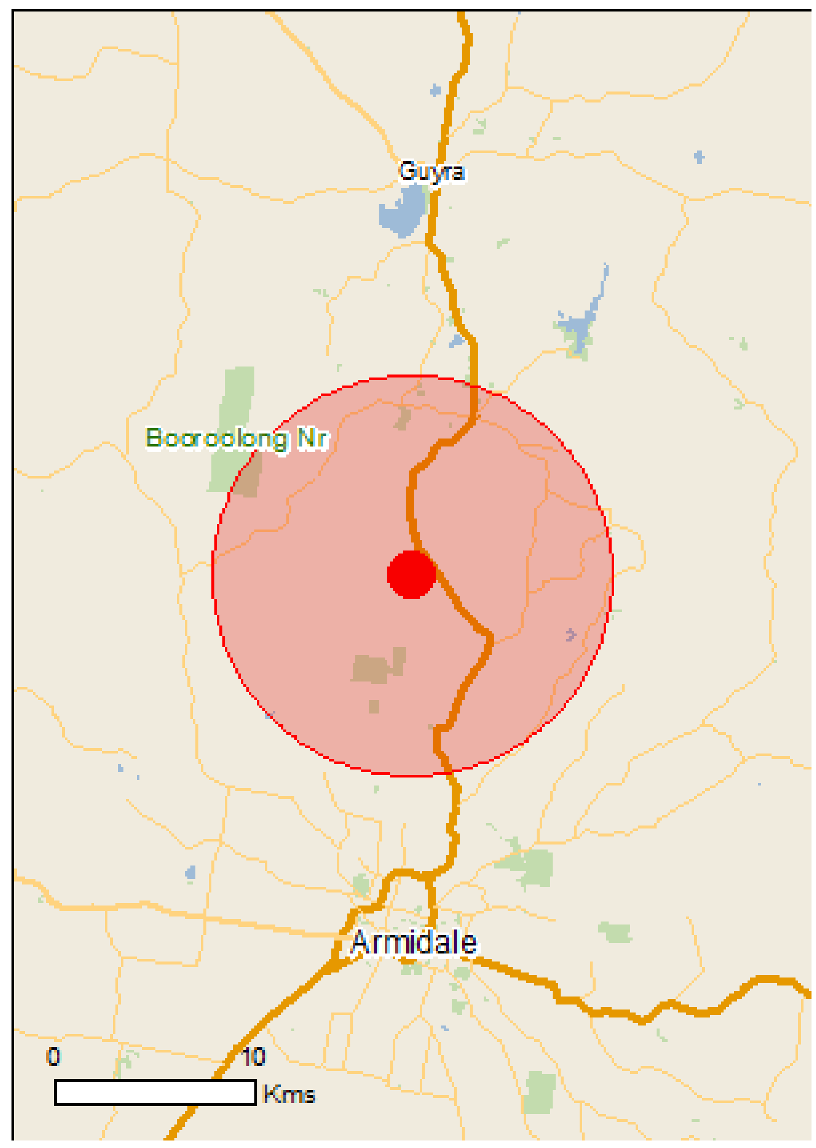

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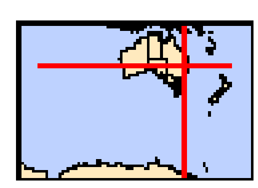

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	29
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	28
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	1100 - 1200km
Gwydir wetlands: gingham and lower gwydir (big leather) watercourses	200 - 300km upstream
Riverland	1000 - 1100km
The coorong, and lakes alexandrina and albert wetland	1200 - 1300km

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands	Critically Endangered	Community likely to occur within area
Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands Bioregion)	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Fish		
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria castanea		
Yellow-spotted Tree Frog, Yellow-spotted Bell Frog [1848]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Callistemon pungens		
[55581]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Diuris eborensis		
[88275]	Endangered	Species or species habitat may occur within area
Diuris pedunculata		
Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid [18325]	Endangered	Species or species habitat likely to occur within area
Eucalyptus nicholii		
Narrow-leaved Peppermint, Narrow-leaved Black Peppermint [20992]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area
Haloragis exalata subsp. velutina		
Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Uvidicolus sphyrurus Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko [84578]	Vulnerable	Species or species habitat likely to occur within area
Wollumbinia belli Bell's Turtle, Western Sawshelled Turtle, Namoi River Turtle, Bell's Saw-shelled Turtle [86071]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Booroolong	NSW
Duval	NSW
New England Tableland	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		

Name	Status	Type of Presence
Rhinella marina		
Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer		
Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis		
Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia		
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Cytisus scoparius		
Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Nassella neesiana		
Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma		
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
New England Wetlands	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.375 151.66254

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX F EPBC ACT HABITAT ASSESSMENT

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
Fauna				
Anthochaera phrygia Regent Honeyeater	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Occurs in woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Present but low quality. Few mistletoes present	Low - outside mapped important areas (OEH). Not detected during surveys	No – Unlikely to occur on site
Australian Bittern *Botaurus poiciloptilus*	Permanent freshwater wetlands with tall, dense vegetation.	Absent – no freshwater wetlands with dense vegetation	Low	No – Unlikely to occur on site
Curlew Sandpiper *Calidris ferruginea*	Intertidal mudflats in both fresh and brackish waters in sheltered coastal areas, such as estuaries, bays, inlets, and lagoons. Also recorded inland, including around ephemeral and permanent lakes, dams, and waterholes, usually with bare edges of mud or sand	Absent – no intertidal mudflats	None	No – Unlikely to occur on site
Red Goshawk *Erythrotriorchis radiatus*	The species is very rare in NSW. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	Open woodland present but degraded such that a viable food source is lacking. Lack of permanent water and diversity if vegetation types.	Low – a rare species in the state and the development site lacks preferred habitat.	No – Unlikely to occur on site
Painted Honeyeater *Grantiella picta*	Boree/Weeping Myall, Brigalow, and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes.	Degraded Box-gum woodland present, low frequency of mistletoes.	Unlikely – not detected during site surveys. Little foraging resources (mistletoes)	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
White-throated Needletail *Hirundapus caudacutus*	White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia.	Foraging present.	Low- a vagrant visitor to Australia. Not observed during surveys.	No – Unlikely to occur on site
Swift Parrot *Lathamus discolor*	On the coast and southwest slopes in areas with abundant flowering eucalypts or lerp. Feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box and Lerp infested trees such as Grey Box and Black Butt.	Present, but poor quality	Unlikely – outside mapped important areas (OEH). Not detected during surveys	No – Unlikely to occur on site
Australian Painted Snipe *Rostratula australis*	Shallow terrestrial freshwater or occasionally brackish wetlands, including temporary and permanent lakes, swamps, and claypans, as well as inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms, and bore drains. Fringes of swamps, dams, and nearby marshy areas with cover of grasses, lignum, low scrub, or open timber. Shallow wetlands with areas of bare wet mud.	Absent	None	No – Unlikely to occur on site
Murray Cod *Maccullochelle peeli*	Wide range of warm water habitat including clear rocky streams, slow flowing turbid rivers, and billabongs, most frequently in main river channel and larger tributaries but occasionally in floodplain channels during floods. Near complex structural cover such as large rocks, woody debris, and overhanging vegetation.	Absent – Duval Creek does present suitable habitat	None	No - suitable habitat
Large-eared Pied Bat *Chalinolobus dwyeri*	Caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	Absent	Unlikely, not detected during survey.	No – Unlikely to occur on site
Spotted-tail Quoll *Dasyurus maculatus*	Variety of vegetation types including rainforest, open forest, woodland, coastal heath	Present	Unlikely	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
	and inland riparian forest, from the sub-alpine zone to the coastline.			
Corben's Long-eared Bat *Nyctophilus corbei*	Variety of vegetation types, most commonly Mallee, Bulloke, and Box-dominated communities, but most common in vegetation with distinct canopy and dense understorey. Roost in tree hollows, crevices, and under loose bark.	Marginal	Unlikely, not detected during survey.	No – Unlikely to occur on site.
Greater Glider *Petauroides volans*	Tall, montane, moist eucalypt forests with relatively old trees and abundant hollows and a high diversity of eucalypts	Present	Recorded during August 2019 surveys with a patch of Zone 1 near the western boundary of the development site.	Yes – recorded as present and habitat would be impacted. AoS required.
Brush-tailed Rock-wallaby *Petrogale penicillata*	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north	Absent	Unlikely	No – Unlikely to occur on site
Koala *Phascolarctos cinereus*	Temperate, subtropical and tropical eucalypt woodlands and forests where suitable food trees grow, of which there are more than 70 eucalypt species and 30 non-eucalypt species that are particularly abundant on fertile clay soils.	Present	Recorded – faecal pellets found during SAT survey 2.	Yes – utilises the development site. AoS required.
Long-nosed Potoroo *Potorous tridactylus tridactylus*	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests.	Absent	Unlikely	No – Unlikely to occur on site
Grey-headed Flying-fox *Pteropus poliocephalus*	Range of vegetation communities including rainforest, open forest, and closed and open woodland. Roost sites usually near water, including lakes, rivers, and coastlines.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
Border Thick-tailed Gecko *Uvidicolus sphyrurus*	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Occurs at sites ranging from 500 to 1100 m elevation. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey.	Marginal	Unlikely – areas of rock within the development site are isolated and the species is unlikely to cross cleared land as it requires shrubby open forest.	No – Unlikely to occur on site
Bells turtle *Wollumbinia belli*	In NSW, currently found in four disjunct populations in the upper reaches of the Namoi, Gwydir and Border Rivers systems, on the escarpment of the North West Slopes. Shallow to deep pools in upper reaches or small tributaries of major rivers in granite country. Occupied pools are most commonly less than 3 m deep with rocky or sandy bottoms and patches of vegetation.	Absent	Unlikely	No – Unlikely to occur on site
Black-faced Monarch *Monarcha melanopsis*	The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Yellow Wagtail *Motacilla flava*	This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra. In the north of its range it is also found in large forest clearings. It breeds from April to August, although this varies with latitude.	Marginal	Unlikely – not detected during site surveys	No – Unlikely to occur on site
Satin Flycatcher *Myiagra cyanoleuca*	The Satin Flycatcher is found along the east coast of Australia in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Absent	Unlikely	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
Rufous Fantail *Rhipidura rufifrons*	The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas.	Absent	Unlikely	No – Unlikely to occur on site
Flora				
Austral Toadflax *Thesium austral*	This species is often hidden amongst grasses and herbs. Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (Themeda australis).	Marginal – no Kangaroo present. Highly degraded.	Unlikely	No – Unlikely to occur on site
Bluegrass *Dichanthium setosum*	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Associated species include Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis.	Marginal – may be more favourable outside of drought conditions and heavy grazing	Possible	Yes – potential habitat and undetected individuals may be removed. AoS required.
Callistemon pungens	In NSW the species occurs from near Inverell to the eastern escarpment in New England National Park. Habitats range from riparian areas dominated by *Casuarina cunninghamiana* subsp. *cunninghamiana* to woodland and rocky shrubland	Marginal – rocky areas present.	Unlikely – survey of potential habitat did not detect any individuals.	No – Unlikely to occur on site
Diuris eborensis	Endemic to New South Wales and known from five locations on the eastern side of the New England Tableland. Favours brown clay loams on moist grassy flats near creeks and	Absent – not associated with PCTs present.	Unlikely	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
	has been recorded at altitudes of between 900 and 1400 m a.s.l.			
Euphrasia arguta	Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance.	Marginal – highly degraded	Unlikely	No – Unlikely to occur on site
Small Snake Orchid *Diuris pedunculata*	Confined to north east NSW. It was originally found scattered from Tenterfield south to the Hawkesbury River, but is now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor. Often in peaty moist areas and sometimes found within shale and trap soils, on fine granite, and among boulders	Marginal – highly degraded	Unlikely	No – Unlikely to occur on site
Narrow-leaved Peppermint *Eucalyptus nicholli*	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	Present	Unlikely – surveyed for and not recorded	No – Unlikely to occur on site
Prasophyllum sp. Wybong	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Known to occur in open eucalypt woodland and grassland.	Marginal – highly degraded	Unlikely	No – Unlikely to occur on site
Tall Velvet Sea-berry *Haloragis exalata* subsp. *velutina*	This subspecies of Tall Sea-berry occurs on the north coast of NSW and southeastern Queensland. It is plentiful in inaccessible areas of the upper Macleay River. Occurs in woodland on the steep rocky slopes of gorges.	Absent	Unlikely	No – Unlikely to occur on site

Species	Distribution and Habitat	Habitat components and abundance on site	Likelihood of occurrence	Potential for impact?
Threatened Ecological Communities				
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands	This woodland community is dominated by trees of New England Peppermint Eucalyptus nova-anglica and occasionally Mountain Gum E. dalrympleana subsp. heptantha, and is usually 8-20 metres tall. Occurs primarily in valley flats subject to cold air drainage and valley flats that are composed of basaltic soils, fine-grained sedimentary and acid volcanic substrates with poorly drained loam-clay soils. In NSW all sites are within the New England Tablelands. This community is or has been known to occur in the Armidale Dumaresq, Guyra, Inverell, Severn and Tenterfield Local Government Areas	**Present**	**Unlikely, not detected during surveys.**	No – Unlikely to occur on site
Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands Bioregion)	This community is composed of a series of high altitude wetlands in the New England Tablelands of Northern NSW. Known to occur between the Tenterfield and Uralla Local Government Areas but may occur elsewhere within the New England Tablelands. Generally above 900m altitude and associated with basalt soils and not connected to river systems by floodplains	Absent	Unlikely	No – Unlikely to occur on site
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.	Present	Recorded	Yes – occurs within development site.

APPENDIX G EPBC ASSESSMENT OF SIGNIFICANT IMPACT

The *Environment Protection and Biodiversity Conservation Act 1999* specifies factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species, listed at the Commonwealth level. The following assessment assesses the significance of the likely impacts associated with the proposed works on:

- White Box – Yellow Box – Blakeley's Red Gum – Grassy Woodland and Derived Native Grassland (Critically Endangered)
- Bluegrass *Dichanthium setosum* (Vulnerable)
- Koala *Phascolarctos cinereus* (Vulnerable)
- Greater Glider *Petauroides volans* (Vulnerable)

Different significant impact criteria apply depending on the level at which a species or community is listed (i.e. vulnerable, endangered, critically endangered etc.). The appropriate criteria have been applied to the entities listed above.

In the context of the assessments below, 'the action' refers to 'the proposal' as described in Section 1.1.

SIGNIFICANT IMPACT CRITERIA

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of a population*
- *reduce the area of occupancy of the species*
- *fragment an existing population into two or more populations*
- *adversely affect habitat critical to the survival of a species*
- *disrupt the breeding cycle of a population*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species.*

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- *a geographically distinct regional population, or collection of local populations, or*
- *a population, or collection of local populations, that occurs within a particular bioregion.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of an important population of a species*
- *reduce the area of occupancy of an important population*
- *fragment an existing important population into two or more populations*
- *adversely affect habitat critical to the survival of a species*

- *disrupt the breeding cycle of an important population*
- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere substantially with the recovery of the species.*

Each of these criteria are addressed below. An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

G.2 WHITE BOX-YELLOW BOX-BLAKELY'S RED GUM GRASSY WOODLAND AND DERIVED NATIVE GRASSLAND

a) reduce the extent of an ecological community?

Native vegetation within the development site that is considered to conform to White Box – Yellow Box – Blakeley's Red Gum – Grassy Woodland and Derived Native Grassland (Box-gum Woodland CEEC) occurs in the north, west and south of the development site. In these areas there is connectivity between vegetation inside and outside of the development site such that criteria relating to patch size and understory health are presumed satisfied. These areas cover about 59.7 ha within the development site, the most intact, diverse and connected of which have been avoided by the development footprint, however, up to 17.1 ha of the community would be removed as a result of the proposal. The extent of the community in the surrounding landscape is likely to be in similar condition due to land use and patchiness of remnant vegetation. The local extent of the CEEC would measure in hundreds of hectares.

b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The Box-gum Woodland CEEC occurring within the development site has poor connectivity generally. Historical clearing, primarily for livestock grazing, but also for significant transmission line infrastructure, has meant that most areas of the community that are connected to suitable vegetation outside the development site on one side, do not extend through the development site to connect with areas on another side. Where this does occur, primarily in the north of the development site but also the south to a lesser degree, avoidance has meant that this connectivity, though poor, has been maintained. As much of the community that would be removed constitutes small patches with a sparse, poorly connected canopy, the proposal would result in only minor fragmentation of the community. No areas thought to be of high conservation value would be disconnected.

c) Will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Whilst surface flows will be altered during construction, with mitigation measures implemented, it is considered unlikely that the abiotic factors necessary for the community's survival would be modified or destroyed by the proposal.

d) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The proposal will remove an area of approximately 17.1 ha of modified Box-gum Woodland CEEC. These areas are influenced by the invasion of exotic improved pasture species but contain enough native understory to be considered the community in light of connectivity to larger, more intact patches that connect to the development site and extend into the surrounding landscape. As such, the less diverse areas of these patches, i.e. that within the development footprint, would be impacted, leaving, surrounding, higher condition areas unchanged. These circumstances are considered likely to ensure that the species complexity and composition of the greater patches remains.

e) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established, or
- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
- interfere with the recovery of an ecological community

- The proposal is not considered likely to generate an increase in invasive species harmful to the ecological community. Mitigation measures implemented during a construction will strictly manage and restrict weed movement through the proposal site.
- It is considered unlikely that proposal would kill or inhibit the growth of the community from the regular mobilisation of fertilisers, herbicides or other chemicals.
- The Box-gum Woodland CEEC that occurs within the development site is highly modified and would be subject to ongoing human land use lowering its overall conservation value. However, the better condition and connected areas have been avoided by the development footprint maintaining areas more likely to contribute to the recovery of the community.

Conclusion

The proposal will impact upon 17.1 ha Box-gum Woodland CEEC, particularly through the siting of solar arrays. Many of the largest patches of the community that occur within and extend outside the development site have been avoided, with impacts limited to those patches with lesser connectivity and ecological value.

Connectivity of the larger patches of the community that extend into the surrounding landscape has generally been maintained. Given the poorest quality areas of the community would be impacted, proposal is not considered to interfere with the recovery of the community.. Potential indirect impacts such as altered hydrology are not considered likely to impact the community.

However, given that 17.1 ha of the 59.7 ha (29%) of the community is proposed to be cleared, this is considered to potentially generate a significant impact to the community and referral to DAWE has been recommended.

G.4 BLUEGRASS *DICHANTHIUM SETOSUM*

a) Lead to a long-term decrease in the size of an important population of a species?
An important population is defined as one that is necessary for a species' long-term survival and recovery, and includes: • A key source population either for breeding or dispersal; • A population that is necessary for maintaining genetic diversity, and/or • A population that is near the limit of the species' distribution range. Initial environmental risk assessments for threatened species deemed Bluegrass *Dichanthium setosum* as having the potential of being present within the development site. Targeted surveys were not undertaken given conditions were not conducive to the species' detection, however, the species was not observed incidentally in either 2018 or 2019 surveys which involved widespread and repeated traversal of the development site. Were a population, or part thereof, of Bluegrass present within the development site, it would not be considered an important population, as the number of individuals would likely be low, and their presence would be well within the known distribution of the species. As such, any individuals potentially present within the development site, are not considered to constitute or be part of an important population of the species.
b) Reduce the area of occupancy of an important population
The species was not recorded within the development site. Any population of the species occurring within the proposal site is not considered to constitute an important population, therefore the proposal is not considered likely to reduce the area of occupancy of an important population.
c) Fragment an existing important population into two or more populations;
An important population of Bluegrass is not considered to be present.
d) Adversely affect habitat critical to the survival of a species
The proposal would permanently impact approximately 178.6 ha of poor-quality habitat. This habitat is not considered critical to the survival of the species, as the species has a wide distribution abundance within the New England Tablelands region. Further, critical habitat has not been declared for the species. As a result, the proposal is not considered likely to adversely affect habitat critical to the survival of Bluegrass.
e) Disrupt the breeding cycle of an important population
Any population of the species occurring within the development site is not considered to constitute an important population, therefore the proposal is not considered likely to disrupt the breeding cycle of an important population.
f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The extent of habitat modification and removal is not considered likely to occur to the extent that Bluegrass is likely to decline. Were some individuals impacted, it would likely be few. Habitat for the species will be retained within the higher quality portions within the development site. Avoidance of higher potential habitat areas has also maintained connectivity such that no areas of habitat would be isolated.
g) Result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat
The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial

reduction in the quality or integrity of the species habitat within the development site. Additionally, the proposal is not considered likely to generate an increase in feral herbivores such as Rabbits.
h) Introduce disease that may cause the species to decline;
The proposal is considered unlikely to introduce disease that may cause the species to decline.
i) Interfere substantially with the recovery of the species;
The proposal is considered unlikely to interfere with the recovery of the species, as were the species to occur within the development site it's presence would likely be minimal, and the proposal will not impact on any known populations of the species.

Conclusion

The proposal is considered unlikely to significantly impact Bluegrass. As no known individuals or populations of the species exist within the development site, the proposal is not known to impact on any populations. Any population occurring within the development site is not considered likely to constitute an important population of the species. Higher quality habitat areas have been avoided and connectivity maintained through the development such that where the species to occur nearby, colonisation of and dispersal through unimpacted areas would still be possible.

G.6 KOALA *PHASCOLARCTOS CINEREUS*

a) Lead to a long-term decrease in the size of an important population of a species?

An important population is defined as one that is necessary for a species' long-term survival and recovery, and includes:

- A key source population either for breeding or dispersal;
- A population that is necessary for maintaining genetic diversity, and/or
- A population that is near the limit of the species' distribution range.

Targeted surveys undertaken revealed Koala scat at one location, no individuals were directly observed. The individual or individuals that frequent the development site are members of a population likely to occupy far higher quality habitat surrounding the development site, primarily to the north, west and south. Visits are likely to be infrequent given the disparity in quality of habitat within the development site and that described above. The size of this population is unknown and as Koala are widely distributed in NSW, it is not near the limit of the species' range. Regionally, the population may act as a key source population for breeding or dispersal aiding in the species' long-term survival and recovery, therefore, the population can be considered an important population.

Mortality of individuals or interruption of breeding is not an anticipated as impacts to Koala concern the removal of 29.2 ha of treed areas containing forage and sheltering resources. Contextually, these resources are widespread and in better quality in the locality such that the population of Koala present is unlikely to rely on them for persistence and/or growth. Therefore, the habitat removal required for the proposal is considered unlikely to lead to a long-term decrease of an important population of Koala.

b) Reduce the area of occupancy of an important population

While there will be habitat removal as described above, this would not decrease the total range of the population.

c) Fragment an existing important population into two or more populations;

Due to historical land use and clearing, connectivity of Koala habitat across the development site is poor, however, the development site may still be used for traversal across a home range. Areas where connective pathways are present, has generally been avoided.

Proposed permanent fencing would act as an impediment to traversal through the development site, as Koala may now. Although pathways present around the development site, particularly along the western boundary, would remain, to assist movement of Koala through the development site, connective structures are proposed. This is at one location in the north of the development site where connectivity is arguably at its greatest. These connective structures are aimed at maintaining this dispersal pathway.

In light of the above, the proposal is considered unlikely to fragment an important population.

d) Adversely affect habitat critical to the survival of a species

The EPBC Act referral guidelines for the vulnerable koala (DoE, 2014) focus on the impacts of proposals to habitat critical to the survival of the koala. Table 4 of the guidelines provide a habitat assessment tool that allows for a flowchart to be followed in determining whether the habitat proposed to be impacted should be considered critical habitat. In the case of the proposal, the habitat to be impacted generated a score of 8 and is therefore considered critical habitat. 29.2 ha of critical habitat would be adversely affected, indicating that a referral is recommended.

e) Disrupt the breeding cycle of an important population

Koala are considered unlikely to breed within the development site as females tend to inhabit higher quality habitat which can support reproduction. The development site supports Koala feed trees but not at a density that would be preferred for a females' home range. The individual that produced the scats found is likely to be a male, possibly a dispersing juvenile. Although the proposal would provide a physical impediment for movement of individuals during breeding season, with the connectivity structure proposed implemented, and maintenance of connectivity around the development site, breeding of the residence population is considered unlikely to be disrupted.

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The extent of habitat modification and removal proposed would marginally reduce the extent of resources available to the population to be impacted. This is considered unlikely to cause the population to decline given the habitat's poor quality contextually. Habitat for the species will be retained within the higher quality portions within the development site. Avoidance of higher quality habitat areas has also maintained connectivity such that no areas of habitat would be isolated.

g) Result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat

The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the species habitat within the development site. Additionally, the proposal is not considered likely to generate an increase in feral predators such as dogs.

h) Introduce disease that may cause the species to decline;

The proposal is considered unlikely to introduce disease that may cause the species to decline.

i) Interfere substantially with the recovery of the species;

The EPBC Act referral guidelines for the vulnerable koala (DoE, 2014) list several potential impacts that could interfere substantially with the recovery of the species, including:

- Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.
- Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.
- Facilitating the introduction or spread of disease or pathogens for example *Chlamydia* or *Phytophthora cinnamomi*, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.
- Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.
- Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.

As mentioned, the habitat to be removed may constitute critical habitat for Koala. Direct mortality of individuals from impacts such as vehicle strike and disruption of breeding is considered unlikely as such impacts can be reliably mitigated. Similarly, implementing hygiene protocols for plant and equipment, and through ensuring that hydrological regimes remain unaltered as far as is practical would protect remaining adjacent vegetation. A barrier to movement would not be created.

The proposal may, however, through the removal of habitat, reduce the carrying capacity of the population through increased competition for resources. The degree of potential reduction is unknown but foreseeably minor given the extent and quality of habitat to be removed. It is entirely possible that there would be no reduction at all. Therefore, a substantial interference to the recovery of the species is considered unlikely.

Conclusion

Despite the 29.2 ha of Koala habitat that would be impacted by the proposal being in sub-optimal condition, it has been assessed as constituting habitat critical to Koala suggesting a significant impact is possible. On this basis, referral to DAWE is recommended.

G.8 GREATER GLIDER *PETAUROIDES VOLANS*

a) Lead to a long-term decrease in the size of an important population of a species?

An important population is defined as one that is necessary for a species' long-term survival and recovery, and includes:

- A key source population either for breeding or dispersal;
- A population that is necessary for maintaining genetic diversity, and/or
- A population that is near the limit of the species' distribution range.

During nocturnal surveys undertaken in August 2019 a Greater Glider was found within a treed area connected to bushland outside the development site near the development site's western boundary. Repeat surveys in November 2019 did not find any Greater Glider.

The species has generally been recorded east of the Great Dividing Range, but this may be a function of study as well as habitat preferences. BioNet records exist as far west as Mount Kaputar National Park, over 140 km west of the development site. This indicates Greater Glider may inhabit suitable habitat from the coast to Mount Kaputar National Park such that the development site is not near the limit of the species' range. In the context of the Armidale Plateau, BioNet records exist in Booroolong Nature Reserve to the north-west and Duval Nature Reserve directly to the south and west. The individual recorded within the development site is likely to be a member of a population present at the latter location whose range includes connected bushland which enters the development site in the south and west. This population is considered an important population as it may be a source population for breeding or dispersal.

Habitat for Greater Glider within the development site and footprint is limited to those treed areas with good connectivity as the species are poor disperses and unable to traverse large disconnects in canopy as smaller, more mobile glider species can. Given this limitation, up to 9.4 ha of foraging habitat and seven hollow-bearing trees (HBTs) would be removed. The seven HBTs do not contain hollows suitable for sheltering or breeding. Although the foraging resources are poor in quality due to historical disturbance, they may contain species preferred by Greater Glider that are seasonally important resources. Whether their removal could lead to a long-term reduction in the population is unclear. The foraging resources to be removed, largely a form of Box-gum Woodland, is likely to be one of the scarcest habitat types present across the populations' range, meaning that any degree of removal is exacerbated

b) Reduce the area of occupancy of an important population

While there will be habitat removal as described above, this would not decrease the total range of the population.

c) Fragment an existing important population into two or more populations;

Due to historical land use and clearing, connectivity of Greater Glider habitat across the development site and immediate surrounds is poor. Where it is greatest, this has been avoided. No barbed wire fencing would be used. As the proposal would have little impact on general connectivity for the species, it is unlikely to fragment an important population.

d) Adversely affect habitat critical to the survival of a species

Currently there is no critical habitat declared for Greater Glider, nor any standardised means for determining habitat quality.

Greater Gliders are known to use a number of hollows. Detailed design following constraint assessment and during construction will preferentially has avoided areas of greatest connectivity to which Greater Glider would be most reliant. The area of occupancy has direct linkages to good quality vegetation with abundant hollow bearing trees that would not be impacted. Given the avoidance of higher quality habitat areas where canopy vegetation would remain a at distance suitable for gliding, it is unlikely that habitat critical to the survival of the Greater Glider be considered likely to adversely affected.

e) Disrupt the breeding cycle of an important population

The HBTs accessible to Greater Glider within the development footprint are not suitable den sites. Therefore, direct disruption to breeding cycle of the species is considered unlikely.

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The extent of habitat modification and removal proposed would reduce the extent of resources available to the population to be impacted. Particularly, the type of resources to be removed, Box-gum Woodland, is likely to be scarcely available to the population. Were Box-gum Woodland a depended upon seasonal resource, malnourishment or competition for resources could cause mortality or decreased reproductive output.

g) Result in invasive species that are harmful to an vulnerable species becoming established in the vulnerable species' habitat

The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the species habitat within the development site. Additionally, the proposal is not considered likely to generate an increase in feral species.

h) Introduce disease that may cause the species to decline;

The proposal is considered unlikely to introduce disease that may cause the species to decline.

i) Interfere substantially with the recovery of the species;

As mentioned, the habitat to be removed may provide an important seasonal resource for the Greater Glider population. This may lead to malnourishment or decreased reproductive output reducing the size of the carrying capacity of the population. This indirect impact could interfere with the recovery of the species, however, the degree of which is difficult to quantify.

Conclusion

Despite the 9.4 ha of Greater Glider habitat that would be impacted by the proposal being in sub-optimal condition, the Eucalypt composition of the habitat may be such that it provides an important seasonal resource for the population present. Given the extent of habitat removal proposed and that the impact this will have on the regional persistence of the species is uncertain, referral to DAWE is recommended.

APPENDIX H CREDIT REPORT

BAM Credit Summary Report

Proposal Details

Assessment Id

00015471/BAAS18155/19/00015472

Proposal Name

Tilbuster Solar Farm

BAM data last updated *

28/04/2020

Assessor Name

Brendon True

Report Created

05/05/2020

BAM Data version *

25

Assessor Number

BAAS18155

BAM Case Status

Open

Date Finalised

To be finalised

Assessment Revision

8

Assessment Type

Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tableland Bioregion								
5	704_Woodland	33.7	8.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	139
6	704_Grassland	0.5	35.9	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
7	704_Scattered	21.4	4.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	46

							Subtotal	**185**
Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion								
1	567_Woodland	54.4	14.9	0.25	High Sensitivity to Potential Gain	2.00	TRUE	406
2	567_Grassland	0.4	61.4	0.25	High Sensitivity to Potential Gain	2.00	TRUE	0
3	567_Scattered	18.2	1.7	0.25	High Sensitivity to Potential Gain	2.00	TRUE	16
							Subtotal	**422**
Tenterfield Woollybutt - Silvertop Stringybark open forest of the New England Tableland Bioregion								
4	575_Forest	59.1	0.2	0.25	High Sensitivity to Potential Gain	1.50		5
8	575_Scattered	37.6	0.7	0.25	High Sensitivity to Potential Gain	1.50		9
							Subtotal	**14**
							Total	**621**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Dichanthium setosum / Bluegrass (Flora)						
567_Woodland	54.4	14.9	0.25	2	False	405
567_Grassland	0.4	61.39	0.25	2	False	11
575_Forest	59.1	0.24	0.25	2	False	7
704_Woodland	33.7	7.84	0.25	2	False	132
704_Grassland	0.5	35.71	0.25	2	False	9
					Subtotal	**564**

Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
704_Woodland	33.7	8.27	0.25	2	False	139
704_Scattered	21.4	4.29	0.25	2	False	46
					Subtotal	**185**
Myotis macropus / Southern Myotis (Fauna)						
567_Woodland	54.4	4.77	0.25	2	False	130
567_Grassland	0.4	30.98	0.25	2	False	6
567_Scattered	18.2	1.02	0.25	2	False	9
704_Woodland	33.7	3.75	0.25	2	False	63
704_Grassland	0.5	15.2	0.25	2	False	4
704_Scattered	21.4	1.5	0.25	2	False	16
					Subtotal	**228**
Phascolarctos cinereus / Koala (Fauna)						
704_Woodland	33.7	8.27	0.25	2	False	139
704_Scattered	21.4	4.29	0.25	2	False	46
					Subtotal	**185**

APPENDIX F ABORIGINAL CULTURAL HERITAGE ASSESSMENT (ACHA)

Aboriginal Cultural Heritage Assessment Report Cover Sheet

Report Title	Tilbuster Solar Farm Aboriginal Cultural Heritage Assessment Report
Author(s) Name	Ali Byrne and Chelsea Jones
Author(s)' Organisation Name (if applicable)	NGH Pty Ltd
Author(s) contact details	Email: ali.b@nghconsulting.com.au Phone: 02 4917 3971 Fax:
Address of Subject Area	No: 11915, 12029-12049 Street: New England Highway Suburb: Black Mountain State: NSW Postcode: 2365 Title Reference: Lot 1 of DP 225170, Lot 1 of DP 585523 and Lot 3 of DP800611 Local Government Area: Armidale-Dumaresq Other:
Report prepared for	Company Name: Enerparc Australia Pty Ltd Contact Person: Benjamin Hannig Address: 223 Liverpool Street, Darlinghurst NSW 2010 Email: b.hannig@enerparc.com Phone: 02 8311 1338 Fax:02 8572 5251

ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Tilbuster Solar Farm Aboriginal Cultural Heritage Assessment Report

August 2020

DOCUMENT VERIFICATION

Project Title:	Tilbuster Solar Farm Aboriginal Cultural Heritage Assessment Report
Project Number:	18-645
Project File Name:	18-645 Tilbuster ACHA Final V2.1 2020 08 03

Revision	Date	Prepared by	Reviewed by	Approved by
Draft	11/03/2020	Ali Byrne and Chelsea Jones	Shoshanna Grounds	Shoshanna Grounds
Amendments based on footprint change	1/05/2020	Chelsea Jones	Ali Byrne	Ali Byrne
Final	17/07/2020	Ali Byrne	Ali Byrne	Ali Byrne
Final	7/08/2020	Ali Byrne	Ali Byrne	Ali Byrne

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TABLE OF CONTENTS

FIGURES

TABLE

ACRONYMS AND ABBREVIATIONS

ACHA	Aboriginal cultural heritage assessment
ACHCRs	Aboriginal cultural heritage consultation requirements for proponents (DECCW 2010b)
ACT	Australian Capital Territory
AHIMS	Aboriginal heritage information management system
AHIP	Aboriginal Heritage Impact Permit
AS	Artefact scatter
BCD	Biodiversity and Conservation Division (formerly OEH)
BP	Before Present
CT	Cultural Tree
Cwth	Commonwealth
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water (Refer to OEH)
DE&E	(Cwth) Department of Environment and Energy
Development footprint / area	The area within the proposal site to which impacts will occur as a result of the construction, operation and/or decommissioning of the proposed solar farm
DPIE	(NSW) Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
Enerparc	Enerparc Australia Pty Ltd
EP&A Act	(NSW) *Environmental Planning and Assessment Act 1979*
ESD	Ecologically Sustainable Development
Heritage Act	(NSW) *Heritage Act 1977*
IBRA	Interim Biogeographic Regionalisation for Australia
IF	Isolated find
LALC	Local Aboriginal Land Council

LEP	Local Environment Plan
LGA	Local Government Area
NGH	NGH Pty Ltd
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water, (refer to BCD)
PAD	Potential Archaeological Deposit
Proposal site	The area to which this assessment applies, proposed for the construction of the Tilbuster Solar Farm
RAPs	Registered Aboriginal Parties
SSD	State Significant Development
ST	Scarred Tree
TP	Test pit

EXECUTIVE SUMMARY

INTRODUCTION

NGH Pty Ltd (NGH) has been contracted by Enerparc Australia Pty Ltd (Enerparc) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) for the proposed Tilbuster Solar Farm Project. The subject land comprises part of 11915 New England highway and part of 12029-12049 New England Highway, Black Mountain NSW. The relevant lots include Lot 1 of DP 225170, Lot 1 of DP 585523 and Lot 3 of DP800611 (Figure 1-1). The project is within the Armidale Local Government Area (LGA).

The solar farm proposal would involve ground disturbance that has the potential to impact on Aboriginal heritage sites and objects which are protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the ACHA is therefore to investigate the presence of any Aboriginal sites and to assess their values and impacts and provide management strategies that may mitigate any impact.

All Aboriginal heritage sites and objects are protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of this ACHAR survey and subsurface testing program was therefore to investigate the presence of any Aboriginal objects within proposed work areas and to assess their values and impacts and provide management strategies that may mitigate any impacts.

PROJECT PROPOSAL

The proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 152 Megawatts (AC) to be supplied directly to the national electricity grid. The Proposal would provide enough clean, renewable energy for about 48,000 average NSW homes while displacing approximately 250,000 metric tons of carbon dioxide annually. The proposal site is approximately 310 hectares of which approximately 178 hectares would be developed for the solar farm and associated infrastructure (Development Footprint). Two existing TransGrid transmission lines transect the site, a 132 kilovolts eastern line and a 330 kilovolts central line. The 330 kilovolts transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during construction and operation for light and heavy vehicles would be off New England Highway, east of the site. The proposed infrastructure map (Figure 1-2) illustrates the indicative layout, including a concept development footprint for the solar arrays.

Key development and infrastructure components would include:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8km in length

- Perimeter security fencing
- Security camera poles
- Construction of creek crossing as required
- Native vegetative screening as required

In total, the construction phase of the proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. Up to five fulltime equivalent operations and maintenance staff and service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability.

The Proposal would require subdivision of Deposited Plan Lots within the proposal site for lease and purchase agreement purposes with the involved landowner.

ABORIGINAL CONSULTATION

Consultation with Aboriginal stakeholders was undertaken in accordance with clause 60 (formerly 80C) of the *National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2019* following the consultation steps outlined in the ACHCRP guide. A comprehensive account of the consultation steps undertaken to comply with the guide, as well as a summary of the actions completed by NGH and responses received from RAPs are provided in Section 3 of this report. A full consultation log and relevant documentary evidence is available in Appendix A.

A copy of this draft report was provided to all registered parties and feedback was sought on the recommendations, the assessment and any other issues that may have been important. Feedback regarding cultural significance and responses to the draft report were received from Iwatta Aboriginal Corporation, Nunnawanna Aboriginal Corporation and Nyakka Aboriginal Culture Heritage Corporation Archaeological & Cultural Heritage Consultants. This included notes on the local cultural sites which are in close proximity to the proposal area, as well as preferences relating to the storage of artefacts. This information is outlined in Section 3 and has been incorporated into the recommendations of this report as appropriate.

ARCHAEOLOGICAL CONTEXT

This assessment includes a review of relevant background information relating to the proposed solar farm location and includes a review of previous archaeological studies undertaken in the local and regional area, as well as presenting an overview of the existing environmental context and studies undertaken within the proposal site. A search of the AHIMS database also formed part of the background analysis.

The information retrieved from the above source indicates that there were no registered sites within the proposal site, however an unregistered isolated find identified by Burke et al (2000) maybe have been located in or very close to the proposed solar farm location. Furthermore, modelling based on the environmental context and archaeological studies undertaken within the local area indicates that there is an increased likelihood for evidence of Aboriginal occupation to be located within the proposal area, , specifically in association with Duval Creek.

ARCHAEOLOGICAL INVESTIGATION RESULTS

An archaeological survey was undertaken of the proposal site in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a). The survey conducted for the purposes of this report was undertaken between the 24th and 25th of September and continued on the 11th of November through to the 15th of November 2019.

The survey resulted in 49 isolated finds, 28 artefact scatters, six scarred trees and three cultural trees being identified and recorded. It should be noted that a small number of sites were identified and recorded outside the boundary of the proposal site where landforms containing artefacts continued outside to the boundary. Sites were also located while navigating between portions of the proposal site. We have reported on these sites as part of the survey results, and have been logically incorporated in accordance with the sections of the proposal site they are proximate to, however we recognise that they are extraneous to the proposal site boundary and are unlikely to be impacted by the proposed solar farm works.

In general, the majority of the proposal site comprised very shallow redeposited A horizon silty topsoils laying over very compacted B horizon silty clay. Significant erosion has occurred due to the presence of large quantities of sheep on the property, in combination with the extreme drought conditions which have resulted in the near-complete absence of ground covering vegetation. Due to erosion and landform deflation, the identification of surface artefacts was increased, however in most locations it was clear that no subsurface deposits would be present within the heavily disturbed landforms. Subsurface potential was however identified on a lower slope landform near artefact scatters AS24 and AS25, and therefore it was determined that subsurface testing would be required in order to adequately assess the subsurface site.

The subsurface excavation was undertaken following the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2011). A total of sixteen 50 centimetres by 50 centimetres test pits were excavated, from which 30 artefacts were recovered. The pits were excavated across two areas: near AS24 (Pits 1 to 9) and AS25 (Pits 10 to 16). From the 16 test pits, a total of 1.2125m^3 was excavated and dry sieved. Test pits depth ranged from 20 centimetres to 40 centimetres, with the majority of test pits excavated to a depth of 30 centimetres below the surface.

The artefacts recovered from the testing programme were present in Pits TP1, TP2, TP3, TP5, TP6, TP7, TP8, TP9 and TP13. Pits TP4, TP10, TP11, TP12, TP14, TP15 and TP16 did not yield artefacts. Pits TP10, TP11, TP12, TP14, TP15 and TP16 were located to the north of the elevated spur above Duval Creek, adjacent to a shallow ephemeral drainage line and below the crest on which the majority of AS24 artefacts were identified. This location was tested as it appeared to have greater depth in soils compared with locations further up the slope, however as a result of agricultural activities such as ploughing, in addition to water movement across the slope, much of the topsoils have eroded, and silty clay subsoils are present close to the surface. Disturbances to the soil profile were evident in all pits substantiating the characterisation of the proposal site as being highly disturbed. From the 16 test pits, a total of 1.2125m^3 was excavated and dry sieved. Test pits depth ranged from 20 centimetres to 40 centimetres, with the majority of test pits excavated to a depth of 30 centimetres below the surface. The locations of the test pits are shown in Figure 5-5 and all soil descriptions are provided in Appendix C.

The technological characteristics of the surface and subsurface artefact assemblage suggest that the artefacts recorded during the survey and testing program may have been made as a part of a ‘general-purpose’ toolkit and manufactured as required. The pattern and density of the stone artefacts recorded and recovered during the survey along with those recovered from a subsurface context suggest that the area was likely to have been frequently visited by Aboriginal people in the past. The low-moderate density of artefacts identified during the survey and testing program conducted across the Tilbuster proposal site demonstrate that the area was likely repeatedly used on multiple occasions by small to medium groups of people as they moved through New England region.

POTENTIAL IMPACTS

An assessment of the proposed development footprint has identified that, of the total number of sites, 45 are within the proposed impact zones of the array and site facilities. These 45 sites comprise 23 isolated finds, 18 artefact scatters, three scarred trees and one cultural tree. It should be noted that an additional 16 sites are located immediately adjacent to areas which would be impacted by the proposed solar farm and it is considered likely that there may be incidental or indirect impacts to these locations. Recommendations have been developed to minimise the impacts of the proposed solar farm on the Aboriginal cultural heritage values identified to exist within the proposal site.

An analysis of the Tilbuster Solar Farm detailed design as compared with the locations of identified Aboriginal cultural heritage items enabled the impact of the proposed solar farm to be accurately characterised. Table 7-1 identifies the sites which will be impacted by the detailed design within the proposal site. The information provided in the table is based on the footprint as shown in Figure 7-1. Figure 7-2 has been prepared to demarcate the areas for which “no impact” zones must be designated and where existing fences must be maintained. This information is based on the development footprint as provided, and the no impact zones are designated within locations where no impacts are proposed. These should be included in the site inductions and any relevant management plans for the site.

The social and cultural values attributed to the artefacts and the sites by the local Aboriginal community may be impacted as a result of the development. The extent to which the total or partial loss of the sites would impact on the community is only something the Aboriginal community can articulate. In particular, it must be noted that a number of scarred and cultural trees are currently within the impact zone of proposed works.

Detailed comments regarding the cultural significance of the area were provided by Iwatta Aboriginal Corporation, including information about the specific significance of the scarred trees, which form a component of a cultural landscape including women’s and men’s sites, ceremonial routes, and songlines. Cultural significance of the area, in particular scarred trees, is very high.

The impact to the scientific values if the artefacts were to be impacted by the current proposal is considered moderate. This is due to the sheer number of sites which will be subject to direct and indirect impacts as a result of the proposal. While the site integrity of the majority of artefact sites has been significantly compromised by historic land use, compounded by the drought conditions, the quantity of artefacts present within this landscape has significantly increased the recorded data for the Armidale region and provided further insight into use of raw materials and occupation patterns during the mid- to late Holocene. The intrinsic values of the artefacts themselves may be affected by the development of the proposal site. Any removal of the artefacts, or their breakage would reduce the low to moderate scientific value they retain.

The current assessed scientific impact to the scarred trees recorded within the area is moderate, as two of the six, or one third, of the recorded scarred trees will be destroyed by the proposal.

RECOMMENDATIONS

It is recommended that:

1. The Tilbuster Solar Farm development avoids the three scarred tree sites (Tilbuster Solar Farm ST1, Tilbuster Solar Farm ST2 and Tilbuster Solar Farm ST3) as well as the cultural trees (Tilbuster Solar Farm CT1 and Tilbuster solar Farm CT3), which are located within the proposed development footprint. A minimum of a five-metre buffer should be established by placing high visibility bunting (or similar) around each of these trees to avoid impacts. Additionally, the locations of the trees have now been designated within a ‘No Impact Zone’ for further protection measures.

2. Tilbuster Solar Farm ST5, Tilbuster ST6 and Tilbuster CT2 are located within the proposed development footprint. It is strongly recommended that development footprint excises the location of Tilbuster Solar Farm ST5, Tilbuster ST6 and Tilbuster CT2 as well as an additional 10m buffer surrounding each tree location to preserve the root system. In addition to the modification to the footprint, each tree should be fenced using high visibility bunting (or similar) demarcating a five-metre buffer around the trees in order to avoid impacts. .

3. Tilbuster Solar Farm ST4 is located between two areas proposed for solar arrays. It is recommended that a minimum of a five-metre buffer should be established by placing high visibility bunting (or similar) around this tree to avoid impacts.
4. No Impact Area 1 and No Impact Area 2 (Figure 7-2), which are based on the areas outside the development footprint, but inside the proposal site, must be fenced or otherwise clearly delineated and included in all onsite inductions and management plans. The development should avoid any direct or indirect impacts to the sites located within these no impact zones, including: Tilbuster Solar Farm IF8, IF12, IF13, IF18, IF30, IF31, IF33, IF51, IF52, IF53; Tilbuster Solar Farm AS1, AS8, AS9; Tilbuster Solar Farm ST2, ST3, CT1 and CT3.
5. In accordance with Figure 7-2, No Impact Zone 3 located to the south and west of the proposal site boundary must not be subject to any impacts, for the protection of Tilbuster Solar Farm IF9, IF21, IF22, IF39, Tilbuster Solar Farm AS13, part of AS16, AS18, AS19; and Tilbuster Solar Farm ST1. The existing fences must remain in place. Further assessment will be required if any impacts will occur within this area, including replacement of existing fencing.
6. There are three sites which were recorded during the survey which are located outside the proposal site boundary (and not included within the No Impact Area): Tilbuster Solar Farm IF38, AS26 and AS28. These must not be subject to indirect or direct impacts as a result of activities relating to the construction, operation or decommissioning of the solar farm.
7. With the exception of the access road from the main house along the northern boundary of the proposal site (refer to Figure 1-2), existing farm tracks not within the development footprint may not be used for the purposes of the solar farm, with specific reference to access by large vehicles or plant. If use of such tracks is required, these tracks must be assessed including archaeological survey and amendments or addendums to this report.
8. Salvage of the isolated finds and artefact scatters within the development footprint and not within a designated No Impact Zone must be undertaken in the form of surface collection. This would include the collection of the artefacts to be temporarily stored at the NGH Newcastle office for further analysis, with permanent storage to be at Armidale and Region Aboriginal Cultural Centre & Keeping Place for all artefacts, or where storage of all artefacts cannot be achieved, formal tools will be stored / displayed at the Cultural Centre, and the remaining artefacts will be buried on site, outside of the development footprint.
9. Monitoring of topsoil stripping by representatives of the RAPs should be undertaken for sites AS4, AS23, AS24 and AS25, with reference to similar programs undertaken at other sites in the region.
10. A minimum five (5) metre buffer should be observed around all sites that are to be avoided and that are not within the designated No Impact Zones 1, 2 and 3.
11. Enerparc Australia should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal objects during the construction of the solar farm and management of known sites and artefacts. The CHMP should include an unexpected finds procedure to deal with construction activity. The preparation of the CHMP should be completed in consultation with RAPs.
12. In the unlikely event that human remains are discovered during the development works, all work must cease in the immediate vicinity. DPIE, the local police and the RAPs should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.
13. Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the registered Aboriginal parties and may include further field survey and subsurface testing.

Enerparc are reminded that it is an offence under the National Parks and Wildlife Act to harm an Aboriginal object without a valid AHIP.

1. INTRODUCTION

NGH Pty Ltd (NGH) has been contracted by Enerparc Australia Pty Ltd (Enerparc) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) for the proposed Tilbuster Solar Farm Project. The subject land comprises part of 11915 New England highway and part of 12029-12049 New England Highway, Black Mountain NSW. The relevant lots include Lot 1 of DP 225170, Lot 1 of DP 585523 and Lot 3 of DP800611 (Figure 1-1). The project is within the Armidale Local Government Area (LGA).

The solar farm proposal will involve ground disturbance that has the potential to impact on Aboriginal heritage sites and objects which are protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the ACHA is therefore to investigate the presence of any Aboriginal sites and to assess their values and impacts and provide management strategies that may mitigate any impact.

1.1. PROJECT PROPOSAL

The proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 152 Megawatts (AC) to be supplied directly to the national electricity grid. The Proposal would provide enough clean, renewable energy for about 48,000 average NSW homes while displacing approximately 250,000 metric tons of carbon dioxide annually. The proposal site is approximately 310 hectares of which approximately 178 hectares would be developed for the solar farm and associated infrastructure (Development Footprint). Two existing TransGrid transmission lines transect the site, a 132 kilovolts eastern line and a 330 kilovolts central line. The 330 kilovolts transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during construction and operation for light and heavy vehicles would be off New England Highway, east of the site. The proposed infrastructure map (Figure 1-2) illustrates the indicative layout, including a concept development footprint for the solar arrays.

Key development and infrastructure components would include:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8km in length
- Perimeter security fencing
- Security camera poles
- Construction of creek crossing as required
- Native vegetative screening as required

In total, the construction phase of the proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. At the end of its operational life, the facility would be decommissioned. All below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability.

The Proposal would require subdivision of Deposited Plan Lots within the proposal site for lease and purchase agreement purposes with the involved landowner.

1.2. PROPOSAL SITE

The Tilbuster Solar Farm (herein referred to as the proposal site) would be located on a rural property approximately 17 kilometres north of Armidale. The majority of the Proposal is contained within the proposal site, a 310-hectare plot of land that is currently owned by one landowner, comprising Lot 1 of DP 225170, Lot 1 of DP 585523 and Lot 3 of DP800611, in addition to some Crown Land. The assessment addresses all portions of these lots as shown in Figure 1-1 and Figure 1-2.

The development footprint encompasses the land that would be used for the construction and operation of the solar farm, and comprises the land required to construct the substation, the solar array, the proposed internal access tracks, and the connection to the existing 330 kV transmission line.

The proposal site is located on land zoned RU1 Primary Production to the north east under the *Armidale Dumaresq Local Environmental Plan 2012* (Armidale Regional LEP). Crown Land is located within the south east part of the proposal site. The proposal site, associated transmission and access roads are located on land zoned RU1 Primary Production under the Armidale Regional LEP.

The proposal site is located within the Parish of Duval, County of Sandon, and is considered to be within the suburb of Black Mountain, postcode 2365.

1.3. PROJECT PERSONNEL

The assessment was undertaken by NGH archaeologists Alexandra Byrne, Chelsea Jones and Shezani Nasoordeen, including research, Aboriginal community consultation, field survey and report preparation. NGH Senior Heritage Consultant Shoshanna Grounds reviewed the report.

Field work was completed with the following sites officers:

- Rhonda Kitchener (Nyakka Aboriginal Corporation)
- Colin Ahoy (Nunnawunna Aboriginal Corporation)
- Anthony Simon (Nunnawunna Aboriginal Corporation)
- Tyson Ahoy (Nunnawunna Aboriginal Corporation)
- Steven Ahoy (Iwatta Aboriginal Corporation)
- Jocelyn Blair (Iwatta Aboriginal Corporation)

Consultation with relevant Aboriginal Community Stakeholders was undertaken following the process outlined in the guidelines *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010). Details about the consultation process and registered Aboriginal parties are provided in Section 3.

1.4. REPORT FORMAT

The ACHA for the proposed Tilbuster Solar Farm has been prepared in accordance with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a); and
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRs)(DECCW 2010b).

The purpose of this ACHA report is therefore to provide an assessment of the Aboriginal cultural values associated with the proposal site and to assess the cultural and scientific significance of any Aboriginal heritage sites. This conforms to the intention of the SEARs.

The objectives of the assessment were to:

- Conduct consultation with relevant Aboriginal stakeholders in accordance with Clause 60 (formerly Clause 80C) of the *National Parks and Wildlife Regulation 2009,* using the consultation process outlined in the ACHCRs;
- Undertaken an assessment of the archaeological and cultural heritage values of the proposal site and any Aboriginal objects, sites or places therein;
- Assess the cultural and scientific significance of any archaeological material;
- Assess the impacts of the development proposal on cultural heritage sites; and
- Provide management and mitigation recommendations for any objects identified.

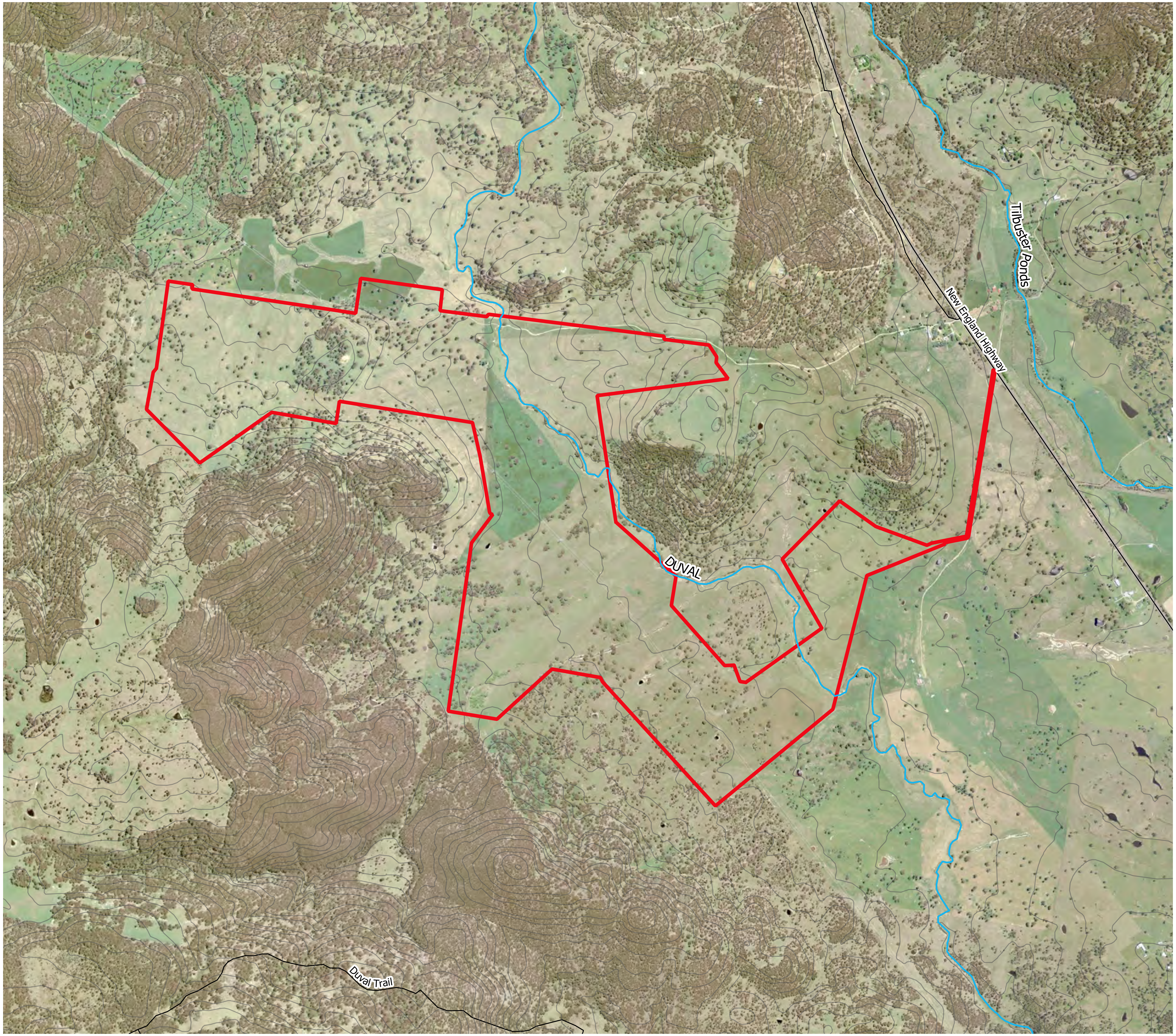
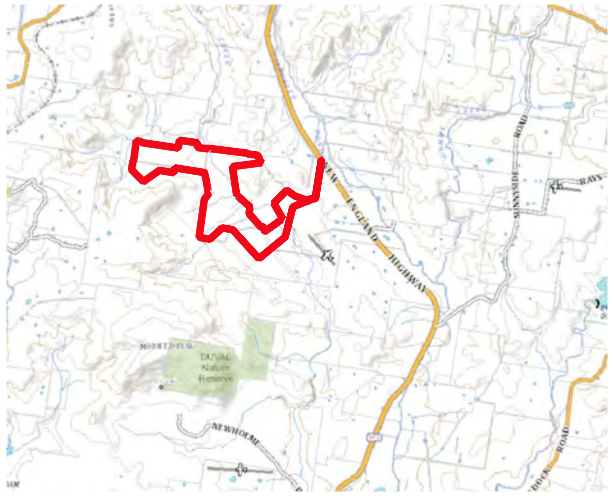


Figure 1-1: Proposed Site Location

Legend
Proposal site location
Waterways
Roads



0 150 300 450 600 750 900 1050 1200 m

Data Attribution
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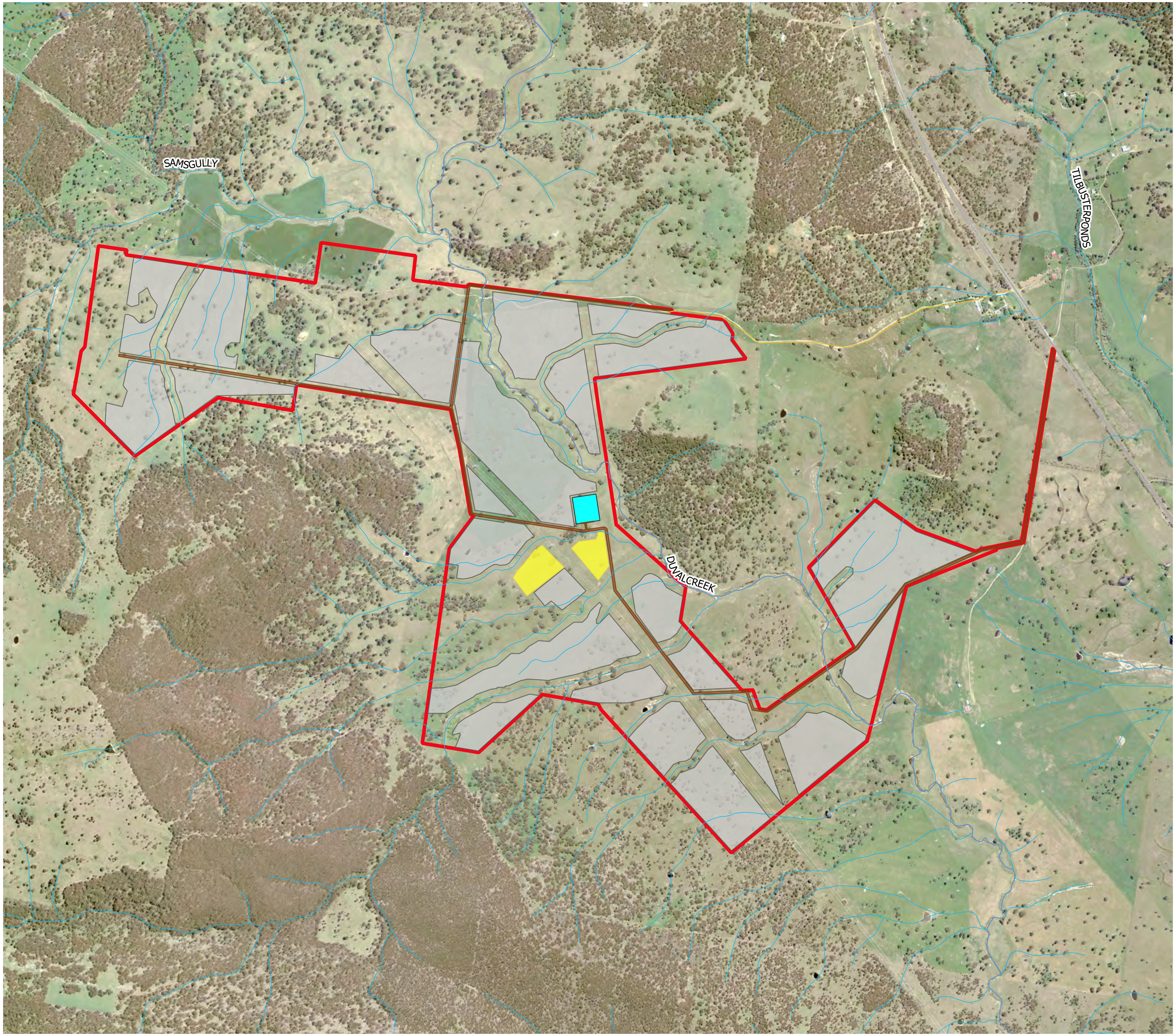
Ref: 18-645 Tillbuster SF Workspace
20191218_qfield.qgs \ a3 land
Author: Chelsea. J
Date created: 10.03.2020
Datum: GDA94 / MGA zone 56

NGH

Figure 1-2: Development footprint



Legend

Proposal site location

Proposed Infrastructure Layout

Access Road

Indicative Location of Site Office , Laydown Area, Car Parking and Battery Storage

Solar Array

Substation

Roads

Waterways

0 150 300 450 600 750 900 m

Data Attribution
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Ref: 18-645 Tillbuster SF Workspace 20191218 \ a3 land
Author: Chelsea. J
Date created: 17.01.2020
Datum: GDA94 / MGA zone 56

NGH

2. LEGISLATIVE CONTEXT

In NSW, Aboriginal heritage is principally protected by two legislative acts:

- *National Parks and Wildlife Act 1974* (NSW) (NPW ACT); and
- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

Summaries of these Acts in context of Aboriginal heritage have been provided below.

NSW *National Parks and Wildlife Act 1974*

Aboriginal heritage is primarily protected under the NPW Act and as subsequently amended in 2010 with the introduction of the National Parks and Wildlife Amendment (Aboriginal Objects and Places) Regulation 2010. The aim of the NPW Act includes:

> *The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including but not limited to places, objects and features of significance to Aboriginal people.*

An Aboriginal object is defined as:

> *Any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with the occupation of that area by persons on non-Aboriginal extraction and includes Aboriginal remains.*

Part 6 of the NPW Act concerns Aboriginal objects and places and various sections describe the offences, defences and requirements to harm an Aboriginal object or place. The main offences under section 86 of the NPW Act are:

- A person must not harm or desecrate an object that the person knows is an Aboriginal object.
- A person must not harm an Aboriginal object.
- For the purposes of this section, "circumstances of aggravation" are:
    - o that the offence was committed in the course of carrying out a commercial activity, or
    - o that the offence was the second or subsequent occasion on which the offender was convicted of an offence under this section.
- A person must not harm or desecrate an Aboriginal place.

Under section 87 of the NPW Act, there are specified defences to prosecution including authorisation through an Aboriginal Heritage Impact Permit (AHIP) or through exercising due diligence or compliance through the regulation.

Section 89A of the Act also requires that a person who is aware of an Aboriginal object, must notify the Director-General in a prescribed manner. In effect this section requires the completion of site cards for all sites located during heritage surveys.

Section 90 of the NPW Act deals with the issuing of an AHIP, including that the permit may be subject to certain conditions. With reference to the below summary of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), an AHIP would not be required for this project as it is an SSD and consent provided by the Minister would include conditions relating to Aboriginal heritage.

NSW *Environmental Planning and Assessment Act 1979*

The EP&A Act is legislation for the management of development in NSW. It sets up a planning structure that requires developers (individuals or companies) to consider the environmental impacts of new proposals. Under this Act, cultural heritage is considered to be a part of the environment. This Act requires that Aboriginal cultural heritage and the possible impacts to Aboriginal heritage that development may have are formally considered in land-use planning and development approval processes.

The proposed Tilbuster Solar Farm has been classified as a State Significant development (SSD) and will be assessed under part 4 of the EP&A Act (SSD 9619). SSDs are major projects which require approval from the

Minister for Planning. An Environmental Impact Statement (EIS) must be prepared in accordance with the requirements of the Secretary of the Department of Planning, Industry and Environment (DPIE). The Secretary's Environmental Assessment Requirements (SEARs) relating to Aboriginal heritage were as follows:

> Include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.

This ACHA has therefore been prepared in order to support the EIS in meeting this requirement.

3. CONSULTATION

The NSW government acknowledges that Aboriginal cultural heritage provides an important link between the past and present which contribute to Aboriginal people's cultural identity, connection and sense of belonging to Country. As such the NPW Act requires that effective consultation with Aboriginal people be undertaken as a fundamental component of the Aboriginal cultural heritage assessment process and acknowledges that:

- Aboriginal people should have the right to maintain culture, language, knowledge and identity;
- Aboriginal people should have the right to directly participate in matters that may affect their heritage;
- Aboriginal people are the primary determinants of the cultural significance of their heritage.

Clause 60 (formerly 80C) of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010 established consultation in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010b) as a requirement under the Act.

The ACHCRs outline a four-stage process of consultation as follows.

Stage 1 – Notification of project proposal and registration of interest

Aim: to identify, notify and register Aboriginal people who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places in the area of the proposed project (DECCW 2010b:10).

The proponent or their representative must use reasonable sources for identifying Aboriginal people who may hold cultural knowledge, including, but not limited to: the relevant local branch of the Biodiversity and Conservation Division (formerly OEH) ; the relevant Local Aboriginal Land Council; the relevant local government authority; the relevant local lands services office; the Registrar, *Aboriginal Land Rights Act 1983*; the National Native Title Tribunal; and Native Title Services Corporation Limited.

The proponent or their representative must then contact the Aboriginal organisations or individuals whose names were obtained from the above sources to notify them of the proposed project. An advertisement must also be placed in a local newspaper inviting expressions of interest in the project. A response period of a minimum of 14 days must be allowed for Aboriginal knowledge holders to register an interest. Aboriginal people who register their interest are referred to as "registered Aboriginal parties" or RAPs.

Stage 2 – Presentation of information about the proposed project

Aim: to provide registered Aboriginal parties with information about the scope of the proposed project and the proposed cultural heritage assessment process (DECCW 2010b:12).

The proponent or their representative must present information about the proposed project including details relating to the nature, scope, methodology and critical timelines. Opportunity must be provided for the RAPs to identify, raise and discuss their cultural concerns, perspective and assessment requirements (if any).

Stage 3 – Gathering information about cultural significance

Aim: to facilitate a process whereby Aboriginal parties can: (a) contribute to culturally appropriate information gathering and research methodology; (b) provide information that will enable the cultural significance of Aboriginal objects and/or places on the proposal site to be determined; (c) have input into the development of any cultural heritage management options (DECCW 2010b: 12).

The proponent or their representative must present and/or provide the proposed methodology for the cultural heritage assessment to the RAPs. A minimum of 28 days must be provided to RAPs to review and provide feedback on the proposed methodology. The proponent must seek cultural information from RAPs to identify whether there are any Aboriginal objects of cultural value in the proposal site and whether there are any places of cultural value including places of spiritual, social and cultural value. The review by the RAPs should address any protocols for the management of information and provide information about any areas of cultural significance that the proposed project may affect, inform or refine the methodology.

Where information provided is confidential or of a sensitive nature, the proponent will develop and implement appropriate protocols for sourcing and holding cultural information appropriately.

Stage 4 – Review of draft cultural heritage assessment report

Aim: to prepare and finalise an Aboriginal Cultural heritage assessment report with input from registered Aboriginal parties (DECCW 2010b:14).

The proponent or their representative must prepare a draft ACHA report and provide a copy of this report to the RAPs for review and comment. A minimum of 28 days must be allowed for responses to the draft ACHA report.

Once responses are received, these must be incorporated (included proponent's response to each comment) into the report and copies of all submissions received should be included as part of the document. The final version of the report must be provided to the RAPs.

3.1. RECORD OF CONSULTATION

Consultation has been undertaken in accordance with the requirements for this ACHA, a summary of which is provided below. A full consultation log and relevant documentary evidence is available in Appendix A.

In accordance with Stage 1 (step 4.1.2), letters requesting information about any known Aboriginal cultural knowledge holders were sent to the following:

- NSW BCD North East Regional Branch
- Armidale Local Aboriginal Land Council (LALC)
- Armidale Regional Council
- Northern Tablelands Local Lands Services
- The Registrar, *Aboriginal Land Rights Act 1983*
- National Native Title Tribunal
- Native Title Services Corporation Limited

An advertisement was placed in the Armidale Express on 10 July 2019 and all Aboriginal stakeholders identified by the above agencies were then contacted on 29 July 2019 in accordance with Stage 1 (step 4.1.3). At the completion of Stage 1, a total of seven groups were registered for the project. The list of RAPs is provided in Table 3-1. In accordance with step 4.1.6, the names and details of the RAPs were forwarded to the LALC and BCD.

Table 3-1 Registered Aboriginal Parties

RAP	Contact Name
Nunnawunna Aboriginal Corporation	Colin Ahoy
Iwatta Aboriginal Corporation	Steven Ahoy
Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants	Rhonda Kitchener
Cheryl Kitchener	Cheryl Kitchener

Anaiwan Traditional Owners Aboriginal Corporation	David Ahoy
Larissa Ahoy	Larissa Ahoy
Garby Elders	Anthony Dootson
Armidale LALC	Tom Briggs

In accordance with Stages 2 and 3, NGH provided RAPs with a copy of the proposed methodology on 13 August 2019 and responses were due by 10 September 2019. The RAPs were provided with information about the proposal and cultural heritage assessment process, including the methodology for collecting cultural information. All comments received have been incorporated into this ACHA as appropriate and are outlined in Table 3-2. A second version of the methodology incorporating the completion of test excavation in accordance with the SEARs and the Code of Practice was supplied to RAPs on 4 October 2019. A list of RAPs who were requested to participated in the field component of the work is included in Table 3-3.

Table 3-2 Responses to methodology

RAP	Comment	NGH Response
Nunnawunna Aboriginal Corporation	Agrees with methodology.	N/A
Iwatta Aboriginal Corporation	Agrees with methodology.	N/A
Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants	Agrees with methodology.	N/A
Cheryl Kitchener	Agrees with methodology.	N/A
Anaiwan Traditional Owners Aboriginal Corporation	Agrees with methodology.	N/A
Larissa Ahoy	Response combined with Anaiwan response.	N/A
Garby Elders	No response.	N/A
Armidale LALC	No response.	N/A

Table 3-3 RAPs requested to attend fieldwork

RAP	Representative/s
Nunnawunna Aboriginal Corporation	Colin Ahoy Tyson Ahoy

	Anthony Simon
Iwatta Aboriginal Corporation	Steven Ahoy Jocelyn Blair
Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants	Rhonda Kitchener
Armidale Local Aboriginal Land Council	(Could not contact in time)

Comments from RAPs regarding cultural value were discussed on site and information was provided by Iwatta in writing on 9 December 2019. This information is incorporated into the responses to the draft report below.

In accordance with Stage 4 (step 4.4.2) the draft ACHA has been provided to the RAPs on 1 June 2020, with responses due by Monday 29 June 2020, and an extension until Friday 10 July 2020. The following responses were received:

Table 4 Cultural information provided by RAPs and responses to Draft ACHA

Organisation	Comments	NGH Response
Iwatta Aboriginal Corporation	[redacted] [redacted] [redacted] [redacted]	[redacted]

	[redacted]	
Nunnawanna Aboriginal Corporation	“Due to the land of the solar farm being developed behind Mt Duval which is of high significance to the Anaiwan people, I would like to recommend that a RAP should be present when the solar farm developers are erecting their fence as the boundary of the solar farm will impact the knapping site at AS1 in figure 5.1. In the case of salvaging of all the artefacts I would like them to be stored in a display case at the Armidale Cultural Centre and Keeping Place.”	This response has been incorporated into the recommendations.
Nyakka Aboriginal Cultural Heritage Corporation Archaeological & Cultural Heritage Consultants	“Thanks for the report, it’s very informative as a scientific report, unfortunately it’s clear that the information regarding the local landscape has been omitted from the report. Regarding Cultural Heritage Values, I would like it noted that I spoke to you about the Women’s sites within the cultural landscape which Tilbuster is part of, too many times Women’s sites and business is left out of the reports and our value to the cultural record is diminished or not recognised. If not too late I would at least like this to be noted in this section. For the management of the artefacts which will be recovered from the project area, we would like the axes displayed at the Armidale Aboriginal Cultural Centre and other artefacts buried on Country land outside the project area.”	NGH responded that some information that had been provided in writing by Iwatta regarding cultural sites, including women’s sites, had been included in the report, specifically Section 6, however it had been redacted from draft reports supplied to all RAPs except Iwatta, in order to avoid breaching confidentiality. Management of artefacts has been included in the recommendations.

4. BACKGROUND INFORMATION

The purpose of carrying out an assessment of background information is to analyse available information in order to understand the context of a proposal site. In accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in* NSW (OEH 2011:5), developing an adequate understanding of a cultural landscape requires information including:

- The physical setting or landscape;
- History of peoples living on that land;
- Material evidence of Aboriginal land use.

This report has provided that information as follows:

- Environmental context (Section 4.1)
- Historic and Ethnographic Background (Section 4.1.5)
- Archaeological Context (Section 4.2)

4.1. ENVIRONMENTAL CONTEXT

The environmental context or physical setting of the proposal site is relevant as the character of a place influences how it was utilised by past Aboriginal people. In some cases, such interaction or attributed significance continues into the present day. Descriptions are provided below of the environment as it would have been prior to colonisation, and its current condition.

4.1.1. Geology, Soils and Topography

The landscape context assessment is based on a number of classifications that have been made at national and regional level for Australia. The national Interim Biogeographic Regionalisation for Australia (IBRA) system identifies the proposal area as located within the NSW New England Tableland Bioregion (DE&E 2016). The dominant IBRA subregion intersected by the proposal is the Armidale Plateau subregion.

The bioregion comprises part the north eastern section of the New England Fold Belt consisting of extensively faulted Carboniferous and Permian age sedimentary rocks. The majority of bedrock is superimposed by Tertiary basalt underlain by gravels, sands and lake sediments. Within the sands, beneath the basalt, inclusions of gold, diamond, tin ore and sapphires have been mined.

The Armidale Plateau subregion is characterised by an undulating plateau at around 1100 metres above sea level with broad valleys and a stepped landscape extending across basalt flows with valleys steepening towards the Great Escarpment Gorges. Geology of the plateau is characterised by fine grained permo-carboniferous sedimentary rocks, multiple tertiary basalt flows and granites.

The New England Geological Map (1:500 000 1973/333) indicates the geology underlying the proposal area consists of Permian and Carboniferous Geological sequences as shown in Figure 4-1 and detailed below. The northern component of the proposal site is within the Dummy Creek Conglomerate (Pd) and the southern component in the Sandon Beds Formation (cs).

- Pd Dummy Creek conglomerate: comprising pebble conglomerate, coarse sandstone and massive mudstone
- Cs Sandon Beds: comprising greywacke, claystone, chert, jasper and black volcanic.

A contrast in soils of the subregion is evident through the friable well drained soils on the upper slopes and compact poorly drained soils of the lower slopes. Soil types vary between black earths along valley floors, inconstant stony loams and dark loamy alluvium in swampy valleys (DE&E 2016).

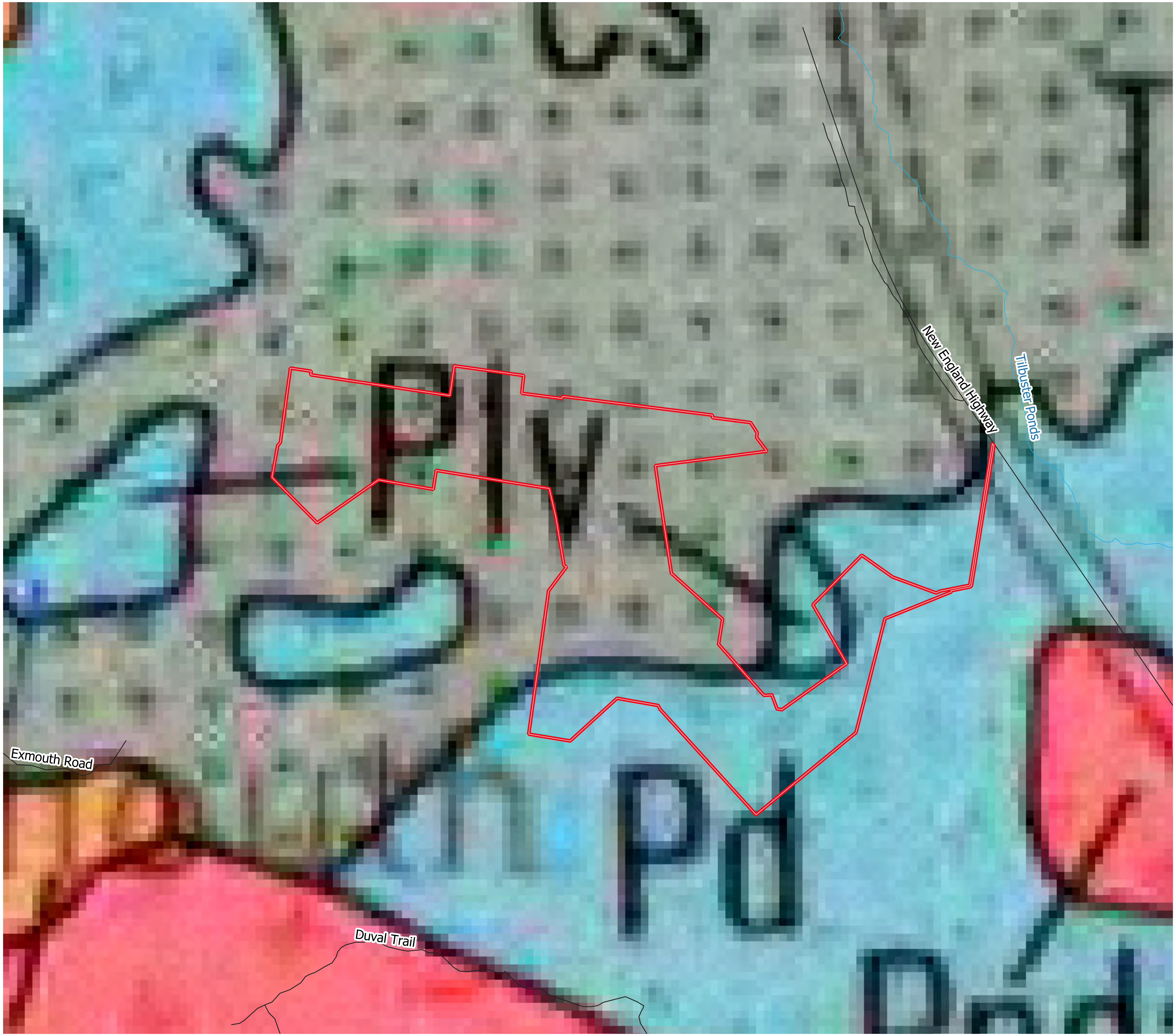
Tilbuster Ponds is located approximately 900 metres to the east of the proposal site, and Dumaresq Creek is four kilometres west. Duval Creek, a fourth order stream which usually contains water (in the current drought the stream is dry), runs through the proposal site. Historic newspaper articles suggest it has rarely been dry (The Armidale Express and New England General Advertiser 1938).

In general, the proposal site is characterised by 'Dingo Spur Meta-sediments' (DSM) according to the landscape information provided by Mitchell (Mitchell Landscapes) (DECC 2002) (Figure 4-2), a description for which is provided in Table 4-1.

Table 4-1 Description of the Dingo Spur Meta-sediments (Dsm) (DECC 2002: 78-79)

Dingo Spur Meta-sediments
"Steep ranges and hills intersected by a dendritic drainage pattern leading into deep gorges with high waterfalls on the Great Escarpment, extends west onto the tablelands. Gorges incised into faulted, steep dipping Devonian quartzose sandstone, greywacke, massive argillite and slate. Tablelands area on Permo-Carboniferous mudstone, lithic sandstone, tuff, slate, hornfels and some schist. General elevation 300 to 1400m, local relief 600m. Shallow stony loam on steep scree slopes with moderate organic content. Shallow gradational loam and sandy loam elsewhere with deeper uniform profiles in low valleys. A very complex vegetation environment encompassing coastal closed forests, dry hardwood forests and cold high plateau components. Open forest of New England blackbutt (Eucalyptus andrewsii ssp. campanulata), messmate (Eucalyptus obliqua), silvertop stringybark (Eucalyptus laevopinea) with New England peppermint (Eucalyptus cinerea), snow gum (Eucalyptus pauciflora) and black sallee (Eucalyptus stellulata) in high cool environments. Dry closed forest species such as shatterwood (Backhousia sciadophora), giant stinging tree (Dendrocnide excelsa), shiny-leaved stinging tree (Dendrocnide photinophylla), and yellow tulip (Drypetes australasica) in lower moister environments and in patches on scree slopes where protected from fire. River Oak (Casuarina cunninghamiana) along all streams and dry hardwood forests of; yellow box (Eucalyptus melliodora), Blakely's red gum (Eucalyptus blakelyii), broad-leaved stringybark (Eucalyptus caliginosa) and cabbage gum (Eucalyptus amplifolia) on valley floors. "(DECC 2002)

Figure 4-1: New England Geological Sheet



Proposal site location
New England Geology
Pd - Dummy Creek Conglomerate
Tb - Basalt and dolerite
Pnda - Mt Duval Adamellite
Cs - Sandon Beds
Waterways
Highways

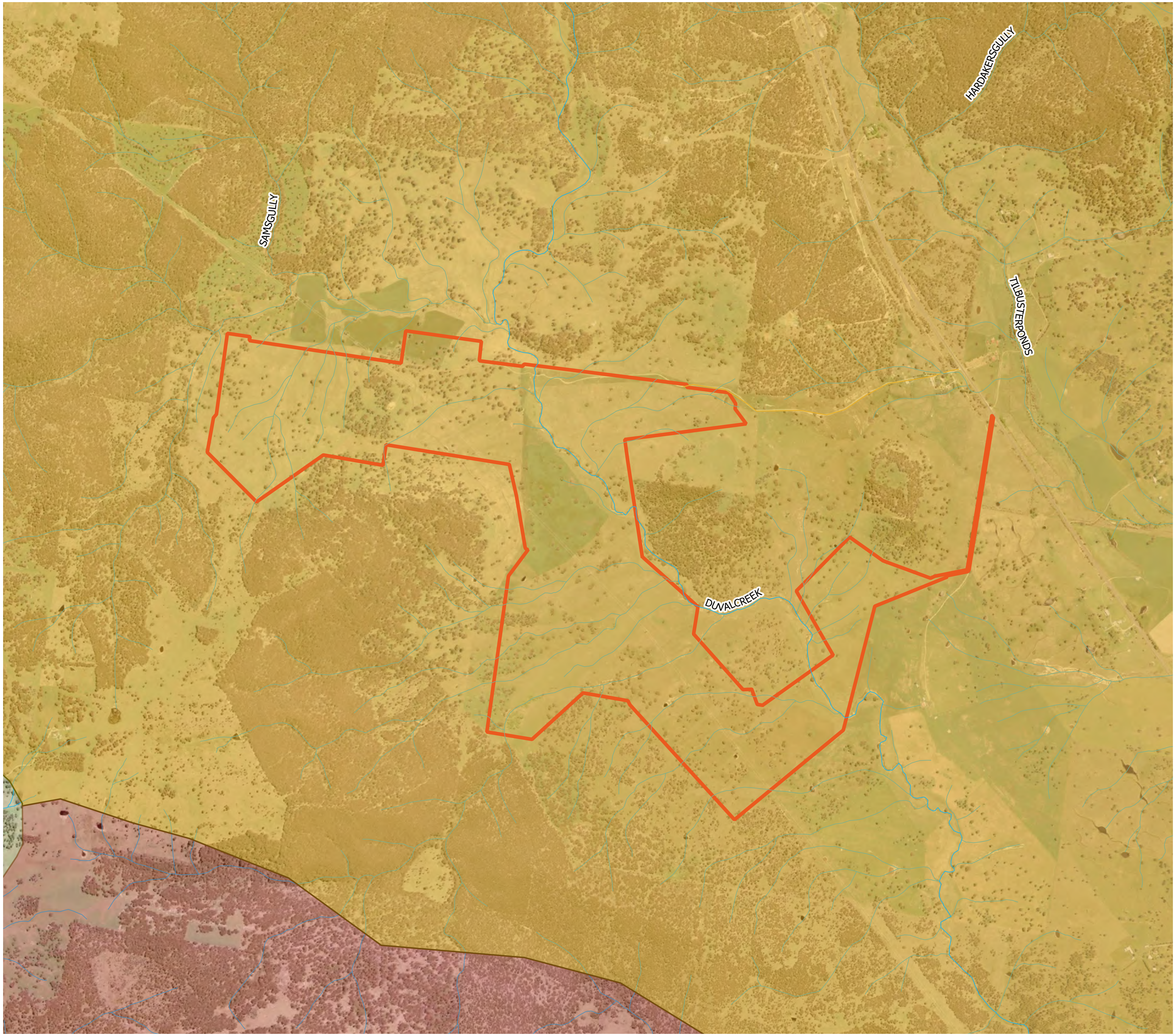
0 250 500 750 1000 1250 1500 m

Data Attribution

Ref: 18-645 Tillbuster SF ACHAR_20190711 \ a3 land
Author: chelsea.j
Date created: 26.11.2019
Datum: GDA94 / MGA zone 56

NGH

Figure 4-2:Mitchell Landscapes



Legend

Proposal site location

Roads

Waterways

Mitchell Landscapes

Dingo Spur Meta-sediments

Guyra Tops Granite

0 150 300 450 600 750 900 1050 m

Data Attribution
© NGH 2020
© LPI 2019

Ref: 18-645 Tillbuster SF Workspace 20191218 \ a3 land
Author: Chelsea. J
Date created: 17.01.2020
Datum: GDA94 / MGA zone 56

NGH

4.1.2. Flora and Fauna

Vegetation mapping of NSW and the ACT has been undertaken on a broad-scale by Keith (2004) including a compilation of vegetation as per present day, as well as reconstructed vegetation mapping prior to land-clearing. Relevant information from this study has been provided in this section. This information is not considered to be an ecological study and is used for general reference only.

The proposal site is located within the New England Grassy Woodlands as classified and reconstructed by Keith (2004) and is near related communities such as the Tableland Clay Grassy Woodlands and the Northern Tableland Dry Sclerophyll Forests.

Prior to extensive land clearing, New England Grassy Woodlands are characterised by a number of species including rough-barked apple (*Angophora floribunda*), Blakely's red gum (*Eucalyptus blakelyii*), a variety of box species including *E. bridgesiana, E. melliodora* and *E. moluccana* and stringybarks including *E. caliginosa, E. laevopinea* and *E. youmanii*. In deeper soils the canopy may reach as tall as 25 metres, however on hills, and areas with drier less fertile soils, the shorter stringybarks were the dominant species. On flats and open valleys, the New England peppermint (*E. nova-anglifolia*) dominates the vegetation community. Understorey species would have been sparse but included wattles (*Acacia filicifolia* and *A. implexa*), blackthorn (*Bursaria* spinosa), dogwood (*Cassinia quinquefaria, Hibbertia obtusifolia, Jacksonia scoparia*) and others. A variety of grasses and herbs were also present within this vegetation community, including kangaroo grass (*Themeda australis*), though grassy ground cover is generally less continuous in this community when compared with the Tableland Clay Grassy Woodlands (Keith 2004: 90-91).

Animals for which the New England Grassy Woodlands may have provided habitat would have included varieties of kangaroos and wallabies, as well as smaller marsupials such as bettongs and quolls, and the now-extinct placental mammal, the white-footed tree rat. A huge variety of birds and reptiles were also present, as well as fish and frogs within the rivers and creeks (Keith 2004: 83).

Such plant and animal species would have provided very important resources for food, shelter, medicine, implements, clothing and other day-to-day items. For example, eucalyptus trees provide a number of resources including bark for the manufacture of tools and weapons, as well as other useful items such as coolamons, shields and construction materials for shelters; and oil for medicine, as it is effective in the treatment of sinus congestion and headaches. Animal species would have been hunted or trapped for food, and evidence from other parts of NSW indicate that the bones and skins of animals were also put to use as tools, ornaments and clothing (Attenbrow 2006).

4.1.3. Climate

The continent has been subject to a number of sea level changes as a result of changes in the climate. Approximately 70,000 years ago, oceans dropped to more than 60 metres below the current sea level, exposing the landmass of 'Sahul' which included Tasmania, Australia and Papua New Guinea (Hiscock 2008:21). From this time, through the last glacial maximum, or ice age, until the melting of the ice caps commenced approximately 18,000 years ago, significantly more land was exposed and accessible for Aboriginal people. From the start of the Holocene approximately 11,700 years before present, sea levels began to rise significantly, forming new coastlines. By 6,500 years before present, sea levels had risen by 120 metres (Short 2000:21). The climate continued to warm to present temperatures until approximately 1,000 years ago, from which time it stabilised to present conditions.

The climate of the New England Tableland in the present day is temperate to cool-temperate comprising warm summers with uniform rainfall. The mean annual temperature is between 9 and 17 degrees Celsius, with a mean annual rainfall between 653-1765 millimetres. This would have provided a year-round habitable environment for past Aboriginal people and the resources they relied on.

4.1.4. Historic Land Use and Disturbances

John Oxley's expedition reached the southern part of the plateau in 1818, however European movement into the New England region didn't commence in earnest until the 1830s and 1840s during the expansion of squatters west into the interior of what is now NSW. As such the main activity during the early development of the area related to farming and pastoralism. The number of sheep and cattle stations had reached 178 by 1852. Through the second half of the nineteenth century, mining of gold, diamonds, asbestos, antimony and tin commenced in other parts of the New England region, however farming remained the primary economy in Armidale and surrounds. Wheat, maize, oats and potatoes were grown in the area (RPS 2019:9-11). The proposal area is located within Duval Parish on the border with Tilbuster Parish and historical parish maps indicate that much of this land was originally granted to the Bank of New South Wales. Articles dating to 1865 (The Maitland Mercury and Hunter River General Advertiser 1865) indicate that gold had been found in Duval Creek and applications were still being made to dredge the creek for gold as late as 1938 (The Armidale Express and New England General Advertiser).

Livestock grazing and agriculture are still major economic activities for the region, with the proposal site having been extensively cleared of native vegetation in order to make way for grazing livestock and the planting of crops. Several large power easements have also been established within the proposal site which have required the removal of additional trees and installation of towers and vehicle tracks. A number of other land modifications associated with farming practices have occurred including terracing on slopes, dam construction and drainage modification.

As a result of these disturbances, the landscape has been significantly altered since European arrival and such disturbances may have resulted in the removal or disturbance of sites. As a result of vegetation clearance and broad scale pastoral activity, a chain reaction of topsoil erosion has been set in motion leading to the deflation of the soil profile in the proposal site.

4.1.5. Historic and Ethnographic Context

Historic information about the presence and lifestyle of Aboriginal people is important for identifying and mapping any potentially important places, landscapes and features which may be within the proposal site. Such information may be retrieved from relevant archival, historical and ethnohistoric sources, as well as existing heritage registers including the Aboriginal Heritage Information Management System (AHIMS), NSW State Heritage Register and the Australian Heritage Database (refer to Section 4.2 for register searches). It must be noted that many local histories and ethnographic accounts provide biased information which must be read critically (OEH 2011:6).

Cultural areas are difficult to define and "must encompass an area in which the inhabitants have cultural ties, that is, closely related ways of life as reflected in shared meanings, social practices and interactions" (Egloff *et al*. 2005:8). Depending on the culture-defining criteria chosen - i.e. which cultural traits and the temporal context (historical or contemporary) - the definition of the spatial boundary may vary. In Australia, Aboriginal "marriage networks, ceremonial interaction and language have been central to the constitution of regional cultural groupings" with the distribution of language speakers being the main determinate of groupings larger than a foraging band (Egloff *et al* 2005:8 & 16).

The current study area is generally noted as being within the traditional lands of the Anaiwan language group according to (UNE 2019) who part of the Nganyaywana language group were according to Horton (1994). Mathews, in 1898, noted that the "Anaywan" tribe was "scattered over the table-land of New South Wales, bound the Thangatty and Koombanggary people on the west (Mathews 1898)." According to the NSW Heritage Office, the New England Tablelands Bioregion encompasses the traditional lands of the following three language groups: the Anaiwan for the area around Armidale, the Kwaimbul to the north and the Banbai around the middle of the region near Ben Lomond and Mt Mitchell. Additionally, the Bunjalung people inhabited the north-eastern side. The Ngarrabul people inhabit the area around Kingplains, Wellingrove and Strathbogie stations. The Tablelands are posited to have been occupied seasonally with predominant occupation occurring in summer and autumn and communities moving towards the west river systems and coast towards the winter months. Items such as boomerangs, waddies and spears as well as stone materials and hardwood from the Tableland groups were traded amongst the Western Slopes populations. Carved trees, art sites and bora grounds are just some of the cultural sites within the region (HO and DUAP 1996).

Mathews provides further descriptions of ceremonies of the Anaywan (also Anaiwan), Thangatty (also Dhunghutti) and Koombaggary (also Gumbaynggir) including the “Burbung”, ceremony in which a number of tribes would gather for the initiation of boys into tribesman. He also describes the encampment set up by the hosting tribe which includes a meeting place for initiated men (to which women and uninitiated men may not go) and a separate space for the single women and girls (Mathews 1898). The description provided by Mathews indicates that the traditions of groups from Kempsey up to the Clarence and west to New England were interlinked with one another.

However, Mathews’ descriptions were outlining events which occurred rarely. It was the small family group that was at the core of Aboriginal society, the basis for their hunting and gathering life. The immediate family camped, sourced food, made shelter and performed daily rituals together. The archaeological manifestations of these activities are likely to be small campsites, characterised by small artefact scatters across the landscape. Places that were visited more frequently would develop into larger site complexes and are represented archaeologically through higher numbers of artefacts and possibly more diverse archaeological assemblages.

The small family units were part of a larger band which comprised a number of families. They moved within an area defined by their particular religious sites (MacDonald 1983). Such groups might come together on special occasions such as pre-ordained times for ceremonies, rituals or simply if their paths happened to cross. They may also have joined together at particular times of the year and at certain places where resources were known to be abundant. The archaeological legacy of these gatherings would be larger sites than small family camps.

The Anaiwan and Ngarrabal people are thought to have utilised the majority of the area north of the Macintyre River, making use of a broad range of natural resources. Although occupation seems to have been focused on the riverine margins, it is believed that their occupation was not restricted to these areas but traversed a variety of landform units away from the major water sources for the gathering of resources, hunting and transport. (McIntyre 1998).

The Ngarrabal continue an oral history which describes traditional seasonal movement patterns between the tablelands in the east during the summer and autumn, and the western river systems during the cooler winter months (DECC, 2008). Traditional knowledge communicated about the area focused on this use of the ridgelines as travel routes, regularly followed seasonally, through the mountains (S.Ahoy and O.Connors *pers comm*).

Prior to European settlement, the Armidale region supported open to dense woodlands, which provided habitat for a broad range of plant and animal species that formed the core of Aboriginal dietary items prior to contact with early European explorers and settlers. Groups are documented as having utilised a broad range of plant species as both food and material resources, including bracken fern, orchids, tubers and lilies, kurrajong trees and the daisy yam, to mention just a few (Morris, 1999:4-6). Major water courses such as the Duval Creek in the proposal site and other perennial creeks, were also a valuable source of plant and animal food and material resources.

With the advancement of the European colonisation into New England in the early 1800s, Armidale saw settlement from the mid-1820s, which increased significantly through the 1830s and 1840s, altering the landscape and impacting the traditionally available resources through the introduction of farming activities. Aboriginal traditional lifestyles were heavily disrupted by the spread of European settlement, with disease and violence by early settlers leading to a decline in the local population. The Myall Creek Massacre in 1836 and the Bluff Rock Massacre of 1842 were two examples of the extreme violence towards the local Aboriginal people which ran almost unchecked in the region. Some remaining families found employment on the large pastoral stations that had become established in the region (DECC. 2008). Aboriginal men also found employment within the shearing or timber industries.

Aboriginal reserves were established at Armidale, Guyra, Ashford, Ingelba and Tingha. Many families congregated at these centres and ceased traditional lifeways as a result of the pressure from the European invaders.

Previous anthropological studies were undertaken by Paton (1998, referenced in Burke et al 2000) for the preliminary assessment of the Armidale to Queensland Transmission Line project. The Armidale LALC and NSW ALC (Northern Tablelands Branch) stressed the importance of the Black Mountain (Mt Boral) ceremonial site and indicated that there were additional potential areas of sensitivity / significance associated with the ceremonial ground. The ceremonial ground was recorded by McBryde in the 1960s as a locally known traditional meeting place and Bora Ground – when recorded an extensive stone arrangement was still present *in situ* but all traces of carved trees (recorded in 1871) were gone (McBryde 1974: 41-42, in Burke et al 2000: 38). Additionally, information regarding a potential massacre which occurred on or near Burying Ground Creek was also recorded (though other sources indicate this is not the reason for the naming of the creek), however this location is not in the vicinity of the current proposal site.

A number of culturally important sites were identified in proximity to the proposal site by the RAPs during the completion of fieldwork. Information relating to these sites is provided in Sections 3 and 6.

4.2. ARCHAEOLOGICAL CONTEXT

Information from previous archaeological studies, as well as records held by heritage registers including AHIMS, the State Heritage Register and the Australian Heritage Database, can provide a context and baseline for our understanding of what is and what may be present within the proposal site (OEH 2011:6). A summary of the results of the register searches undertaken, and summaries of relevant archaeological reports, have been provided in this section.

4.2.1. Aboriginal Heritage Information Management System

AHIMS provides a database of previously recorded Aboriginal objects and sites, as well as Aboriginal Places, which is was established and is maintained by the NSW Government in accordance with Section 90Q of the NPW Act. A Basic Search of the AHIMS database provides limited information regarding the presence or absence of registered sites or Places within specified search parameters; an Extensive Search provides additional information including the site type, location and associated reports or permits for the sites registered within these parameters. However, a search of the database cannot be considered to be conclusive with regard to the presence or absence of Aboriginal objects or places, as AHIMS contains only those sites which have already been identified, and the information submitted to the Aboriginal Heritage Information Office of Heritage NSW. An AHIMS search is therefore utilised as a starting point for establishing whether any sites are known within or adjacent to a proposal site and can also provide information which assist in establishing potential site patterning based on known site types in a region.

An Extensive Search of the AHIMS database was conducted using the following parameters:

- **Zone:** MGA Zone 56
- **Eastings:** 366386 - 375450
- **Northings:** 6634815 - 6641601
- **Buffer:** 200 metres
- **Aboriginal objects and sites:** 15
- **Aboriginal Places:** 0
- **Client Service ID:** 437091

The search identified 15 registered sites within approximately five kilometres of the proposal site. Of these, none were within the proposal site boundary, but one is located less than 300 metres to the north of the northern boundary. A summary of the AHIMS results broken down by site type is provided in Table 4-2 and locations of these sites are shown in Figure 4-3.

Table 4-2 AHIMS Results by Site Type

Site Type	Quantity	Frequency
Artefact Scatter / Open Camp Site	13	86.67%
Isolated Find	1	6.67%
Aboriginal Ceremony and Dreaming	1	6.67%
TOTAL	**15**	**100%**

The dominant site types identified in the local area are constituted by artefact scatters and isolated finds. Artefact sites can occur across the landscape, however higher density scatters tend to be present in association with specific landform units such as creek lines or broad ridgelines. As the New England region contains numerous and various raw stone material resources which are available as surface outcrops or alluvial gravels, the presence of significant numbers of such sites is to be expected. Further information regarding the characteristic patterning of Aboriginal site locations is provided in Section 4.2.5.

AHIMS 21-2-0074 (S55)

This site is located approximately 250 metres north of the proposal site. The site card describes it as an artefact scatter containing four artefacts in an area measuring 20 x 8 metres. The raw materials identified included silcrete, quartz and quartzite. The site was described as having been disturbed as a result of road construction, flooding, erosion, clearing and stock grazing, and that the visibility was poor. It was recommended that the artefacts be salvaged prior to the commencement of works associated with the ‘QLD Interconnection Project’, however the site status currently remains listed as valid on the AHIMS database, suggesting either that the salvage of these sites never took place, or that an update to the site status was never submitted following completion of a salvage.

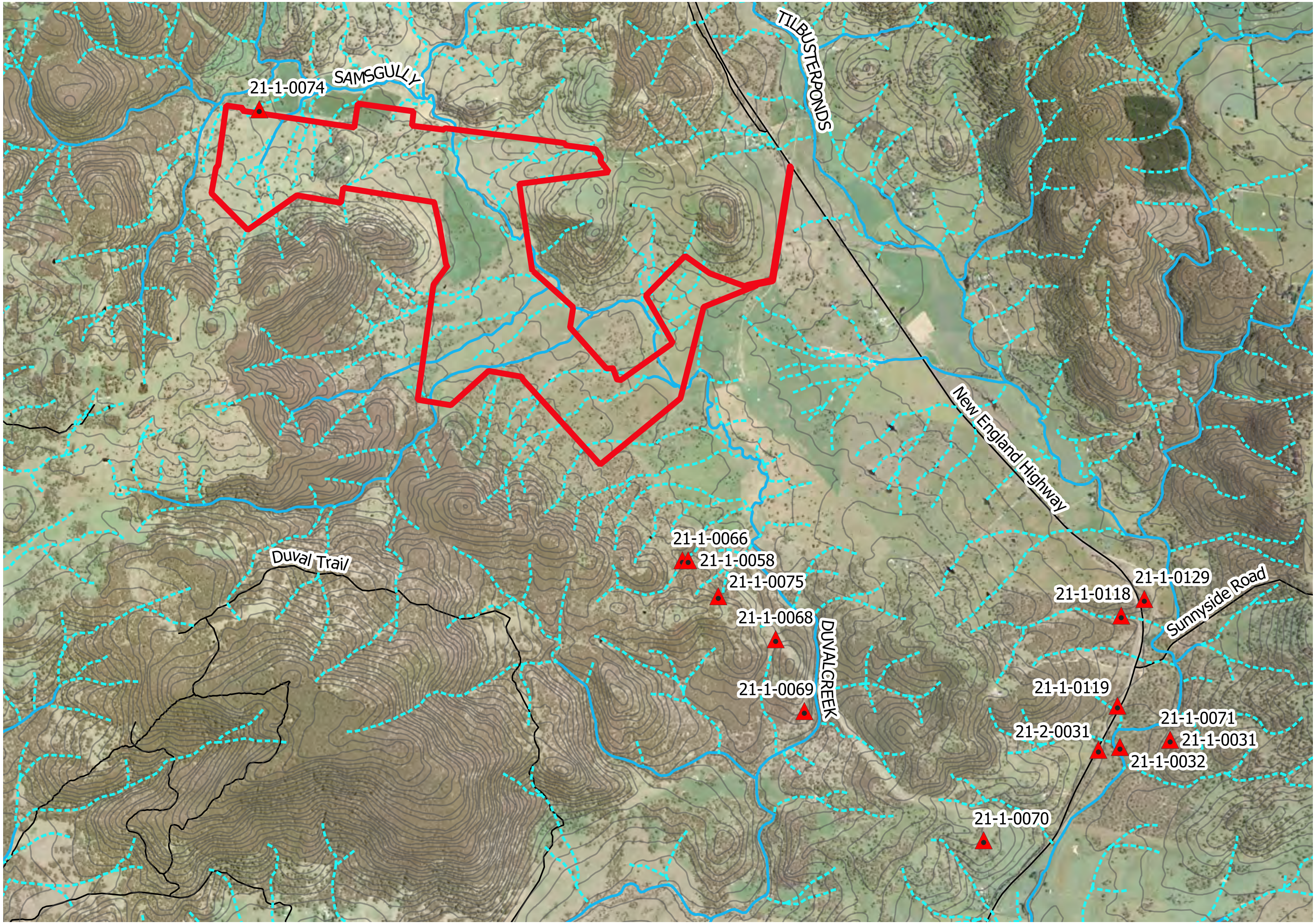


Figure 4-3: Proposal Site With AHIMS

Legend

- Proposal_Site
- AHIMS
- Roads

Strahler

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Data Attribution
© NGH 2019
© ENERPAC 2019
© DFSI 2019

Ref: 18-645 Tillbuster SF Workspace 191118
LT \ text land A4
Author: C. Jones
Date created: 17.01.2020
Datum: GDA94 / MGA zone 56

0 500 1000 1500 m

NGH

4.2.2. Other Heritage Register Searches

Searches of the State Heritage Inventory and the Australian Heritage Database were also undertaken for the proposal site.

- The NSW State Heritage Inventory (SHI) includes items of heritage value on the State Heritage Register, as well as items listed by government agencies in accordance with Section 170 of the NSW *Heritage Act 1977* and items listed by local government authorities in accordance with the EP&A Act.
- The Australian Heritage Database includes items of heritage value on the National and Commonwealth Heritage Lists.

No Aboriginal Places or sites are listed on these registers in proximity to the proposal site. There is one local heritage item listed on the Armidale-Dumaresq LEP which is technically within less than 50 metres of the proposal site, however it should be noted that the location of the actual heritage item, a house, is 2.1 kilometres from the proposal site, and it is one edge of the curtilage of the site which is across the road from the proposal site. This will therefore not be impacted by the project.

Table 4-3 LEP item located in proximity to project area

Item	Address and details	Distance from proposal site
Lydbrook, Pinch Flat	12150 New England Highway Armidale NSW 2365	Curtilage 20m east of proposal site, House approximately 2.1km north east of proposal site.

4.2.3. Previous Studies and Archaeological Models

The Tilbuster area is within a region identified as part of the Nganyaywana (Anaiwan) language group. This name defines an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1996, Tindale 1974 and Horton 1996). The borders are, however, not static but rather fluid, expanding and contracting over time with relation to the movements of smaller family or clan groups. Boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought or abundance.

As a result of the archaeological research of the wider New England Tablelands region, there are a number of theoretical stances which are important to outline—the majority of these are mainly based on the quantity of stone artefact concentrations present. This is due to their ability to survive in the record more commonly than other archaeological features or objects – stone does not break down as organics such as wood and bone do. Many research questions surrounding the analysis of stone artefacts are concerned with the interpretation of stone artefacts as representations of occupational histories in the landscape. Researchers have asked questions such as:

- How did Aboriginal people use the landscape?
- How did Aboriginal people use the resources and landscape available to them?
- What patterns of occupation can we see?
- Did Aboriginal people stay in some places longer than others?
- What is the age of the deposit and what time duration does the deposit represent?

Limited dating information regarding occupation of the New England region by Aboriginal people is available. Excavations undertaken in the Hunter Valley and Nepean region further to the south east have indicated dates at least as far back as 20,000 years and up to 40,000 years before present (Koettig 1987, McDonald 2005; Nanson et al. 1987; Stockton 1993; Stockton & Holland 1974). Dates retrieved from archaeological sites in New England are detailed in Table 4-4.

Table 4-4. Dated Sites in Greater New England Region (Source: McBryde 1977, in RPS 2010)

Site	Date	Laboratory Reference
Seelands (near Grafton)	6444 ±74 BP	V-27
Graman Shelter B1 (near Inverell)	5450 ±100 BP	Gak-806
Moore Creek (near Tamworth)	3820 ±110 BP	Gak-1631

This is consistent with the majority of dates retrieved from other sites throughout south eastern NSW, with a number of theories posited to explain this. One such theory suggests that an increase in occupation density during the last 3,000 to 5,000 years is responsible for the higher number of sites identified which date to this period, while another theory suggests that sites which were concentrated along the coast were inundated during sea level rise and therefore lost from the archaeological record (Kohen 1986; McDonald 1994; McDonald & Rich 1993).

Analysis from excavations at Bendemeer Rockshelters 1 and 2 and Graman Rockshelters by McBryde (1974; 1977, in Davies 2002), revealed occupation dates of 4,400 and 9,000 years before present respectively. The Graman rockshelters are located on the western edges of the tablelands, where the underlying geological formations comprise basalt and sandstone. Of four sites excavated, two contained evidence of backed blade industries dating to 4,960 and 5,450 years before present. Grindstones were also present, suggesting some reliance on grass seeds as part of the diet. Faunal remains, likely remains of food consumption, include brush-tailed possum, bandicoot, grey kangaroo, lizard, fish and shellfish. The upper layers of one of the shelters, GB4, contained a marked increase in the presence of bandicoot remains, coinciding with a decrease in kangaroo remains, a change which was accompanied by greater quantities of edge-ground axes.

The Bendemeer shelters, sites 1 and 2, were located west of Bendemeer, and yielded sequences of approximately 3,000 to 300 years before present, and 4,350 to 950 years before present respectively. Evidence from these sites suggests that yam was a more common food source than grass seeds, grindstones being absent. Backed blades were also common (McBryde 1976 in Davies 2002). As a result of the analysis of the excavated material, it was noted that stone tool assemblages on the Tablelands and the coast were distinct from one another after 3,000 years before present, and McBryde indicated that determining whether this difference was representative of a cultural boundary or rather indicated assemblages specialised to the environments in which they were used and the associated resources available, was an important question for New England (1974, in Davies 2002).

Later research by Hall and Lomax (1991, in Davies 2002), suggested that the separation of technologies may not have been as distinct in the north eastern parts of the tablelands.

McBryde's research also indicated that there were no recorded artefacts, stratified archaeological deposits or surface Bondaian sites above 1,000 metres above sea level. However, research by Godwin resulted in the identification of sites above 1,000 metres, citing a bias in McBryde's survey methodology (1983, in Davies). Godwin's results indicated that while there was some interaction between the people of the tablelands and the people of the western slopes, there was little evidence to suggest that the people of the tablelands interacted much with the coastal people, which had been theorised by Belshaw (1978) and Bowdler (1981) (Godwin 1993, in Davies 2002:33).

It has been noted by Appleton (1990) that a number of predictive models, specifically those of McBryde (1974;1977) and Bowdler (1981), for the New England region, formulated in the 1970s and 1980s, were based on discussions with local knowledge holders during field work, and not necessarily on the results of systematic survey. Appleton suggests that Godwin's research was the first to include intensive surveys which provided suitable data for the preparation of an accurate model for the region (Appleton 1993: 7). Godwin's observations included that many relatively dense artefact scatters are located on woodland (or formerly wooded) ridges, parallel to and at a short distance from water courses. He also observed that the two site types, near water or in woodland settings, exhibited differing characteristics, both in density of artefacts and in distinctive characteristics of lithic artefacts identified.

In the Armidale area and surrounds, Sutton (1988, in Appleton 1990) recorded a number of artefact sites at locations around the township. These sites included three surface scatters and five isolated surface artefacts; material was primarily silcrete, with porcellanite and mudstone also present at one site.

Davidson and Appleton (1990) recorded a number of artefact locations along Cluny Road to the north of Armidale. These were also surface sites dominated by artefacts manufactured from silcrete materials. A silcrete quarry was identified by Piper (nd, in Appleton 1990), containing upwards of 100 artefacts per square metre. Appleton and Davidson also identified a chert / silcrete quarry and sandstone boulder with grinding grooves was recorded to the northeast of Armidale Airport. Appleton states that with the exception of the two quarries, and two other sites, the artefacts were all recorded on erosion features in a secondary context (Appleton 1990:11).

Tilbuster and Black Mountain

Extensive surveys undertaken as part of the Transgrid Queensland Connection project included portions of the current proposal site. The assessment identified a number of previously identified sites within the transmission line study area including cultural sites. Several sites labelled “Aboriginal Special Place” were mapped to the north west of the proposal site, less than one kilometre from the northern boundary of the current proposal site. This map is provided below (Figure 4-4). It also notes that previous studies have identified that silcrete is an extremely important raw material for the manufacture of stone implements within the region, and that site types range from artefact sites (including isolated finds) to bora grounds/ceremonial sites, scarred trees and stone quarries. In general artefact sites identified have been primarily “non-stratified isolated stone artefacts and low-density artefact scatters” (2000:27).

Stone quarries have been identified to the south of the proposal site within Armidale, which contained densities to 100 artefacts per 100m^2. Artefact types identified at one of these quarries included flakes, retouched flakes, flaked pieces, cores, an axe, two broken axes and three grindstones manufactured from fine and coarse-grained siliceous raw material.

Prior to the completion of the transmission line, detailed archaeological survey by Burke et al (2000) and Paton (1998, referenced in Burke et al 2000) undertook a sample survey of the local area as part of the preliminary archaeological assessment for the whole transmission line from Armidale to the Queensland border. He divided his study area into four separate environmental zones of which the Armidale region was categorised as Zone 1, described as undulating hills drained by small ephemeral creeks which flow into larger watercourses, and stated that this zone was unlikely to have been an area favoured for camping due to “it’s high elevation and cold climate and comparative lack of water” (Paton 1998:63 in Burke et al). Burke et al (2000:36) note that this interpretation was likely to have been based on the studies undertaken by McBryde and Bowdler, which suggested that the Tablelands were abandoned during the colder months, however more recent work has revised this model. High concentrations of sites in the region indicate that occupation was year-round.

The assessment predicted that stone artefact scatters were the most likely site type to be present within the transmission line study area, followed by: Aboriginal special places and other significant sites; scarred trees; quarries; stone arrangements; carved trees; burials; rock art sites (Burke et al 2000:40).

During the archaeological survey completed by Burke et al (2000), it was noted that sedimentation was generally very stable though some exposures as a result of erosion were observed within the alignment. Exposures made up less than 5% of each survey unit, primarily caused by stock and ant activity, gully bank erosion and through the building dams and contour banks. Between the New England Highway and the Main Northern Railway (including parts of the current proposal site), these were in addition to the bulldozing undertaken to create the access road for the existing powerline. The report notes that the ground surface visibility was limited but that the survey was undertaken comprehensively (Burke et al 2000:48).

In total, 33 sites and 11 isolated finds were identified in the transmission line study area, totalling 293 stone artefacts. Of these, one artefact scatter was located within less than 200 metres of the current proposal site (recorded as S55 and later registered on AHIMS as 21-1-0074), and one isolated artefact identified within the proposal site, recorded as IF11 but never recorded on AHIMS. The location of IF11 is shown on Figure 4-5 below, taken directly from Burke et al (2000). This isolated artefact likely formed part of the assemblage identified during the completion of the archaeological survey for the current study. S55 was described as a scatter of four artefacts including silcrete, quartz and quartzite raw materials, with a density of approximately two artefacts per metre, located on a creek flat. The isolated find IF11 was described as a broken silcrete flake knapped from a rotated core, probably a blade core, on a lower-mid slope on the southern bank of a tributary. Both sites were assessed to be in poor condition.

Overall silcrete was the dominant raw material, which is in keeping with other studies in the area. It was noted that, although Appleton had previously predicted that sites closer to Armidale would contain more silcrete of a grey type with blue and white inclusions, and sites closer to Hillgrove (east of Armidale) would contain more fine-grained cream silcrete artefacts, however this was not the case. Sites in the transmission line proposal site (closer to Armidale) were found to contain an assortment of silcrete types but did not include the grey silcrete predicted, with the exception of IF8. Silcrete raw material resources identified were limited to one type near Puddledock Road from which only one artefact identified was manufactured. Other common raw material types present in the overall assemblage were quartz, chert, metabasalt and quartzite.

The analysis concluded that all the raw materials were being used in the sites in a conservative manner, suggesting that sources may have been some distance from the study area. The presence of artefacts which did not appear in the Australian archaeological record until approximately 5000 years before present (such as backed blades, Bondi points and eloueras) suggesting that these sites were deposited at or after this time period. Comparison of the artefact assemblages detailed in previous studies suggest that those located by Burke et al (2000) are typical of assemblages in the area. The authors concluded that it was unlikely that the artefacts they recorded represented the true extent of each site, but rather what was visible within the extent of the transmission line study area at the time of survey. Therefore, they assessed that, where visibility was improved, in many instances the sites would likely be found to contain higher densities of artefacts. Specific reference was made to the likelihood that IF11 and a number of other isolated finds recorded may be associated with larger numbers of obscured artefacts.

A summary of the overall analysis by Burke et al (2000:140) concluded that:

- The variation in artefact numbers and site extent at each location is likely to have been resultant of the ground surface visibility at the time of survey and may not be reflective of a preference by Aboriginal people for selection of camping location;
- Silcrete was the preferred raw material for the manufacture of stone implements across the study area, which may be due to the lack of abundance of other raw materials, but it is noted that the silcrete identified at all sites was always of high quality for knapping;
- The silcrete source/s are likely to be located to the south [*sic*] of the New England Highway, possibly within the area between Rockvale Road and Puddledock Road;
- Quartz sources are likely located in association with the Tilbuster Granodiorite;
- The metabasalt source/s are most likely located south of the New England Highway within one kilometre of Rockvale Road;
- Chert source/s are most likely to be found south of the New England Highway and close to the Rockvale Road area; and
- Quartzite source/s are most likely found south of the New England Highway and closest to Rockvale Road.

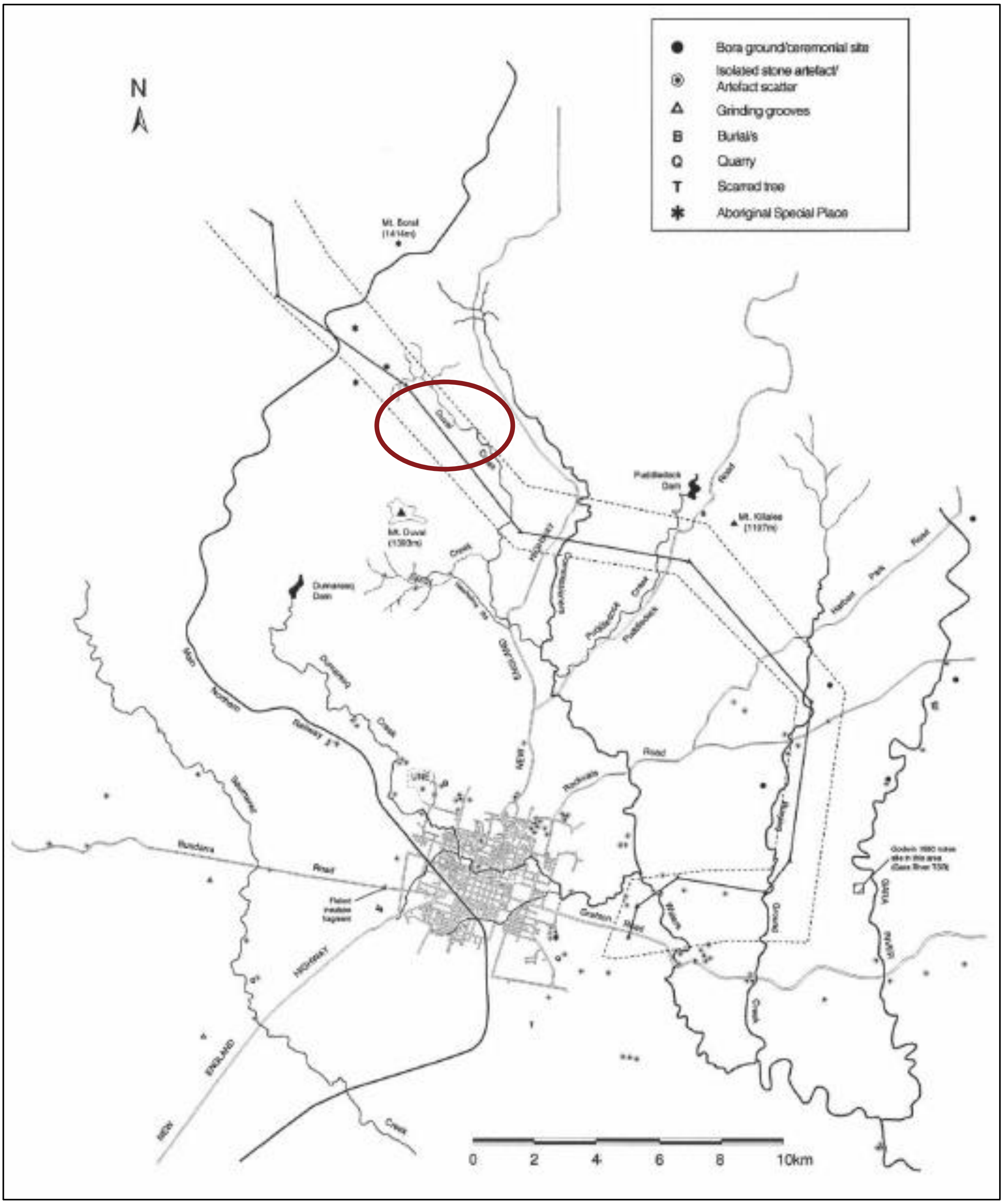


Figure 4-4 Previously recorded sites identified by Burke et al (2000:28). Proposal site circled in red.

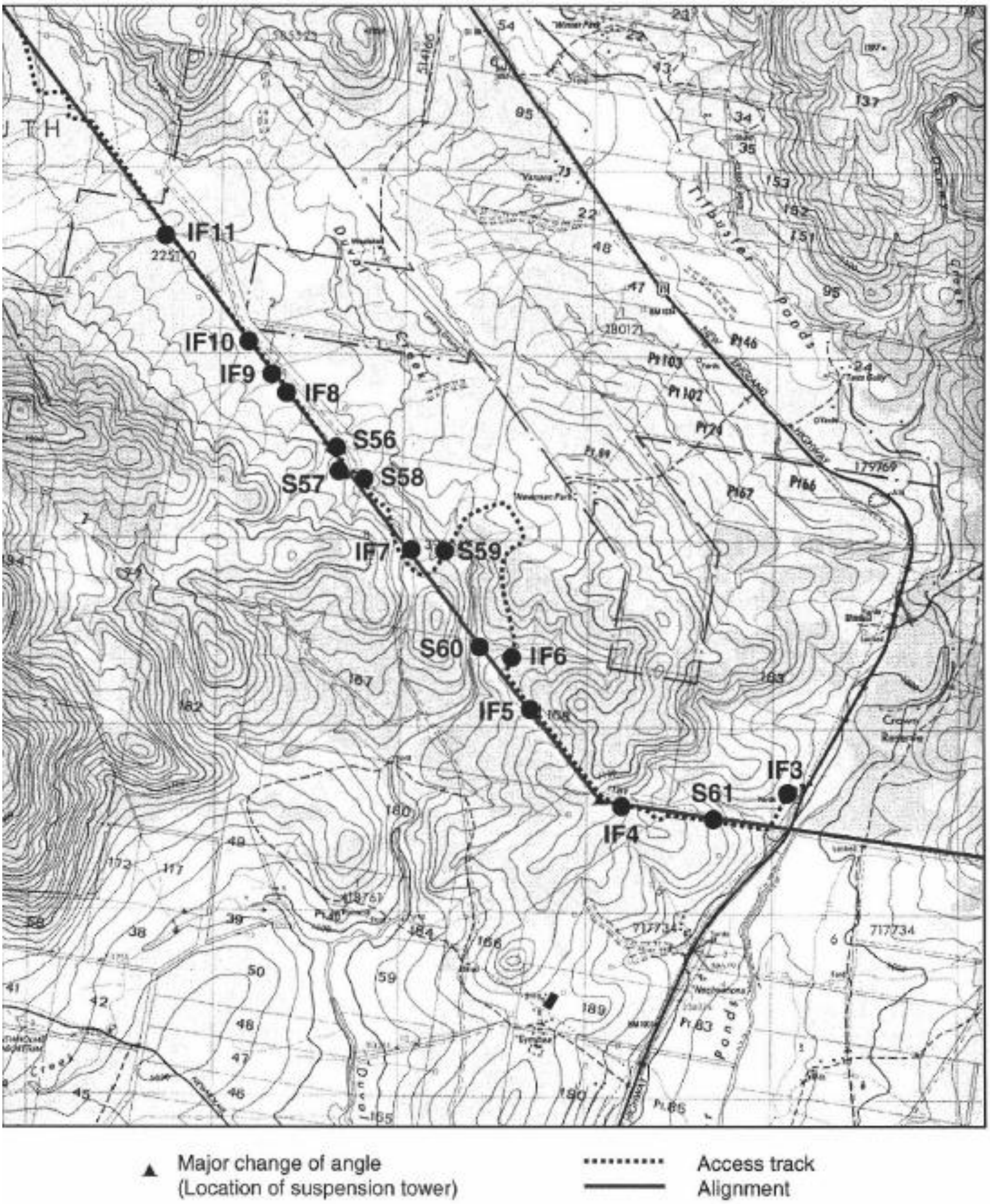


Figure 4-5 Location of IF11 and other sites identified by Burke et al (2000:55,Figure 7.1).

Umwelt (Australia) Pty Ltd completed a study of a number of circular features that had been identified within the Northern Tablelands to assess whether they were cultural or natural in origin. Umwelt concluded that the features in the New England area were natural and not associated with traditional activities undertaken by past Aboriginal people (Umwelt 2000).

Davies (2002) was engaged to complete an assessment at Tilbuster in 2002, and a review of previous literature for the local and regional area indicated that the area had low to moderate archaeological potential. The study area was located approximately five kilometres to the south of the current proposal site, near Newholme Road. Davies' survey identified no Aboriginal objects or sites within the 5.15ha proposal site, however the report indicated that there was a potential archaeological deposit on the southern bank of Duval Creek to the east of the road reserve within the proposal site. It was therefore recommended that a preliminary research permit be obtained to undertake test excavation at the site prior to works.

4.2.4. Summary of Aboriginal Land Use

The results of previous archaeological surveys in close proximity to the proposal area show that there are sites and artefacts present throughout the landscape. There is a notable dominance of artefacts either as isolated finds or artefact scatters. There appears to be a pattern of site location that relates to the presence of potential resources for Aboriginal use, in particular the local area contains a wide variety of suitable raw stone materials of the manufacture and maintenance of stone tools. This is in contrast to the findings of Burke et al (2000), however it is noted that as a result of the linear nature of that survey, opportunities to understand the availability of resources in the local area were limited. The current study identified outcrops of raw stone materials which may have been suitable for knapping, including pink silcrete, white quartz and jasper. Furthermore, the creek bed of Duval Creek contains cobbles and pebbles of a variety of stone types, some of which would likely be suitable for the manufacture of stone tools. The Aboriginal site modelling for the region to date suggests that while Aboriginal sites may be expected throughout all landscapes the most archaeologically sensitive areas occur in proximity to water courses on the wooded (or formerly wooded) ridges which provide elevated locations suitable for camping.

The Aboriginal land use of the area has been subject to a large number of studies, undertaken both as a result of development projects as well as academic or community research. However, much of this work is still ongoing and currently inaccessible. It is possible however, to ascertain that proximity to raw materials and resources was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the archaeological record of that activity is currently limited.

4.2.5. Archaeological Site Location Model

A detailed understanding of Aboriginal land use of the proposal site is lacking, as few in depth studies completed in the local area are accessible. Furthermore, with specific reference to the Burke et al (2000) study, the sites previously recorded did not describe the full extent of these sites, due to the linear study area which limited the opportunity to gather data by targeting landform units. In general, previous studies have indicated that areas of deflation or erosion have allowed the identification of sites and are these impacts are therefore the reason that higher numbers of sites are identified in an area, as opposed to being a reflection of preference by Aboriginal people. While the Tilbuster proposal site has also been subject to extensive deflation of the soil profiles, the extent of the survey area allowed a more adequate set of data to be obtained, which accommodated characterisation of the archaeological landscape. Disturbances in the proposal site are extensive enough to reduce the scientific significance of the sites, however the presence of high numbers of displaced artefacts in a localised area cannot be mistaken as anything other than evidence of focussed occupation of this area.

It is possible, however, to ascertain that proximity to water sources and raw materials was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the current archaeological record of that activity is limited.

Solar farm developments are proceeding throughout the south eastern Australian landscape. The majority of these projects are based in landscapes similar in topography to the current proposal site. These landscapes also mainly consist of grids of panels located on broad, level paddocks, set away from the riparian zone, though they are still within less than 200 metres of water courses.

Per the results of Godwin's studies, it is noted that proximity to water is one of the defining factors for the presence of sites containing higher densities of artefacts (Godwin, in Appleton 1990). Results from the work of Appleton and predecessors including McBryde (1977) indicate that the most common site type in the region is surface artefact sites, with closed sites such as shelters occurring only on the scarps and slopes of the upper slopes areas.

Appleton (2000:30, as cited in Davies 2002) notes, for the New England region, that the majority of sites are stone artefact sites including scatters and isolated finds, located in the following contexts:

- In proximity to geological outcrops or deposits of suitable raw material resources such as quartz, quartzite, jasper, silcrete, chert, chalcedony, metamorphosed greywacke and other siliceous sedimentary rocks, or redeposited fine grained volcanics;
- Adjacent to watercourses including rivers, creeks or gullies, especially junctions of watercourses, which contain raw materials as listed above; or
- On ridges and spurs, or other locations with views over watercourses, waterholes or swamps, or over access routes of the area such as saddles.

Based on this information, it is assessed that the Tilbuster Solar Farm proposal area has moderate to high potential to contain Aboriginal objects, particularly in association with the raised spurs and low ridges adjacent to Duval Creek. This section of Duval Creek is in proximity to a number of outcrops of notable raw stone materials including quartz, silcrete and jasper. The creek itself also contains a gravel bed likely to include suitable stone materials.

Based on the results of these previous archaeological investigations in the local area, it is possible to provide the following model of site location in relation to the proposed Tilbuster Solar Farm proposal site.

Stone artefact scatters – representing camp sites these sites can occur across the landscape, usually in association with some form of resource or landscape unit such as broad ridgelines which were used for travel through the mountainous landscape. Creek lines and small water holding bodies can also be a focus of Aboriginal occupation. Boundaries between changes in vegetation can also be a focus for occupation. Within the solar farm proposal site, gently sloping simple slopes and low ridgelines, with small creek line crossings are present. As such, there is moderate to high potential for this site type to be present.

Burials – are generally found in sandy contexts or in association with rivers and major creeks. No such features exist with the solar farm proposal site and therefore such sites are unlikely to occur.

Scarred Trees – these require the presence of mature trees and are likely to be concentrated along major ridgelines, flat level open areas in the landscape or in association with water courses. Much of the proposal site has been cleared for use as agricultural land, however there are some wooded areas still extant. If mature trees exist in the area, there is moderate potential for scarred trees to occur in the study area.

Stone resources – are areas where people used natural stone outcrops as a source material for flaking. This requires geologically suitable material outcropping so as to be accessible. The solar farm proposal site may contain some natural outcropping stone including silcrete. There is therefore moderate potential for this site type to occur.

Isolated Artefacts – are present across the entire landscape, in varying densities. As Aboriginal people traversed the entire landscape for thousands of years, such finds can occur anywhere and indicate the presence of isolated activity, dropped or discarded artefacts from hunting or gathering expeditions or the ephemeral presence of short-term camps. Discarded single artefacts are most likely to be present in the vicinity of creeks.

In summary, the presence of low gently clopping simple slopes, and Duval Creek and its tributaries, may have made the area attractive to past Aboriginal people for camping or resource procurement. This suggests that there is a moderate to high probability for site types such as artefact scatters or isolated finds to be present.

Repeated use of these areas would increase the probability of leaving archaeological traces and increasing the significance of the site location. Nonetheless, given that Aboriginal people have lived in the region for tens of thousands of years, there is some potential for archaeological evidence to occur in all areas. This low density, dispersed material away from loci is most likely to be in the form of isolated stone artefacts or scarred trees.

4.2.6. Comment on Existing Information

The AHIMS database is a record of those places that have been identified and had site cards submitted to the Aboriginal Heritage Information Management office of the Department of Premier and Cabinet (formerly part of OEH within Department of Planning and Infrastructure). It is not a comprehensive list of all places in NSW as site identification relies on an area being surveyed and on the submission of site forms to AHIMS. There are likely to be many areas within NSW that have yet to be surveyed and therefore have no sites recorded. However, this does not mean that sites are not present.

Within the general vicinity of the current proposal area there has been at least one archaeological assessment which included the proposal site, and multiple studies undertaken in the region around Armidale. The information relating to site patterns, their age and geomorphic context is relatively well understood. The AHIMS survey results are therefore considered to be moderately accurate for the present investigation, as there are a number of sites recorded near the proposal site. However, it is considered likely that there are sites present within the proposal site which are as yet unrecorded. Past land use activity has greatly disturbed the archaeological record and there are unlikely to be many places that retain *in situ* archaeological material.

With regard to the limitations of the information available, archaeologists rely on Aboriginal parties to impart information about places with cultural or spiritual significance in situations where non archaeological sites may be threatened by development. NGH has been advised that there are a number of significant cultural sites in proximity to the proposal site, but none known within the boundaries of the proposal site. Further information on the cultural sites in the area is provided in Section 6.

5. ARCHAEOLOGICAL INVESTIGATION RESULTS

5.1. SURVEY

5.1.1. Survey Strategy

The pedestrian survey strategy was to cover as much of the ground surface as possible within the proposal area. The survey conducted for the purposes of this assessment was undertaken on the 24th and 25th of September and continued on the 11th of November through to the 15th of November 2019. The survey team comprised two NGH archaeologists, one representative from Nunnawunna Aboriginal Corporation, one representative from Iwatta Aboriginal Corporation and one representative from Nyakka Aboriginal Cultural Heritage Corporation Archaeological and Cultural Heritage Consultants. The survey followed a systematic approach walking transects in straight lines where possible within areas identified to have at least 80% visibility owing to severe drought, at a spacing between 20 and 30 metres. The shape of the proposal site and terrain resulted in transects of unusual shape as needed in order to achieve adequate coverage.

Owing to the high levels of visibility and sparse grass cover, broader transects and more coverage of the proposal area was achievable. Any mature trees within the proposal area were also inspected for any evidence of Aboriginal scarring (c.f. Long 2005). Notes were made about visibility, photos taken, and any possible Aboriginal objects or features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

5.1.2. Survey Coverage

Transects were completed across the entire proposal site, with transect widths, lengths and axis. On average visibility within the areas surveyed was very high and averaged more than 80%. Soils within the proposal site consisted of a grey-brown silty sand which overlies a sandy clay, atop compact clay. Table 5-1 below show the calculations of effective survey coverage for the ACHA field assessments, including their results combined. Plates 1-6 show examples of the transected landforms and visibility for the proposal site. Between the five survey participants present per day over the course of the field survey, approximately 20,270 metres (20.27 kilometres) of transects were walked across the proposal area. Allowing for an effective view width of approximately five (5) metres per person, with 5 people present, this equates to a total surface area examined of 496,750 square metres or approximately 49.68 hectares. However, allowing for the visibility restrictions, the effective survey coverage overall is calculated to have been 39.74 hectares or 12.82% of the total proposal area.

Overall, it is considered that the archaeological survey programme achieved sufficient and effective coverage. The subsurface testing program also facilitated identification of further archaeological material at one location within the proposal site which contained a high density of surface artefacts and was assessed to contain A horizon soils. Much of the remainder of the proposal site contained only surface artefacts redeposited atop heavily eroded B horizon clays. The archaeological potential of the proposal area was assessed during the survey and then test pits were excavated at the location/s identified to have some archaeological potential. This was considered the most effective method for identifying sites in the landscape. The sites identified are therefore considered to be a true reflection of the nature of the Aboriginal archaeological record present within the proposal area. This is further supported by previous archaeological assessments conducted in the wider Armidale region.

Plate 5-1 Spacing between survey transects

Plate 5-2 Drainage gully

Plate 5-3 Lowest visibility example around fence line and cluster of trees. Still approximately 80%.

Plate 5-4 Cleared paddock, excellent visibility, only occasional tufts of grass due to extreme drought.

Plate 5-5 High visibility within cleared paddock, with grey- brown silty clay subsoils exposed on surface

Plate 5-6 Good visibility with scattered trees surrounding transmission line

Table 5-1. Effective Survey Coverage Table

Survey unit/ Landscape unit/Topography	Number of Survey Transects	Exposure type	Survey Unit Area (ha)	Surveyed area (length m x width covered per transect m)	Surveyed Area m^2	Archaeological Visibility	Effective coverage (area x visibility) m^2	Effective coverage (ha)	Percentage of survey unit effectively surveyed	Survey Result
Lower slopes	25	Bare ground, soil mounds, vehicle tracks, ground disturbance areas	251	400m x 25; 630m x 25; 550m x 25; 400m x 25; 750m x 25; 750m x 25; 775m x 25; 500m x 20; 500m x 20; 500m x 20; 500m x 20; 350m x 25; 700m x 25; 650m x 25; 300m x 25; 400m x 25; 300m x 25; 700m x 25; 430m x 25; 285m x 25; 650m x 25; 500m x 25; 600m x 25; 800m x 25; 650m x 25	329,250	80% average	263,400	26.34	10.49%	39 isolated finds 26 artefact scatters 4 scarred trees 1 cultural tree
Low-lying swamp	4	Bare ground, soil mounds, vehicle tracks, ground disturbance areas	44	1200m x 25; 1200m x 25; 1200m x 25; 1200m x 25	120,000	80% average	96,000	9.6	21.82%	6 isolated finds 2 artefact scatters 1 scarred tree 2 cultural trees
Upper slopes	2	Bare ground, soil mounds, vehicle tracks, ground disturbance areas	15	950m x 25; 950m x 25	47,500	80% average	38,000	3.8	25.33%	4 isolated finds 1 scarred tree
TOTAL	**31**	**-**	**310**	**-**	**496,750**	**80% average**	**397,400**	**39.74**	**12.82%**	**84 sites**

5.1.3. Survey results

Over the course of the two survey periods, 49 isolated finds, 28 artefact scatters, six scarred trees and three cultural trees were identified and recorded. It should be noted that a small number of sites were identified and recorded outside the boundary of the proposal site where landforms containing artefacts were continuous and during attempts to access certain portions of the proposal site. These have been incorporated into the results as part of the survey unit to which they lay closest. In general, the majority of the proposal site comprised very shallow redeposited A horizon silty topsoils laying over very compacted B horizon silty clay. It must also be noted that data processing has resulted in site names that do not match with the actual quantity of that site type, for example IF53 refers to the 49th isolated find site.

Significant erosion has occurred due to the presence of large quantities of sheep on the property, in combination with the extreme drought conditions which have resulted in the near-complete absence of ground covering vegetation. This assisted in the identification of surface artefacts, however in most locations it was clear that no subsurface deposits would be present within the heavily disturbed sheep paddocks.

While Duval Creek is a major stream in the local area, at present it is dry, with the exception of very small areas of moist soil within the gully. Additionally, tributaries of Duval Creek, a number of which are deeply incised and likely to contain water regularly outside of drought periods, were all dry. Numerous dead animals were observed adjacent to these streams and in the creek beds, likely having arrived there in search of water. This indicates that when healthy, Duval Creek and its tributaries forms an important source of potable water and attracts flora and fauna which would have been important resources for Aboriginal people during the last 5,000 during mid-late Holocene climatic conditions.

Trees present in the proposal site were surveyed to identify any potential cultural scarring.

The details of the sites are outlined below. Their locations are shown in Figure 5-1 and Figure 5-4.

Isolated Finds

Tilbuster Solar Farm IF1 *AHIMS #21-1-0280*

This site consisted of a single artefact on an alluvial plain in a predominantly cleared paddock. The artefact was a quartzite flake located approximately 24 metres north of an unnamed tributary of Duval Creek and immediately west of the existing transmission line. The soils consisted of a redeposited A horizon grey-brown sandy silt atop visible eroded B horizon silt clay. Visibility within the area was 80%.

Plate 5-7 Close up of greywacke flake, part of Tilbuster Solar Farm IF1.

Plate 5-8 Close up of greywacke flake, part of Tilbuster Solar Farm IF1.

Tilbuster Solar Farm IF2 AHIMS #21-1-0325

This site consisted of a single artefact in a predominantly cleared paddock on an upper slope. The artefact was a volcanic core with only one flake scar. It was located approximately 30 metres south of an unnamed tributary of Duval Creek which has been utilised to create a small farm dam. Vehicle tracks and movement has disturbed the area close to the artefact location. The soil consisted of a grey-brown sandy loam A horizon deposit atop visible B horizon clay. Visibility within the area was 70%.

Plate 5-9 Close up of volcanic core, Tilbuster Solar Farm IF2.

Plate 5-10 Close up of volcanic core, Tilbuster Solar Farm IF2.

Tilbuster Solar Farm IF3 AHIMS #21-1-0279

This site consisted of a single artefact broken in two, beneath the existing transmission line within a previously cropped field. The artefact was a greywacke flaked piece located approximately 98 metres north of an unnamed tributary of Duval Creek. The soils consisted of a grey-brown sandy loam A horizon deposit with B horizon clay visible through the shallow topsoils. Visibility within the area was 70%.

Plate 5-11 Greywacke flaked piece, Tilbuster Solar Farm IF3.

Plate 5-12 General location of greywacke flaked piece, Tilbuster Solar Farm IF3.

Tilbuster Solar Farm IF4 *AHIMS #21-1-0324*

This site consisted of a single artefact with a predominantly cleared paddock that has previously been used for cropping. The artefact was a silcrete scraper located approximately 47 metres west of an unnamed tributary of Duval Creek and less than 100 metres west of Duval Creek itself. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-13 Close up of silcrete scraper, Tilbuster Solar Farm IF4.

Plate 5-14 Close up of silcrete scraper Tilbuster Solar Farm IF4.

Tilbuster Solar Farm IF7 *AHIMS #21-1-0273*

This site consisted of a single artefact within a small cluster of trees. The artefact was a silcrete flake located between two unnamed tributaries of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-15 Close up of silcrete flake, Tilbuster Solar Farm IF7.

Plate 5-16 Close up of silcrete flake, Tilbuster Solar Farm IF7.

Tilbuster Solar Farm IF8 *AHIMS #21-1-0274*

This site consisted of a single artefact adjacent to a small cluster of trees which had not been previously cleared. The artefact was a basalt distal fragment located approximately 17 metres south of an unnamed tributary of Duval Creek and 155 metres north of a third order tributary. The soils consisted of a shallow yellow-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-17 Close up of basalt distal fragment, Tilbuster Solar Farm IF8.	 Plate 5-18 Close up of basalt fragment, Tilbuster Solar Farm IF8.

Tilbuster Solar Farm IF9 *AHIMS #21-1-0275*

This site consisted of a single silcrete flake located at the confluence of a first order and third order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-19 Close up of silcrete flake, Tilbuster Solar Farm IF9.	 Plate 5-20 Close up of silcrete flake, Tilbuster Solar Farm IF9.

Tilbuster Solar Farm IF10 *AHIMS #21-1-0276*

This site consisted of a single artefact on within a predominantly cleared paddock. The artefact was a basalt broken flake located approximately 225 metres east of an unnamed first order drainage line associated with Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-21 Close up of basalt broken flake, Tilbuster Solar Farm IF10.	 Plate 5-22 General location of basalt broken flake Tilbuster Solar Farm IF10.

Tilbuster Solar Farm IF11 *AHIMS #21-1-0277*

This site consisted of a single artefact within a cluster of trees south of a third order unnamed tributary of Duval Creek. The artefact was a silcrete flake located approximately 54 metres south of the stream. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-23 Close up of silcrete flake, Tilbuster Solar Farm IF11.	 Plate 5-24 Close up of silcrete, Tilbuster Solar Farm IF11.

Tilbuster Solar Farm IF12 *AHIMS #21-1-0326*

This site consisted of a single artefact adjacent to a sparse collection of trees. The artefact was a chert proximal fragment located approximately 18 metres south of an unnamed drainage line and 154 metres north of an unnamed first order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-25 Close up of chert proximal fragment, Tilbuster Solar Farm IF12.

Plate 5-26 Close up of chert proximal fragment, Tilbuster Solar Farm IF12.

Tilbuster Solar Farm IF13 *AHIMS #21-1-0278*

This site consisted of a single artefact adjacent to a tree. The artefact was a volcanic distal fragment located approximately 39 metres north of an unnamed first order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-27 Close up of volcanic distal fragment, Tilbuster Solar Farm IF13.

Plate 5-28 Close up of volcanic distal fragment, Tilbuster Solar Farm IF13.

Tilbuster Solar Farm IF14 *AHIMS #21-1-0321*

This site consisted of a single artefact adjacent to a cluster of trees. The artefact was a cream chert flake located along an unnamed third order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-29 Close up of chert flake, Tilbuster Solar Farm IF14.

Plate 5-30 Close up of chert flake, Tilbuster Solar Farm IF14.

Tilbuster Solar Farm IF15   *AHIMS #21-1-0322*

This site consisted of a single unifacial silcrete flake core located approximately 10 metres south of a third order tributary of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-31 Close up of unifacial silcrete flake core, Tilbuster Solar Farm IF15.

Plate 5-32 Close up of unifacial silcrete flake core, Tilbuster Solar Farm IF15.

Tilbuster Solar Farm IF16   *AHIMS #21-1-0323*

This site consisted of a single artefact along the existing transmission line easement adjacent to a small cluster of trees. The artefact was a quartz flake located approximately 145 metres south of a third order tributary and 60 metres north of a first order tributary of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-33 Close up of quartz flake, Tilbuster Solar Farm IF16.

Plate 5-34 Close up of quartz flake, Tilbuster Solar Farm IF16.

Tilbuster Solar Farm IF18 *AHIMS #21-1-0281*

This site consisted of a single artefact west of the existing transmission line. The artefact was a greywacke flake located near the confluence of a first order and third order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-35 Close up of greywacke flake, part of Tilbuster Solar Farm IF18.

Plate 5-36 Close up of greywacke flake, part of Tilbuster Solar Farm IF18.

Tilbuster Solar Farm IF19 *AHIMS #21-1-00282*

This site consisted of a single greywacke flake located at the confluence of a first order and third order tributary of Duval Creek, west of the transmission line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-37 Close up of greywacke flake, Tilbuster Solar Farm IF19.

Plate 5-38 Close up of greywacke flake, Tilbuster Solar Farm IF19.

Tilbuster Solar Farm IF21 AHIMS #21-1-0283

This site consisted of a single artefact within a large cluster of trees. The artefact was a quartz flake located approximately 30 metres east of an unnamed drainage line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-39 Close up of quartz flake, part of Tilbuster Solar Farm IF21.

Plate 5-40 Close up of quartz flake, part of Tilbuster Solar Farm IF21.

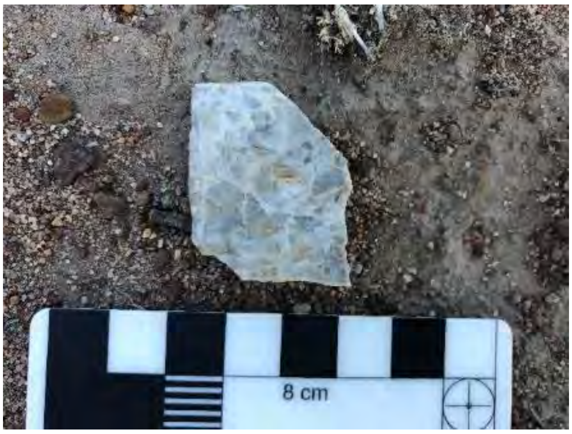
Tilbuster Solar Farm IF22 AHIMS #21-1-0284

This site consisted of a single artefact along the lower slope of a hill. The artefact was a silcrete distal fragment located approximately 108 metres east of an unnamed third order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

<table>
<tr><td>
Plate 5-41 Close up of silcrete distal fragment, Tilbuster Solar Farm IF22.</td><td>
Plate 5-42 Close up of silcrete distal fragment, Tilbuster Solar Farm IF22.</td></tr>
</table>

Tilbuster Solar Farm IF23 *AHIMS #21-1-0285*

This site consisted of a single artefact 30 metres east of the existing transmission line within a previously cropped field. The artefact was a chert proximal fragment located approximately 96 metres north west of an unnamed second order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

<table>
<tr><td>
Plate 5-43 Close up of chert proximal fragment, Tilbuster Solar Farm IF23.</td><td>
Plate 5-44 Close up of chert proximal fragment, Tilbuster Solar Farm IF23.</td></tr>
</table>

Tilbuster Solar Farm IF24 *AHIMS #21-1-0286*

This site consisted of a single artefact within a previously cropped paddock. The artefact was a silcrete flake located approximately 30 metres south west of an unnamed drainage line and approximately 60 metres from Duval Creek itself. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-45 Close up of tertiary silcrete flake, Tilbuster Solar Farm IF24.

Plate 5-46 Close up of tertiary silcrete flake, Tilbuster Solar Farm IF24.

Tilbuster Solar Farm IF25 *AHIMS #21-1-0287*

This site consisted of a single artefact within a previously cropped paddock. The artefact was a chert split located approximately 158 metres west of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 90%.

Plate 5-47 Close up of chert split flake, Tilbuster Solar Farm IF25.

Plate 5-48 Location of Tilbuster Solar Farm IF25.

Tilbuster Solar Farm IF26 *AHIMS #21-1-0288*

This site consisted of a single artefact 80 metres south of a vehicle track with a predominantly cleared paddock. The artefact was a silcrete distal fragment located approximately 102 metres south east of an unnamed first order tributary of Duval Creek, and less than 200 metres east of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-49 Close up of silcrete distal fragment Tilbuster Solar Farm IF26.


Plate 5-50 Location of Tilbuster Solar Farm IF26.

Tilbuster Solar Farm IF27 *AHIMS #21-1-0289*

This site consisted of a single artefact within a small cluster of trees. The artefact was a cream silcrete core of a highly siliceous silcrete (“cherty” in appearance) located approximately 56 metres south of an unnamed drainage line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-51 Close up of silcrete core, Tilbuster Solar Farm IF27.

Plate 5-52 Close up of silcrete core, Tilbuster Solar Farm IF27.

Tilbuster Solar Farm IF28 *AHIMS #21-1-0290*

This site consisted of a single artefact on the base of a slope. The artefact was a silcrete flake with 20% cortex present indicating secondary production phase, located approximately 28 metres south east of an unnamed drainage line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-53 Close up of silcrete flake, Tilbuster Solar Farm IF28.

Plate 5-54 Close up of silcrete flake, Tilbuster Solar Farm IF28.

Tilbuster Solar Farm IF29 *AHIMS #21-1-0291*

This site consisted of a single artefact along the base of a slope. The artefact was a silcrete flake located approximately 66 metres south of an unnamed drainage line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-55 Close up of silcrete flake, Tilbuster Solar Farm IF29.

Plate 5-56 Close up of silcrete flake, Tilbuster Solar Farm IF29.

Tilbuster Solar Farm IF30 *AHIMS #21-1-0292*

This site consisted of a single artefact along an existing transmission line easement. The artefact was a silcrete flake located approximately 57 metres east of an unnamed drainage line; the left and right lateral margins exhibited some evidence of retouch. The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-57 Close up of silcrete flake, Tilbuster Solar Farm IF30.

Plate 5-58 Close up of silcrete flake, Tilbuster Solar Farm IF30.

Tilbuster Solar Farm IF31 AHIMS #21-1-0293

This site consisted of a single artefact adjacent to a small cluster of trees a west of the existing transmission line easement. The artefact was a silcrete core located approximately 102 metres south of an unnamed drainage line associated with a major tributary of Duval Creek known as Sams Gully. The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-59 Close up of silcrete flake core, Tilbuster Solar Farm IF31.

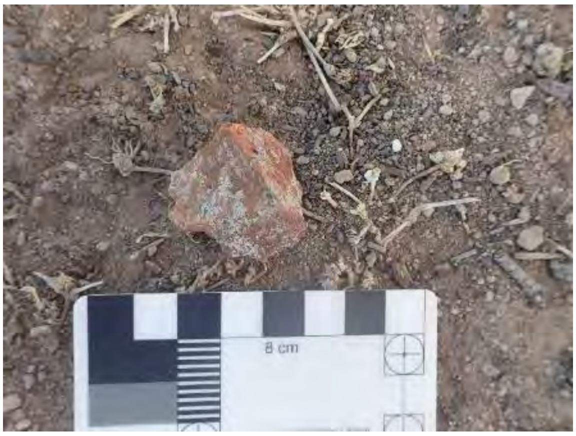


Plate 5-60 Close up of silcrete flake core, Tilbuster Solar Farm IF31.

Tilbuster Solar Farm IF32 AHIMS #21-1-0294

This site consisted of a single artefact located with a small group of trees. The artefact was a silcrete scraper located approximately 54 metres east of Duval Creek. The scraper contained 50% cortex and was therefore likely the result of primary production. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-61 Close up of silcrete scraper, Tilbuster Solar Farm IF32.

Plate 5-62 Location of Tilbuster Solar Farm IF32, looking west towards Duval Creek (mid-ground).

Tilbuster Solar Farm IF33   *AHIMS #21-1-0295*

This site consisted of a single artefact adjacent to a small cluster of trees between two unnamed tributaries of Duval Creek. The artefact was a silcrete proximal fragment located 104 metres south of one unnamed drainage line and 74 metres north of another. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-63 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF33.

Plate 5-64 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF33.

Tilbuster Solar Farm IF34   *AHIMS #21-1-0296*

This site consisted of a single artefact within a predominantly cleared paddock. The artefact was a silcrete flake located approximately 10 metres north of an unnamed drainage line. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-65 Close up of silcrete flake, Tilbuster Solar Farm IF34.	 Plate 5-66 General location of silcrete flake, Tilbuster Solar Farm IF34.

Tilbuster Solar Farm IF35 *AHIMS #21-1-0297*

This site consisted of a single artefact located immediately adjacent to an alluvial depression and small group of trees. The artefact was a quartz flake located approximately four metres south of a third order tributary of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-67 Close up of quartz flake, Tilbuster Solar Farm IF35.	 Plate 5-68 Close up of quartz flake, Tilbuster Solar Farm IF35.

Tilbuster Solar Farm IF36 *AHIMS #21-1-0298*

This site consisted of a single artefact within a predominantly cleared field approximately 86 metres east of a third order and 36 metres west of a first order tributary of Sams Gully, which is itself a major tributary of Duval Creek. The artefact was a silcrete proximal fragment. The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-69 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF36.

Plate 5-70 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF36.

Tilbuster Solar Farm IF37 AHIMS #21-1-0299

This site consisted of a single artefact on an alluvial plain within a cleared paddock. The artefact was a volcanic flake located approximately 43 metres south east of an unnamed drainage line and 70 metres north east of Duval Creek. The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-71 Close up of volcanic flake, Tilbuster Solar Farm IF37

Plate 5-72 Close up of volcanic flake, Tilbuster Solar Farm IF37

Tilbuster Solar Farm IF38 AHIMS #21-1-0300

This site consisted of a single artefact on the crest of an upper slope in a cleared paddock. The artefact was a chert core located approximately 80 metres north east of an unnamed tributary of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-73 Close up of chert core, Tilbuster Solar Farm IF38.

Plate 5-74 Close up of chert core, Tilbuster Solar Farm IF38.

Tilbuster Solar Farm IF39 AHIMS #21-1-0301

This site consisted of a single artefact adjacent to a large cluster of trees. The artefact was a jasper located within a third order tributary of Duval Creek. The soils consisted of a redeposited grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-75 Close up of jasper flake, Tilbuster Solar Farm IF39.

Plate 5-76 Close up of jasper flake, Tilbuster Solar Farm IF39.

Tilbuster Solar Farm IF40 AHIMS #21-1-0302

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek. The artefact was a chert debitage flake located approximately 100 metres south of the confluence of two unnamed tributaries of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-77 Close up of chert debitage flake, Tilbuster Solar Farm IF40.

Plate 5-78 Close up of chert debitage flake, Tilbuster Solar Farm IF40.

Tilbuster Solar Farm IF41 AHIMS #21-1-0303

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek. The artefact was a retouched silcrete flake located approximately 58 metres south of an unnamed drainage line associated with Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-79 Close up of retouched silcrete flake, Tilbuster Solar Farm IF41.

Plate 5-80 Close up of retouched silcrete flake, Tilbuster Solar Farm IF41.

Tilbuster Solar Farm IF42 AHIMS #21-1-0304

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek, with a westerly aspect. The artefact was a retouched silcrete notched scraper located approximately 39 metres south of an unnamed drainage line and 23 metres north of another unnamed drainage line, both tributaries of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-81 Close up of retouched silcrete notched scraper, Tilbuster Solar Farm IF42.

Plate 5-82 Close up of retouched silcrete notched scraper, Tilbuster Solar Farm IF42.

Tilbuster Solar Farm IF43 AHIMS #21-1-0305

This site consisted of a single artefact in a cleared paddock on a lower slope. The artefact was a quartz flake, possible scraper, located approximately 19 metres south of an unnamed tributary of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

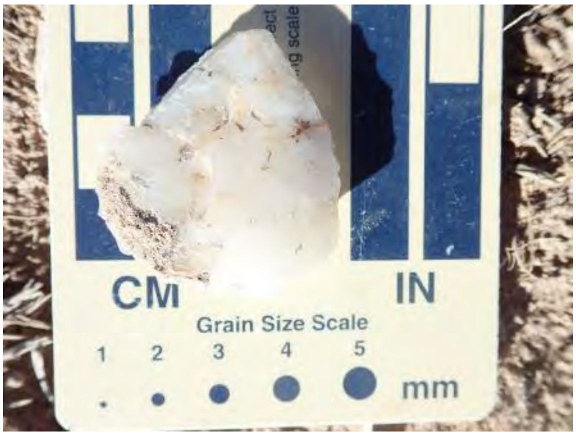


Plate 5-83 Close up of quartz flake, Tilbuster Solar Farm IF43

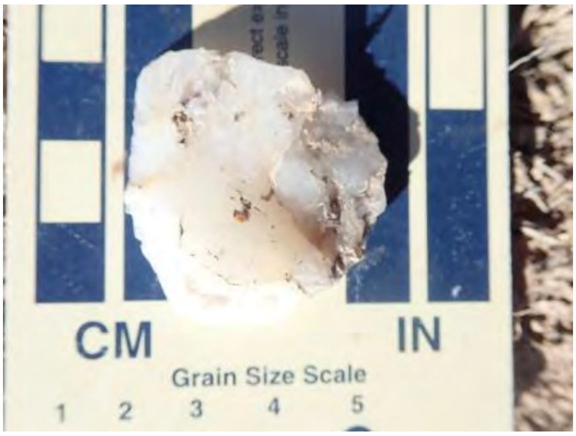


Plate 5-84 Close up of quartz flake, Tilbuster Solar Farm IF43.

Tilbuster Solar Farm IF44 AHIMS #21-1-0306

This site consisted of a single artefact in a cleared paddock on a lower slope. The artefact was a chert angular fragment with 30% cortex located approximately 100 metres east of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-85 Close up of chert angular fragment, Tilbuster Solar Farm IF44.

Plate 5-86 Close up of chert angular fragment, Tilbuster Solar Farm IF44.

Tilbuster Solar Farm IF45 *AHIMS #21-1-0307*

This site consisted of a single artefact on an alluvial plain adjacent to a fence line in a cleared paddock. The artefact was a silcrete flake located approximately 40 metres south of a second order tributary of Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-87 Close up of silcrete flake, Tilbuster Solar Farm IF45.

Plate 5-88 Close up of silcrete flake, Tilbuster Solar Farm IF45.

Tilbuster Solar Farm IF46 *AHIMS #21-1-0308*

This site consisted of a single artefact on an alluvial plain in a cleared paddock. The artefact was a possible distal silcrete flake located directly adjacent to an unnamed drainage line. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-89 General location of distal silcrete flake, Tilbuster Solar Farm IF46, facing south west.

Plate 5-90 Close up of possible distal silcrete flake, Tilbuster Solar Farm IF46.

Tilbuster Solar Farm IF47   *AHIMS #21-1-0309*

This site consisted of a single artefact on an alluvial plain in a cleared paddock. The artefact was a quartz proximal fragment located approximately 82 metres south east of an unnamed drainage line associated with Duval Creek. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%. This site is likely associated with AS20 and AS21.

Plate 5-91 Close up of quartz proximal fragment, Tilbuster Solar Farm IF47.

Plate 5-92 Close up of quartz proximal fragment, Tilbuster Solar Farm IF47.

Tilbuster Solar Farm IF48   *AHIMS #21-1-0310*

This site consisted of a single artefact in a cleared paddock on lower slope overlooking Duval Creek, with an easterly aspect. The artefact was a basalt axe. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-93 Close up of basalt axe, Tilbuster Solar Farm IF48.	 Plate 5-94 Close up of basalt axe, Tilbuster Solar Farm IF48.

Tilbuster Solar Farm IF49 *AHIMS #21-1-0311*

This site consisted of a single artefact on an existing vehicle track within a cleared paddock. The artefact was a silcrete manuport located approximately 67 metres south of an unnamed drainage line, a tributary of Duval Creek. The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

 Plate 5-95 Close up of silcrete manuport, Tilbuster Solar Farm IF49.	 Plate 5-96 Close up of silcrete manuport, Tilbuster Solar Farm IF49.

Tilbuster Solar Farm IF50 *AHIMS #21-1-0312*

This site consisted of a single artefact within a predominantly a cleared paddock beside a tree, with a south west aspect overlooking Duval Creek. The artefact was a silcrete flake located approximately 48 metres north west of an unnamed drainage line. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-97 Close up of silcrete flake, Tilbuster Solar Farm IF50.

Plate 5-98 Close up of silcrete flake, Tilbuster Solar Farm IF50.

Tilbuster Solar Farm IF51 *AHIMS #21-1-0313*

This site consisted of a single artefact along an existing vehicle track on a lower slope with a north-easterly aspect. The artefact was a silcrete proximal fragment. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-99 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF51.

Plate 5-100 Close up of silcrete proximal fragment, Tilbuster Solar Farm IF51.

Tilbuster Solar Farm IF52 *AHIMS #21-1-0314*

This site consisted of a single artefact along an existing transmission line and adjacent to a vehicle track on a lower slope with a north-easterly aspect, overlooking Duval Creek. The artefact was a silcrete flake. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-101 Location of Tilbuster Solar Farm IF52.

Plate 5-102 Close up of silcrete flake, Tilbuster Solar Farm IF52.

Tilbuster Solar Farm IF53 *AHIMS #21-1-0315*

This site consisted of a single artefact within a large cluster of trees. The artefact was a secondary quartz flake located east of the existing transmission line. The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Plate 5-103 Close up of quartz flake, Tilbuster Solar Farm IF53.

Plate 5-104 Close up of quartz flake, Tilbuster Solar Farm IF53.

Artefact Scatters

Tilbuster Solar Farm AS 1 *AHIMS #21-1-0337*

This site consisted of large artefact scatter comprising 48 artefacts located adjacent to a vehicle track in the north of the proposal area. The site was on a level to very gently sloping low ridge overlooking Duval Creek, with an easterly aspect. Material composition of the artefact scatter was predominantly characterised by silcrete and chert material with lesser inclusions of basalt, quartz and volcanic. Flakes were the most common artefact type (n=26), followed by proximal flakes (n=6), retouched flakes (n=3) and cores (n=3). Distal flakes (n=2), broken flakes (n=2) and a singular medial fragment (n=1) were also recorded. Notable artefacts included two basalt ground-edge axes (n=2), two geometric microliths (n=2) and one silcrete core tool (n=1). The majority of complete flakes were all identified as products of the tertiary stage of reduction with one or two anomalous artefacts exhibiting characteristics of secondary reduction phase, with partial cortex visible on the dorsal surface. The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 100% along the vehicle track and 80% adjacent to the vehicle track. The area has been subject to disturbance associated with continued vehicle use of the track and the slope exhibits significant erosion, which has removed topsoils from much of the area. The presence of artefacts on and adjacent to the track is a result of the high visibility in addition to the more level gradient on which it runs, meaning that movement of artefacts as a result of erosion is reduced compared with on the nearby slope. An assessment of the site determined that, due to erosion, there was nil to low potential for subsurface material to be present.

Plate 5-105 Close up of one basalt axe, part of Tilbuster Solar Farm AS1.

Plate 5-106 Close up of retouched silcrete flake, part of Tilbuster Solar Farm AS1.

Plate 5-107 Detail of second basalt axe, showing ground edge

Plate 5-108 Close up of silcrete core tool, part of Tilbuster Solar Farm AS1.

Plate 5-109 Close up of silcrete geometric microlith, part of Tilbuster Solar Farm AS1

Plate 5-110 Detail of silcrete geometric microlith, showing backing on left lateral margin

Plate 5-111 Looking east along the track main cluster of artefacts from Tilbuster Solar Farm AS1

Plate 5-112 Looking west along track, west extent of Tilbuster Solar Farm AS1

Tilbuster Solar Farm AS 2   AHIMS #21-1-0336

This site consisted of low-density artefact scatter comprising two artefacts and one manuport located along a vehicle track towards the middle of the north boundary of the proposal site over 500 metres east of Tilbuster Solar Farm AS1. The scatter included one silcrete flake (n=1), one silcrete proximal fragment (n=1) and one silcrete manuport (n=1). The artefacts were located on a grey-brown sandy loam redeposited on clay and visibility within the area was approximately 80% visibility along the vehicle track. The area has been subject to disturbance associated with continued vehicle use of the track.

Plate 5-113 Close up of silcrete flake, part of Tilbuster Solar Farm AS2.

Plate 5-114 Context of Tilbuster Solar Farm AS2.

Tilbuster Solar Farm AS 3   AHIMS #21-1-0335

This site consisted of low-density artefact scatter comprising three artefacts located within Duval Creek near the eastern side of the proposal site. The scatter included two flakes (silcrete (n=1) and chert (n=1)) and a greywacke core (n=1). The artefacts were located on a redeposited grey-brown sandy loam and visibility within the area was approximately 80% visibility along the creek bed. The area has been subject to disturbance through alluvial processes and these artefacts are likely to have been washed to this location during periods of high-water movement.

Plate 5-115 Close up of chert flake, part of Tilbuster Solar Farm AS3.

Plate 5-116 Termite mound located near Tilbuster Solar Farm AS3.

Tilbuster Solar Farm AS 4 AHIMS #21-1-0334

This site consisted of large artefact scatter comprising 39 artefacts located within a cleared paddock east of the existing transmission line and overlooking Duval Creek with an easterly aspect. The landform was gently sloping. The scatter was predominantly characterised by silcrete material with some of chert, greywacke, volcanic and quartz materials. Lithic types mainly included flakes (n=22) with some occurrences of cores (n=6), broken flakes (n=3), proximal fragments (n=2), split flakes (n=1). Additionally, there were some formal type inclusions also including two scrapers (silcrete (n=1), greywacke (n=1)), one greywacke axe (n=1), a silcrete core tool (n=1) and one chert flake tool (n=1, possibly an implement for piercing). The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility within a cleared paddock along an existing fence line. The area has been subject to disturbance through alluvial processes.

 Plate 5-117 Close up of greywacke axe, part of Tilbuster Solar Farm AS4.	 Plate 5-118 Close up of greywacke scraper part of Tilbuster Solar Farm AS4.
 Plate 5-119 Close up of chert flake tool, part of Tilbuster Solar Farm AS4.	 Plate 5-120 Detail of silcrete scraper part of Tilbuster Solar Farm AS4.

 Plate 5-121 Location of Tilbuster Solar farm AS4, facing east	 Plate 5-122 General location of Tilbuster Solar farm AS4, facing west

Tilbuster Solar Farm AS 5 AHIMS #21-1-0333

This site consisted of low-density artefact scatter comprising two artefacts located within a cleared paddock along the existing transmission line, approximately 200 metres west of Duval Creek. The scatter included one silcrete flake and one silcrete axe. The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 80% visibility along the vehicle track.

 Plate 5-123 Close up of silcrete axe, part of Tilbuster Solar Farm AS5.	 Plate 5-124 Close up of silcrete flake, part of Tilbuster Solar Farm AS5.

Tilbuster Solar Farm AS 6 AHIMS #21-1-0332

This site consisted of low-density artefact scatter comprising two artefacts located within a small clump of trees. The scatter included two silcrete flakes. The artefacts were located on an eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility along the cleared paddock.

Plate 5-125 Close up of silcrete flake, part of Tilbuster Solar Farm AS6.

Plate 5-126 Close up of silcrete flake, part of Tilbuster Solar Farm AS6.

Tilbuster Solar Farm AS 7 AHIMS #21-1-0331

This site consisted of low-density artefact scatter comprising nine artefacts located west of the transmission line and 70 metres north of an unnamed drainage line. The scatter was predominantly characterised by silcrete and chert material with some inclusions of quartz and greywacke. Artefact types included silcrete flakes (n=4), manuports (n=2), a core (n=1), a broken flake (n=1) and a proximal flake (n=1). The artefacts were located on an eroded grey-brown sandy loam A horizon and visibility within a previously ploughed paddock was approximately 80% visibility along the cleared paddock.

Plate 5-127 Close up of silcrete flake, part of Tilbuster Solar Farm AS7.

Plate 5-128 Close up of greywacke flake, part of Tilbuster Solar Farm AS7.

Tilbuster Solar Farm AS 8 AHIMS #21-1-0330

This site consisted of low-density artefact scatter comprising four artefacts located on a low rise between two tributaries of Duval Creek, a third order stream on the southern side and a first order stream on the northern side. The rise was vegetated by a small open woodland. The scatter was predominantly characterised by quartz material with one chert artefact. Artefact types included flake (n=2), one proximal fragment (n=1) and one manuport (n=1). The artefacts were located on an eroded orange grey-brown sandy loam deposit and visibility within a previously ploughed paddock was approximately 70% visibility along the cleared paddock.

Plate 5-129 Close up of quartz flake, part of Tilbuster Solar Farm AS8.

Plate 5-130 Close up of quartz flake, part of Tilbuster Solar Farm AS8.

Tilbuster Solar Farm AS 9 AHIMS #21-1-0329

This site consisted of low-density artefact scatter comprising two artefacts located 24 metres north west of an unnamed waterway. The scatter comprised one silcrete flake (n=10) and one medial chert fragment (n=1). The artefacts were located on a grey-brown sandy loam and visibility within a previously ploughed paddock was approximately 90% visibility along the cleared paddock.

Plate 5-131 Close up of silcrete flake, Tilbuster Solar Farm AS9.

Plate 5-132 Close up of silcrete flake, Tilbuster Solar Farm AS9.

Tilbuster Solar Farm AS 10 AHIMS #21-1-0328

This site consisted of an artefact scatter comprising 11 artefacts located 62 metres north west of an unnamed third order tributary of Duval Creek within a small cluster of trees. The scatter was predominantly characterised by silcrete material with single instances of chert, volcanic and quartz made items. Artefact types included flakes (n=4), proximal fragments (n=3), distal fragments (n=1) and manuports (n=3). The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the small cluster of trees was approximately 50% due to surrounding leaf litter material.

Plate 5-133 Close up of silcrete flake, part of Tilbuster Solar Farm AS10.

Plate 5-134 Context of Tilbuster Solar Farm AS10.

Tilbuster Solar Farm AS 11   AHIMS #21-1-0327

This site consisted of a low-density artefact scatter comprising two artefacts located four metres east of an unnamed drainage line associated with Duval Creek. The scatter included a retouched silcrete flake (n=1) with a point and a retouched chert flake (n=2). The artefacts were located on a grey-brown sandy loam and visibility was approximately 90% within the cleared paddock.

Plate 5-135 Close up of chert flake, part of Tilbuster Solar Farm AS11.

Plate 5-136 Close up of silcrete flake with point, part of Tilbuster Solar Farm AS11.

Tilbuster Solar Farm AS 12   AHIMS #21-1-0349

This site consisted of a low-density artefact scatter comprising two artefacts located 45 metres east of an unnamed third order tributary of Duval Creek. The scatter included one silcrete flake (n=1) and one volcanic flake (n=1). The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 70%.

Plate 5-137 Close up of volcanic flake, part of Tilbuster Solar Farm AS12.

Plate 5-138 Close up of silcrete flake, part of Tilbuster Solar Farm AS12.

Tilbuster Solar Farm AS 13 AHIMS #21-1-0348

This site was an artefact scatter comprising 10 artefacts located adjacent to a small cluster of trees. The site was predominantly characterised by silcrete and quartz material with one instance of chert. Artefact types included flakes (n=3), manuports (n=3), broken flakes (n=2), a proximal fragment (n=1) and a distal fragment (n=1). The artefacts were located on a grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbance.

Plate 5-139 Close up of silcrete flake, part of Tilbuster Solar Farm AS13.

Plate 5-140 Location, facing west, of Tilbuster Solar Farm AS13.

Tilbuster Solar Farm AS 14 AHIMS #21-1-0347

This site consisted of a low-density artefact scatter comprising six artefacts located adjacent to a small cluster of trees on a lower slope overlooking a third order tributary of Duval Creek, with a northerly aspect. The scatter included equal quantities of silcrete, quartz and chert materials. Tool types included cores (n=2), flakes (n=2), a distal fragment (n=1) and a proximal fragment (n=1). The artefacts were located on an eroded grey-brown sandy loam and visibility was approximately 80%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbance.

Plate 5-141 Close up of silcrete flake, part of Tilbuster Solar Farm AS14.

Plate 5-142 Chert core, part of Tilbuster Solar Farm AS14.

Tilbuster Solar Farm AS 15   AHIMS #21-1-0346

This site consisted of a low-density artefact scatter comprising two artefacts located adjacent to a small cluster of trees on a lower slope overlooking a third order tributary of Duval Creek, with a northerly aspect. The scatter included one silcrete flake (n=1) and one silcrete proximal fragment (n=1). The artefacts were located on an eroded redeposited grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbance.

Plate 5-143 Close up of silcrete proximal fragment, part of Tilbuster Solar Farm A15.

Plate 5-144 Close up of silcrete flake, part of Tilbuster Solar Farm A15.

Tilbuster Solar Farm AS 16   AHIMS #21-1-0345

This site consisted of a large artefact scatter comprising 36 artefacts located within a small cluster of trees and within a highly eroded area of sheetwash, with rill erosion evident in some areas. The scatter is predominantly characterised by silcrete material with some quartz, basalt and volcanic materials and one occurrence each of quartzite and chert. Lithic types were mainly characterised by flakes (including one backed) (n=22), proximal fragments (n=3), flaked pieces (n=3), distal fragments (n=2), cores (n=2), broken flakes (n=2), a medial fragment (n=1) and a split flake (n=1). The majority of artefacts showed evidence of tertiary stage reduction. The artefacts were located on a heavily eroded grey-brown sandy loam and visibility was approximately 80%.

Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbance.

Plate 5-145 Close up of two silcrete flakes, the one on the left being backed, part of Tilbuster Solar Farm AS16.

Plate 5-146 Location, facing west, of Tilbuster Solar Farm AS16.

Tilbuster Solar Farm AS 17   AHIMS #21-1-0344

This site consisted of a low-density artefact scatter comprising three artefacts located between two first order tributaries of Duval Creek. The scatter included a retouched silcrete flake (n=1), a broken silcrete flake (n=1) and a silcrete manuport (n=1). The artefacts were located on a shallow grey-brown sandy loam deposit and visibility was approximately 90%.

Plate 5-147 Close up of silcrete flake, part of Tilbuster Solar Farm AS17.

Plate 5-148 Location of Tilbuster Solar Farm AS17.

Tilbuster Solar Farm AS 18   AHIMS #21-1-0343

This site consisted of a large artefact scatter comprising 12 artefacts located along a vehicle track. The scatter was predominantly characterised by silcrete material with some inclusions of quartz and volcanic materials. Lithic types were mainly characterised by flakes (n=5), distal fragments (n=2), a broken flake (n=1), a core (n=1), a medial fragment (n=1) and a split flake (n=1). Additionally, one formal type, a silcrete scraper, was also identified (n=1). The majority of artefacts showed evidence of tertiary stage reduction and also demonstrated evidence of vehicle damage. The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 80%.

Plate 5-149 Close up of silcrete scraper, part of Tilbuster Solar Farm AS18.

Plate 5-150 Two silcrete flakes located at Tilbuster Solar Farm AS18.

Tilbuster Solar Farm AS 19   AHIMS #21-1-0342

This site consisted of a low-density scatter comprising two artefacts located between two low order tributaries of Duval Creek on a low-lying cleared paddock containing scattered trees. The scatter included a silcrete flake (n=1) and a chert core (n=1). The artefacts were located on a shallow grey-brown sandy loam which has been significantly eroded by sheep grazing and drought, and visibility was approximately 80%.

Plate 5-151 Close up of silcrete flake, part of Tilbuster Solar Farm AS19.

Plate 5-152 Close up of chert core, part of Tilbuster Solar Farm AS19.

Tilbuster Solar Farm AS 20   AHIMS #21-1-0357

This site consisted of a low-density scatter comprising two artefacts located adjacent to a small cluster of trees and a first order tributary of Duval Creek. The scatter included a chert flake (n=1) and a quartz core (n=1). The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS21 and IF47.

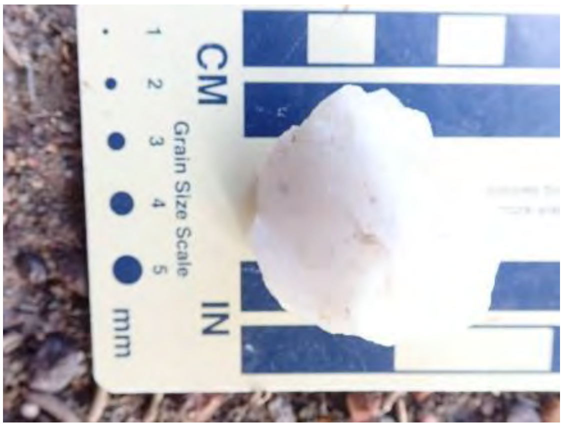


Plate 5-153 Close up of quartz core, part of Tilbuster Solar Farm AS20.

Plate 5-154 Location of Tilbuster Solar Farm AS20.

Tilbuster Solar Farm AS 21 AHIMS #21-1-0358

This site consisted of a low-density scatter comprising two artefacts located adjacent to a small cluster of trees and a first order tributary of Duval Creek. The scatter included silcrete proximal fragment (n=1) and a chert retouched flake (n=1). The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS20 and IF47.

Plate 5-155 Close up of silcrete proximal fragment, part of Tilbuster Solar Farm AS21.

Plate 5-156 Close up of chert retouched flake, part of Tilbuster Solar Farm AS21.

Tilbuster Solar Farm AS 22 AHIMS #21-1-0356

This site consisted of a low-density scatter comprising two artefacts located adjacent to a small cluster of trees along a low order tributary of Duval Creek. The scatter included one silcrete and one chert flake (n=2). The artefacts were located shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Plate 5-157 Close up of silcrete flake, part of Tilbuster Solar Farm AS22.

Plate 5-158 Close up of chert flake, part of Tilbuster Solar Farm AS22.

Tilbuster Solar Farm AS 23 AHIMS #21-1-0355

This site consisted of a large artefact scatter comprising 39 artefacts located towards the south of the proposal site and 26 metres south of the confluence of two second order tributaries of Duval Creek. The artefacts occurred in association with a contour line on a lower slope which overlooked the incised drainage lines and Duval Creek further to the north. The scatter was predominantly characterised by silcrete material with some occurrences of greywacke, chert and basalt materials. The assemblage was dominated by flakes (n=10) and cores (n=8), proximal fragments (n=3), broken flakes (n=3), distal fragments (n=2), medial fragment s(n=2), retouched flakes (n=2), a split flake (n=1), an angular fragment (n=1), a geometric microlith (n=1), one hammerstone (n=1) and a core tool scraper (n=1). There were also four manuports recorded (n=4). The artefacts were located on shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Plate 5-159 Detail of silcrete flake scraper, part of Tilbuster Solar Farm AS23.

Plate 5-160 Blade core, part of Tilbuster Solar Farm AS23.

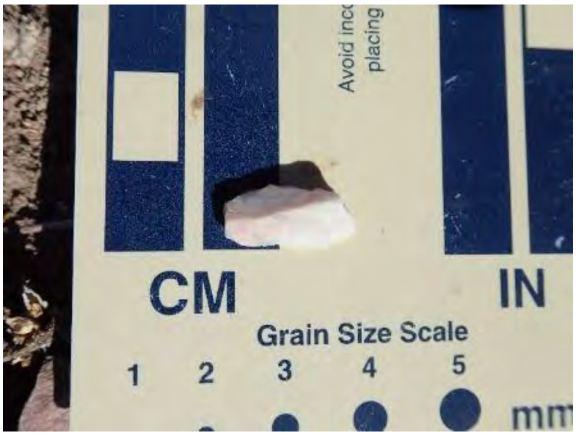


Plate 5-161 Close up of geometric microlith, Tilbuster Solar Farm AS23.

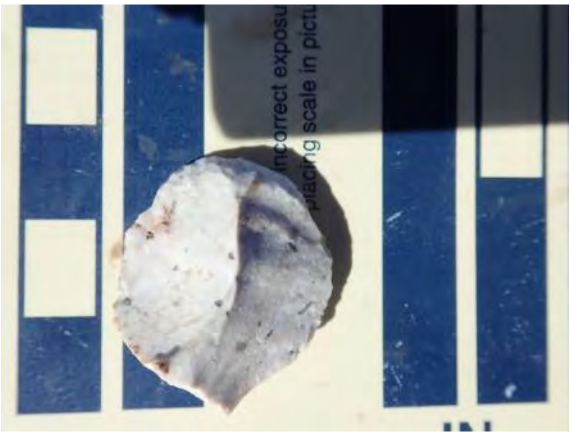


Plate 5-162 Retouched silcrete flake, part of Tilbuster Solar Farm AS23.

Plate 5-163 Hammerstone at AS23

Plate 5-164 Location of Tilbuster Solar Farm AS23 (mid-ground) facing north east.

Tilbuster Solar Farm AS 24 AHIMS #21-1-0354

This site consisted of a large artefact scatter comprising a minimum of 47 artefacts located in a cleared paddock 20 metres east of Duval Creek, overlooking the creek on two sides of a low-lying spur. The scatter was predominantly characterised by silcrete, quartz and chert materials with some instances of basalt and greywacke. The assemblage contained flakes (n=18), broken flakes (n=6), cores (n=6), proximal fragments (n=5), angular fragments (n=3), medial fragments (n=2), retouched flakes (n=2), one axe (n=1), a hammerstone (n=1), a scraper (n=1), a flake tool (n=1) and a distal fragments (n=1). The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site. AS24 is likely to be closely related to AS25.

 Plate 5-165 Close up of basalt axe, part of Tilbuster Solar Farm AS24.	 Plate 5-166 Hammerstone identified at AS24
 Plate 5-167 Detail of backing on silcrete flake, part of AS24	 Plate 5-168 Location of Tilbuster Solar Farm AS24, facing south west to edge of spur overlooking Duval Creek.

Tilbuster Solar Farm AS 25 AHIMS #21-1-0353

This site consisted of a large artefact scatter comprising 36 artefacts between two drainage lines feeding into the nearby Duval Creek. The scatter was predominantly characterised by silcrete and quartz with some inclusions of chert, basalt and greywacke material. The assemblage was dominated by flakes (n=12), followed by angular fragments (n=7), broken flakes (n=6), manuports (n=3), proximal flakes (n=2), a retouched flake (n=1), a core (n=1) and a split flake (n=1). Additionally, two axes (n=2) and a scraper (n=1) were identified and characterised the only formal tool types identifiable throughout the assemblage. The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. AS25 is closely related to AS24. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site.

Plate 5-169 Close up of axe, part of Tilbuster Solar Farm AS25.

Plate 5-170 Close up of chert flake, part of Tilbuster Solar Farm AS25.

Plate 5-171 Close up of silcrete flake, part of Tilbuster Solar Farm AS25.

Plate 5-172 Context of Tilbuster Solar Farm AS25, facing north

Tilbuster Solar Farm AS 26 AHIMS #21-1-0352

The site consisted of a low-density artefact scatter comprising two artefacts, a quartz core (n=1) and a quartz flake (n=1). The artefacts were located on the banks of Duval Creek atop an eroded sandy silt redeposited A horizon layer.

Plate 5-173 Close up of quartz core, part of Tilbuster Solar Farm AS26

Plate 5-174 Quartz flake at Tilbuster Solar Farm AS26

Tilbuster Solar Farm AS 27   AHIMS #21-1-0351

This site consisted of a low-density artefact scatter comprising two artefacts between in cleared paddock. The scatter comprised two greywacke flakes (n=2). The artefacts were located on a grey-brown sandy loam deposit and visibility was approximately 80%.

Plate 5-175 Close up of greywacke flake, part of Tilbuster Solar Farm AS27.

Plate 5-176 Location of Tilbuster Solar Farm AS27, facing south east.

Tilbuster Solar Farm AS 28   AHIMS #21-1-0350

This site consisted of a low-density artefact scatter comprising three artefacts in the bed of Duval Creek. These may have been eroding out of the banks of the creek but equally may have been washed into the creek bed and then imbedded as a result of sedimentation. The deeply incised banks of Duval Creek suggest that movement of water can be rapid at times of flood or heavy rain. The scatter comprised two broken silcrete flakes and one broken greywacke flake (n=3). Visibility was approximately 80%.

Plate 5-177 Close up of broken silcrete flake, part of Tilbuster Solar Farm AS27.

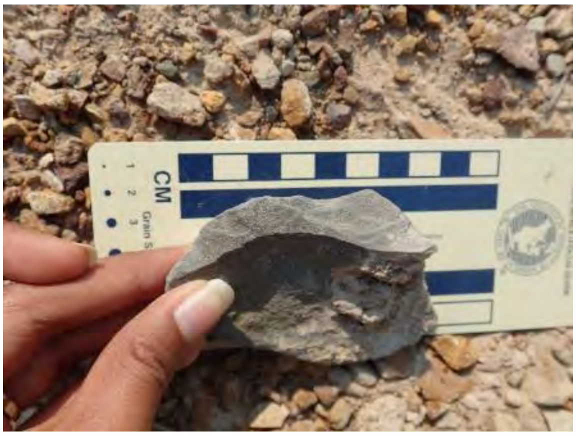


Plate 5-178 Close up of greywacke flake, part of Tilbuster Solar Farm AS27.

5.1.4. Summary of Artefact Sites Recorded

Table 5-2 Summary of Artefact Sites Recorded

Site Name	Site Type	Details
Tilbuster Solar Farm IF1	Isolated find	1 artefact
Tilbuster Solar Farm IF2	Isolated find	1 artefact
Tilbuster Solar Farm IF3	Isolated find	1 artefact
Tilbuster Solar Farm IF4	Isolated find	1 artefact
Tilbuster Solar Farm IF7	Isolated find	1 artefact
Tilbuster Solar Farm IF8	Isolated find	1 artefact
Tilbuster Solar Farm IF9	Isolated find	1 artefact
Tilbuster Solar Farm IF10	Isolated find	1 artefact
Tilbuster Solar Farm IF11	Isolated find	1 artefact
Tilbuster Solar Farm IF12	Isolated find	1 artefact
Tilbuster Solar Farm IF13	Isolated find	1 artefact
Tilbuster Solar Farm IF14	Isolated find	1 artefact
Tilbuster Solar Farm IF15	Isolated find	1 artefact
Tilbuster Solar Farm IF16	Isolated find	1 artefact

Tilbuster Solar Farm IF18	Isolated find	1 artefact
Tilbuster Solar Farm IF19	Isolated find	1 artefact
Tilbuster Solar Farm IF21	Isolated find	1 artefact
Tilbuster Solar Farm IF22	Isolated find	1 artefact
Tilbuster Solar Farm IF23	Isolated find	1 artefact
Tilbuster Solar Farm IF24	Isolated find	1 artefact
Tilbuster Solar Farm IF25	Isolated find	1 artefact
Tilbuster Solar Farm IF26	Isolated find	1 artefact
Tilbuster Solar Farm IF27	Isolated find	1 artefact
Tilbuster Solar Farm IF28	Isolated find	1 artefact
Tilbuster Solar Farm IF29	Isolated find	1 artefact
Tilbuster Solar Farm IF30	Isolated find	1 artefact
Tilbuster Solar Farm IF31	Isolated find	1 artefact
Tilbuster Solar Farm IF32	Isolated find	1 artefact
Tilbuster Solar Farm IF33	Isolated find	1 artefact
Tilbuster Solar Farm IF34	Isolated find	1 artefact
Tilbuster Solar Farm IF35	Isolated find	1 artefact
Tilbuster Solar Farm IF36	Isolated find	1 artefact
Tilbuster Solar Farm IF37	Isolated find	1 artefact
Tilbuster Solar Farm IF38	Isolated find	1 artefact
Tilbuster Solar Farm IF39	Isolated find	1 artefact
Tilbuster Solar Farm IF40	Isolated find	1 artefact
Tilbuster Solar Farm IF41	Isolated find	1 artefact
Tilbuster Solar Farm IF42	Isolated find	1 artefact
Tilbuster Solar Farm IF43	Isolated find	1 artefact
Tilbuster Solar Farm IF44	Isolated find	1 artefact

Tilbuster Solar Farm IF45	Isolated find	1 artefact
Tilbuster Solar Farm IF46	Isolated find	1 artefact
Tilbuster Solar Farm IF47	Isolated find	1 artefact
Tilbuster Solar Farm IF48	Isolated find	1 artefact
Tilbuster Solar Farm IF49	Isolated find	1 artefact
Tilbuster Solar Farm IF50	Isolated find	1 artefact
Tilbuster Solar Farm IF51	Isolated find	1 artefact
Tilbuster Solar Farm IF52	Isolated find	1 artefact
Tilbuster Solar Farm IF53	Isolated find	1 artefact
Tilbuster Solar Farm AS1	Artefact scatter	48 artefacts
Tilbuster Solar Farm AS2	Artefact scatter	3 artefacts
Tilbuster Solar Farm AS3	Artefact scatter	3 artefacts
Tilbuster Solar Farm AS4	Artefact scatter	39 artefacts
Tilbuster Solar Farm AS5	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS6	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS7	Artefact scatter	9 artefacts
Tilbuster Solar Farm AS8	Artefact scatter	4 artefacts
Tilbuster Solar Farm AS9	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS10	Artefact scatter	11 artefacts
Tilbuster Solar Farm AS11	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS12	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS13	Artefact scatter	10 artefacts
Tilbuster Solar Farm AS14	Artefact scatter	6 artefacts
Tilbuster Solar Farm AS15	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS16	Artefact scatter	36 artefacts
Tilbuster Solar Farm AS17	Artefact scatter	3 artefacts

Tilbuster Solar Farm AS18	Artefact scatter	12 artefacts
Tilbuster Solar Farm AS19	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS20	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS21	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS22	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS23	Artefact scatter	39 artefacts
Tilbuster Solar Farm AS24	Artefact scatter	47 artefacts
Tilbuster Solar Farm AS25	Artefact scatter	36 artefacts
Tilbuster Solar Farm AS26	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS27	Artefact scatter	2 artefacts
Tilbuster Solar Farm AS28	Artefact scatter	3 artefacts

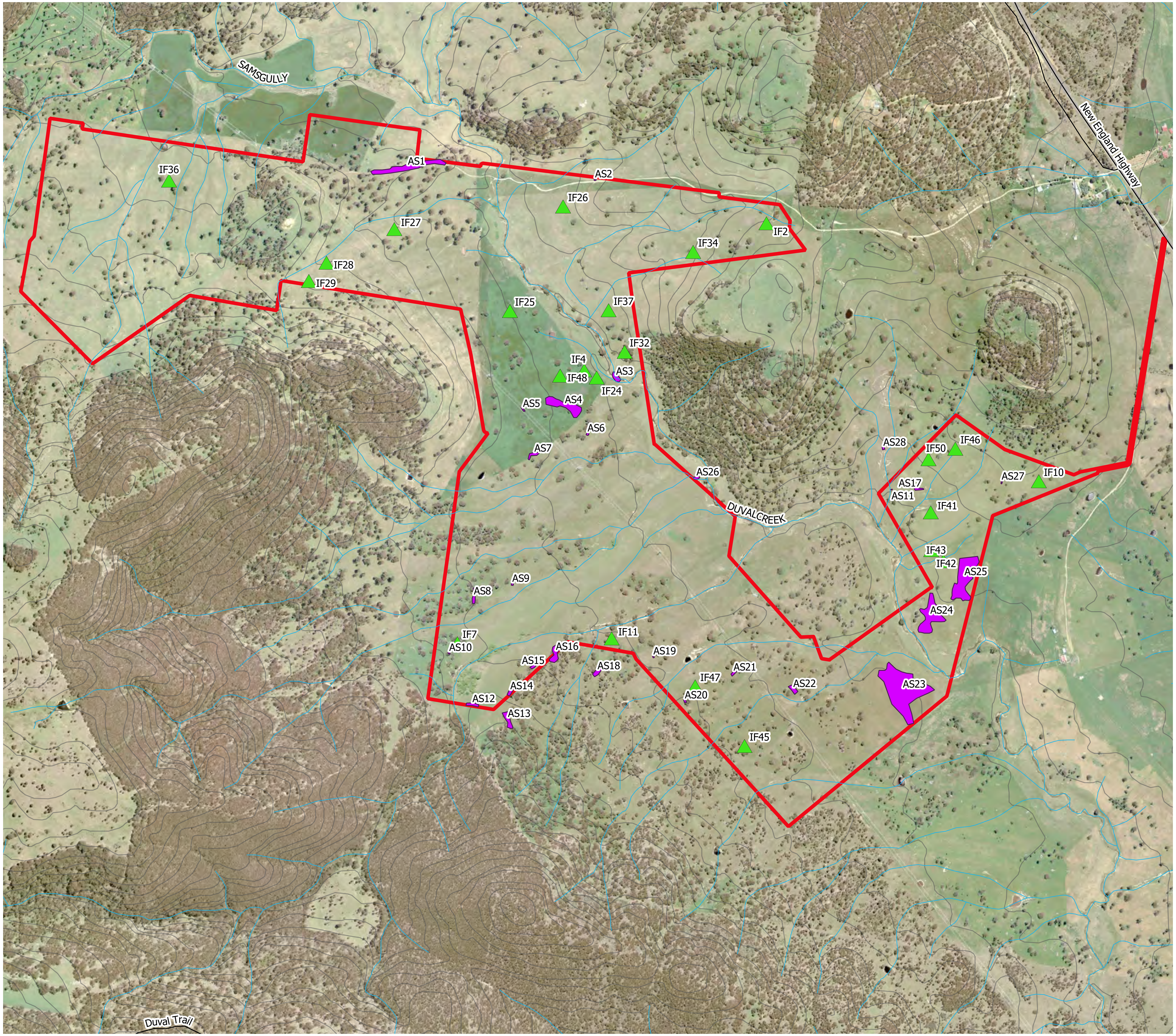


Figure 5-1: Artefact Scatters and Isolated Finds identified during survey

Legend
- Proposal site location
- Artefact Scatters
- Isolated Finds
- Roads
- Waterways

0 150 300 450 600 750 900 m

Data Attribution
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© LPI 2019

Ref: 18-645 Tillbuster SF Workspace 20191218 \
a3 land
Author: Chelsea. J
Date created: 17.01.2020
Datum: GDA94 / MGA zone 56

NGH

5.1.5. Material Recorded During Survey

As noted above, 49 isolated finds and 28 artefact scatters, containing a total of 382 artefacts, were recorded during the archaeological survey of the proposal site. The artefact data is provided in Appendix B, and a breakdown of the data has been provided in Table 5-3, Figure 5-2 and Figure 5-3. The spatial distribution of the surface artefacts recorded during the archaeological survey of the proposed Tilbuster Solar Farm is shown in Figure 5-1.

The data indicates that the majority of artefacts (n=366, 95.81%) were recorded in lower slopes landforms, with 13 sites (3.4%) recorded in the swamp/low-lying ground in the central portion of the proposal site and the least artefacts were identified on upper slopes (n=3, 0.79%), although it should be noted that these two landform types comprised much smaller portions of the proposal site, therefore there is considered to be some bias in the results. In particular, the artefacts were identified in landforms directly associated with Duval Creek or its tributaries. Sites with higher densities, including Tilbuster Solar Farm AS1 (n=49), AS4 (n=39), AS23 (n=39), AS24 (n=47), and AS25 (n=36) were all located on lower slopes overlooking Duval Creek itself, while AS16 (n=33) was located at the base of a simple slope with a north facing aspect overlooking a third order tributary of Duval Creek.

Silcrete was the dominant raw material in the assemblage (n=201, 52.62%), followed by chert (n=66, 17.28%) and quartz (n=62, 16.23%). Smaller numbers of a variety of other raw materials were also present including: basalt (n=18, 4.71%), greywacke (n=16, 4.19%), hornfels (n=3, 0.79%), indurated mudstone-tuff-chert (IMSTC) (n=1, 0.26%), red jasper (n=1, 0.26%), quartzite (n=1, 0.26%) and other (n=1, 0.26%).

The most commonly occurring artefact type was flakes (n=175, 45.81%), followed by cores (n=39, 10.21%), proximal fragments (n=37, 9.69%), broken flakes (n=37, 8.64%), manuports (n=18, 4.71%), distal fragments (n=16, 4.19%), retouched flakes (n=13, 3.40%), angular fragments (n=12, 3.14%), axes (n=8, 2.09%), medial fragments (n=8, 2.09%), split flake (n=6, 1.57%), flaked piece (n=4, 1.05%), scraper (n=3, 0.79%), core tools (n=3, 0.79%), flake tools (n=2, 0.52%), geometric microliths (n=2, 0.52%), hammerstones (n=2, 0.52%) and one notched scraper (n=1, 0.26%). It should be noted that angular fragments were included in the assemblage as the evidence of damage as a result of agricultural activities such as ploughing was clear among the finds and these angular fragments, while retaining no characteristic features, are likely to be broken artefacts as opposed to waste material from the manufacture process. Manuports were incorporated into the assemblage because they represent movement of raw materials from source to the location of the artefact scatter or open camp sites and human movement of stone material forms a significant element of these sites.

Of these artefacts, the majority were recorded with 0-25% cortex (n=371, 97.12%), with a smaller number in the secondary (n=8, 2.09%) and tertiary (n=3, 0.79%) reduction stages.

The technological characteristics of the artefacts would suggest they were for the most part discarded pieces formed as collateral during the manufacture of a general-purpose toolkit. Such tools would likely have been manufactured as required, with some blade manufacturing potentially occurring onsite. This is consistent with the core and flake industry as outlined by Witter (1990) and consistent with observations made in the region and local area by Godwin (1993), Davidson and Appleton (1990) and Burke et al (2000). It is also worth noting that the high number of flake fragments is likely a result of damage sustained by ploughing.

Table 5-3 Breakdown of lithology and artefact types by landform

Landform	Lithologies											Typologies																		Total
	Silcrete	Quartz	Chert	Basalt	Greywacke	Volcanic misc.	Hornfels	IMSTC	Quartzite	Red jasper	Other	Flake	Core	Proximal frag	Broken flake	Manuport	Distal frag	Retouched flake	Angular frag	Axe	Medial frag	Split flake	Flaked piece	Scraper	Core tool	Flake tool	Hammerstone	Geometric microlith	Notched scraper	
Lower slopes	196	63	59	17	14	10	3	1	1	1	1	168	36	34	33	17	15	13	12	8	7	6	4	3	3	2	2	2	1	**366**
Swamp/ low lying	4	3	2	1	2	1						6	1	3		1	1				1									**13**
Upper slopes	1		1			1						1	2																	**3**
Total	**201**	**66**	**62**	**18**	**16**	**12**	**3**	**1**	**1**	**1**	**1**	**175**	**39**	**37**	**33**	**18**	**16**	**13**	**12**	**8**	**8**	**6**	**4**	**3**	**3**	**2**	**2**	**2**	**1**	**382**

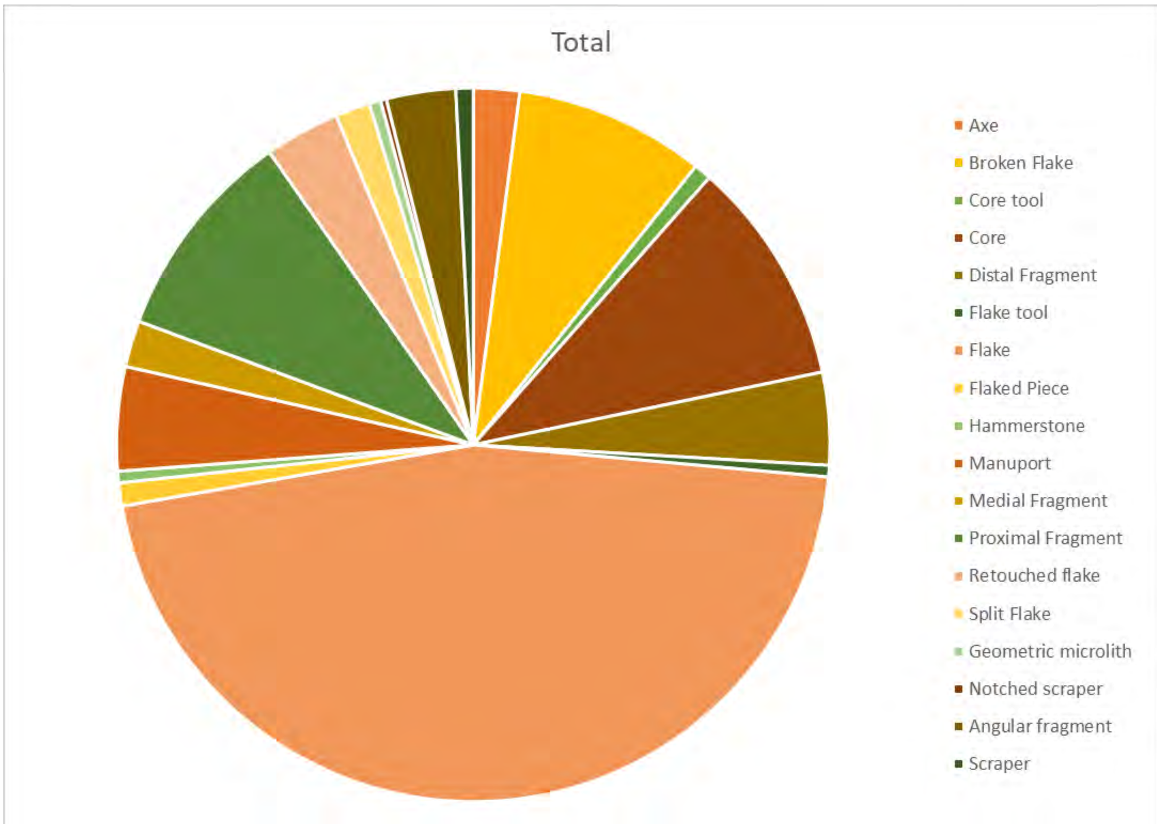

Figure 5-2 Artefact types by quantity, recorded during archaeological survey

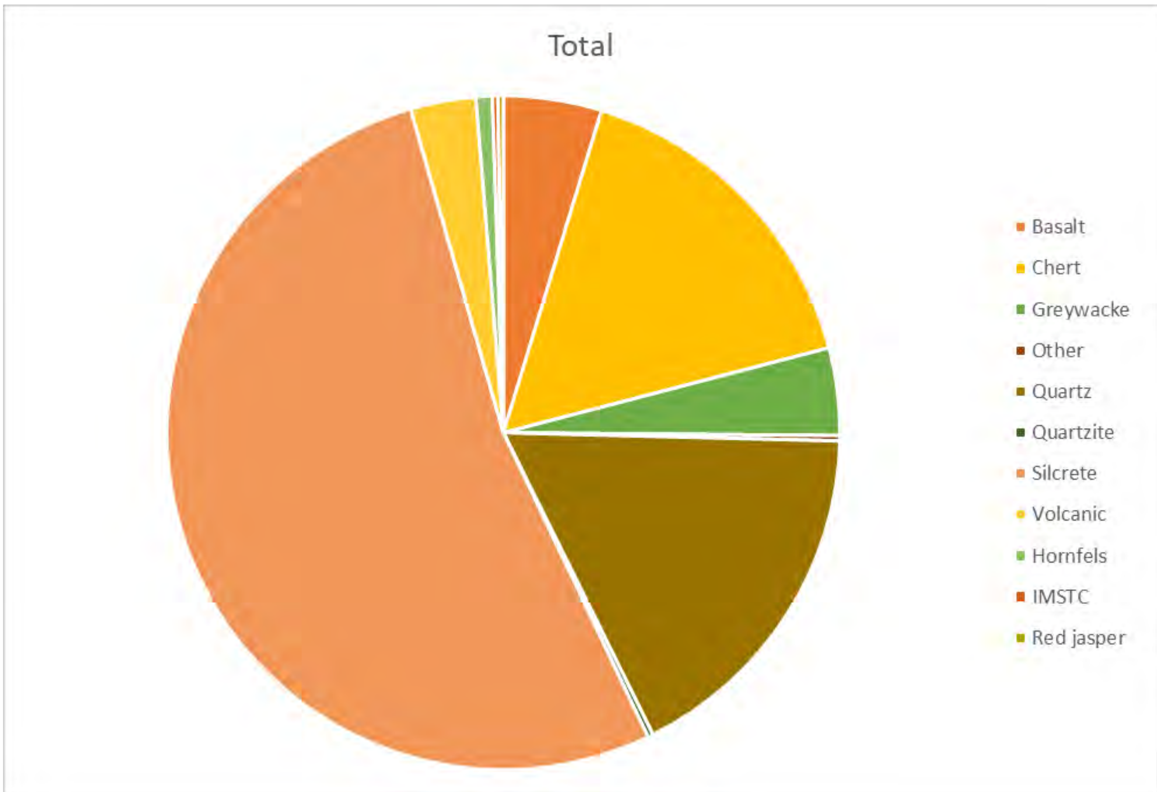

Figure 5-3 Raw materials recorded during survey

Scarred Trees (Figure 5-4)

Tilbuster Solar Farm ST1 *AHIMS # 21-1-0338*

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is a dead, standing, and of undetermined species in poor condition that has a single curved pre-form scar assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located between a third order and first order tributary of Duval Creek, near an isolated artefact (IF9) in south west of the proposal site and is approximately 5 metres in height. The oval scar is in good condition and located on the trunk of the tree facing north. The scar measures 90 centimetres in length by 23 centimetres in width and has a depth of 20 centimetres. The base of the scar is approximately 20 centimetres above the ground. No axe marks were visible. It was noted that perimeter of the scar appeared hollowed and the general degradation of the tree was likely due to age and insect damage.

	
Plate 5-179 Close up of scar at Tilbuster Solar Farm ST1.	Plate 5-180 View south south-west of Tilbuster Solar Farm ST1.

Tilbuster Solar Farm ST2 *AHIMS # 21-1-0317*

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is an alive, standing and of box species, in poor condition that has a single curved pre-form scar assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located towards the north west of the proposal site located with a moderately sized cluster of trees and is approximately 8 metres in height. The oval scar is in poor condition and located on the trunk of the tree facing southwest. The scar measured 187 centimetres in length by 40 centimetres in width and has a depth of 20 centimetres. The base of the scar is approximately 42 centimetres above the ground. No axe marks were visible. It was noted that scar was in poor condition with large sections of the dry face missing and generally degraded.

Plate 5-181 Close up of scar at Tilbuster Solar Farm ST2.

Plate 5-182 View north-west of Tilbuster Solar Farm ST2.

Tilbuster Solar Farm ST3 *AHIMS # 21-1-0318*

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is a dead, standing and of undetermined species, in poor condition that has a single curved pre-form scar assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located within a small cluster of trees in the central part of the proposal site along the western boundary and is approximately 5 metres in height. It was noted that the scar preservation was poor, while the oval shape and possible regrowth were evident the scar timber had physically decayed leaving a hollowed oval shape. The oval scar is located on the trunk of the tree facing northeast. The scar measures 110 centimetres in length by 20 centimetres in width and has a depth of 7 centimetres. The base of the scar is approximately 53 centimetres above the ground. No axe marks were visible.

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Plate 5-183 Close up of scar at Tilbuster Solar Farm ST3.

Plate 5-184 View north-west of Tilbuster Solar Farm ST3.

Tilbuster Solar Farm ST4 *AHIMS # 21-1-0319*

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is alive, standing and is a stringybark species, in good condition that has a curved pre-form single scar assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located along a drainage line towards the north east corner of the proposal site and is approximately 7 metres in height. It was noted that the upper perimeter of the scar had been subject to significant weathering. The oval scar is located on the trunk of the tree facing north east. The scar measure 370 centimetres in length by 36 centimetres in width and has a depth of 20 centimetres. The base of the scar is approximately 24 centimetres above the ground. No axe marks were visible.

Plate 5-185 Close up of scar at Tilbuster Solar Farm ST4.

Plate 5-186 View south-west of Tilbuster Solar Farm ST4.

Tilbuster Solar Farm ST5 *AHIMS # 21-1-0320*

This site consists of a scarred tree with two cultural scars considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is a dead, standing and of undetermined species, in poor condition that has two scars assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located south of Duval Creek on a lower slope in the central portion of the proposal site along the eastern perimeter. It is approximately 7 metres in height. Both scars are of a rounded rectangular shape. The south facing scar measures 65 centimetres in length by 40 centimetres in width and has a depth of 6 centimetres. The base of the scar is approximately 72 centimetres above the ground. The west facing scar is approximately 61 centimetres in length by 37 centimetres in width and has a depth of 5 centimetres. The base of the west scar is approximately 73 centimetres from the ground. No axe marks were visible. It was noted in the field by the registered Aboriginal parties that this tree may have been a marker tree related to movement around Mount Duval (a sacred site).

Plate 5-187 Close up of west scar at Tilbuster Solar Farm ST5.

Plate 5-188 Close up of south scar Tilbuster Solar Farm ST5.

Plate 5-189 View of west scar, facing east of Tilbuster Solar Farm ST5.

Plate 5-190 View of south scar, facing north of Tilbuster Solar Farm ST5.

Tilbuster Solar Farm ST6 *AHIMS # 21-1-0339*

This site consists of a scarred tree with two cultural scars considered to be Aboriginal in origin within a predominantly cleared paddock. The tree is alive, standing and appears to be a box species, in moderate condition that has two scars assessed as conforming to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The tree is located also within the central portion of the proposal site, west of the transmission line along the bottom of the hill slope and is approximately 5 metres in height. The narrow oval scar and the large misshapen oval scar are both located on the trunk of the tree facing west. The narrow oval scar measures 40 centimetres in length by 19 centimetres in width. The base of the scar narrow oval scar is approximately 87 centimetres above the ground. The misshapen larger oval scar measures 40 centimetres in length and 10 centimetres in width. The base of the larger misshapen oval scar is 47 centimetres from the ground. No axe marks were noted. The registered Aboriginal parties present during the survey indicated that the narrow oval scar may reflect manufacture of Coolamon and the larger oval scar some sort of food or water receptacle.

Plate 5-191 Close up of scar at Tilbuster Solar Farm ST6.

Plate 5-192 View north-west of Tilbuster Solar Farm ST6.

Cultural Scarred Trees (Figure 5-4)

Tilbuster Solar Farm CT1 *AHIMS # 21-1-0340*

The scar identified on this tree were determined to not be archaeological in nature and did not conform to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The morphological characteristics of the scarring are interpreted to conform with natural scarring (cf. Long 2005). Despite the general oval shape, the scar splits towards the base of the tree and this in association with splitting and degradation towards the top of the trunk likely indicates the result of natural scarring rather than cultural scarring. The assessment of the tree concluded it not to be consistent with Aboriginal scarring morphology is due to the amorphous shape of the scar and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was determined to be of cultural importance to the community.

 . Plate 5-193 Close up of scar at Tilbuster Solar Farm CT1.	 Plate 5-194 View north-west of Tilbuster Solar Farm CT1.

Tilbuster Solar Farm CT2 *AHIMS # 21-1-0316*

The scar identified on this tree were determined to not be archaeological in nature and did not conform to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The morphological characteristics of the scarring are interpreted to conform with natural scarring (cf. Long 2005). There is fleece evident along the bottom of the scar indicating sheep rubbing along the trunk of the tree may have contributed to damage. The assessment of the tree concluded it not to be consistent with Aboriginal scarring morphology due to the amorphous shape of the scar and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was determined to be of cultural importance to the community.

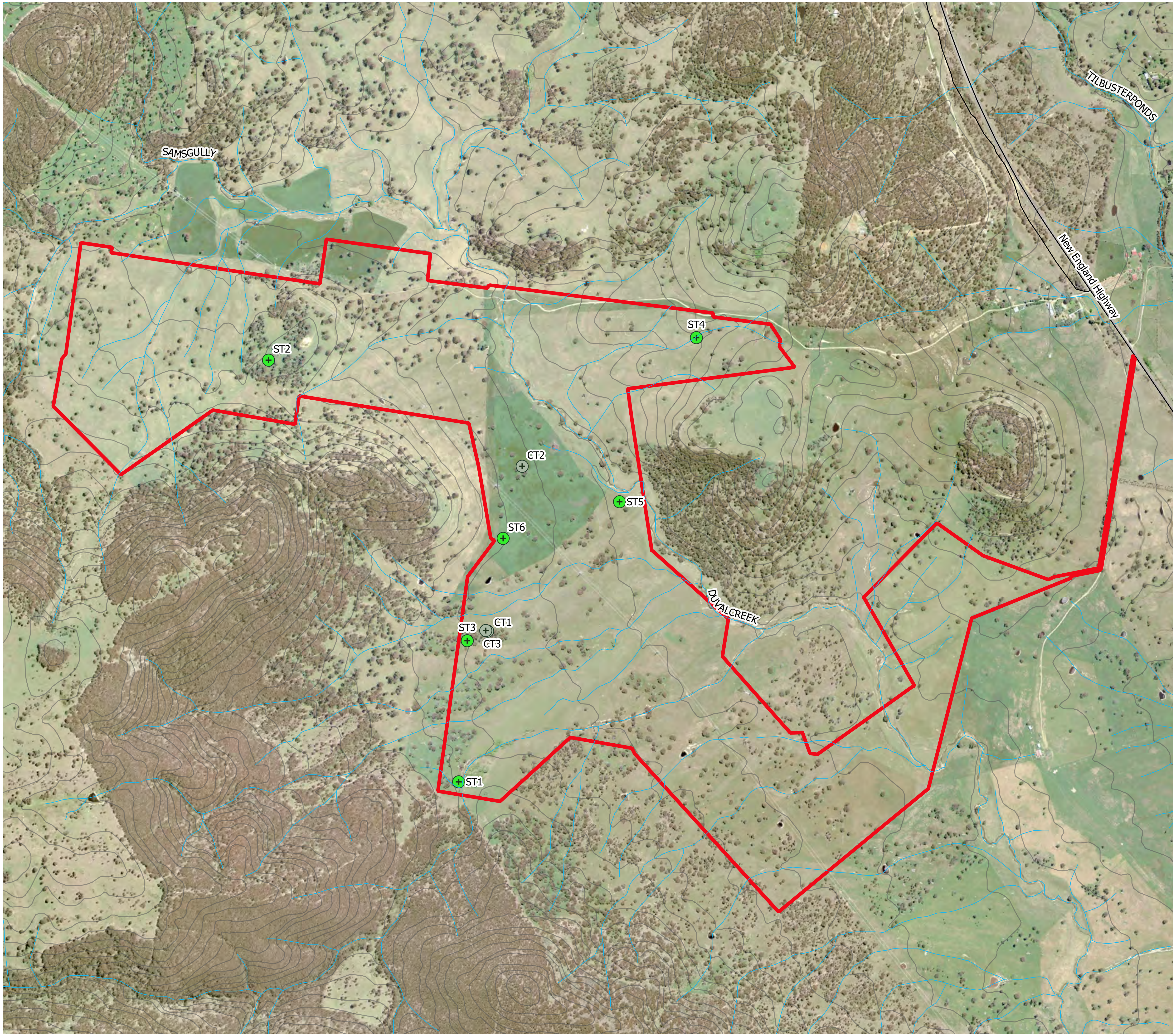
 Plate 5-195 Close up of scar at Tilbuster Solar Farm CT2.	 Plate 5-196 View north-west of Tilbuster Solar Farm CT2.

Tilbuster Solar Farm CT3 *AHIMS # 21-1-0341*

The scar identified on this tree were determined to not be archaeological in nature and did not conform to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The morphological characteristics of the scarring are interpreted to conform with natural scarring (cf. Long 2005). Modern axe marks were evident at regular intervals either side of the scar and the amorphous shape of the scar is likely associated with breakage from the likely European tree felling process. However, the Aboriginal community members present during the site survey indicated that this tree was determined to be of cultural importance to the community.

 Plate 5-197 Close up of scar at Tilbuster Solar Farm CT3.	 Plate 5-198 View north-west of Tilbuster Solar Farm CT3.

Figure 5-4: Scarred Trees and Cultural Trees identified during survey



Legend
Proposal site location
Recorded Trees
Cultural Tree (CT)
Scarred Tree (ST)
Roads
Waterways

0 150 300 450 600 750 900 m

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Ref: 18-645 Tillbuster SF Workspace 20191218 \ a3 land
Author: Chelsea. J
Date created: 17.01.2020
Datum: GDA94 / MGA zone 56

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5.1.6. Consideration of Potential for Subsurface Material

The field survey of the proposed Tilbuster Solar Farm proposal site, in conjunction with an assessment of contour data, archaeological modelling and consideration of the comments from the RAPs resulted in the identification of one location within the overall proposal site which was considered to have some potential to contain subsurface material, the depth of which would determine whether *in situ* material would be present or not. As such, this area required further assessment.

The PAD area was located in the southern and eastern portion of the proposal site on a lower slope landform in proximity to Duval Creek, within a paddock which did not contain sheep but had been subject to agricultural activities such as grazing. A large quantity of surface artefacts was identified across this paddock, which were divided into two artefact scatters and several isolated find sites, determined by landform unit and distance between surface finds. A disused and dilapidated feed station with a wooden frame and tin roof was also present within the paddock, indicating that it has once been utilised for livestock grazing. This PAD encompassed two artefact scatters (AS24 and AS25) and 3 isolated finds (IF49, IF52 and IF53).

Avoidance of the PAD was not considered a viable option for the solar farm proposal as the location was intended for the placement of solar panel arrays. Therefore, further archaeological assessment was undertaken in the form of test excavations in order to establish the nature and significance of any subsurface deposits.

The remaining parts of the proposal site were determined to contain little to no topsoil and it was assessed that subsurface potential was nil to low as a result of extensive erosion due to drought, vegetation clearance and livestock grazing.

Plate 5-199 View of PAD near AS25, facing south west across spur towards Duval Creek (mid-ground)

Plate 5-200 View of PAD from AS25 towards AS24, facing north and showing lower slope landform

5.2. TEST EXCAVATION

5.2.1. Excavation Methodology

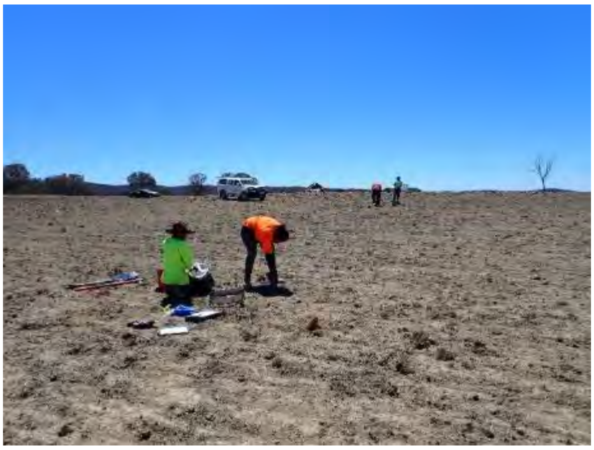
Based on the results of the survey component of this assessment it was determined that subsurface testing was required to investigate the presence and extent of archaeological material with the lower slope landform where it forms a spur above Duval Creek on which multiple surface artefacts were identified. The subsurface excavation was undertaken following the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2011). As such, the basic parameters of the investigation were limited to the methodology outlined in *the Code.* The following provides details of the methodology used in the testing strategy for the current Tilbuster Solar Farm subsurface testing program.

A total of sixteen 50 centimetres by 50 centimetres test pits were excavated. Test pits were numbered in sequential order as they were excavated. Two clusters of test pits were placed, one across the northern artefact scatter (AS25) adjacent to a shallow ephemeral drainage line feeding into Duval Creek, and one on the southern artefact scatter (AS24), overlooking Duval Creek. AS24 included two transects of pits running north-south and AS25 included four transects, running east-west. Test pits were placed at approximate 20 metre intervals along each of the transects with some deviation from this in order to investigate the drainage line cutting across this area. Excavation proceeded in line with the requirements of the Code of Practice and outlined in the methodology provided to the Aboriginal stakeholders. The test pitting methodology involved the following actions.

- Each test pit was 50cm x 50cm in area;
- The upper spits of the first pit at each PAD/Site was excavated by shovel in 5cm increments;
- Subsequent pits were excavated at 10cm spit depths to a clay, sterile layer, or until they were unable to be excavated by hand any deeper;
- All excavated material from each spit was dry sieved through a 5mm aperture sieve;
- Descriptions of soil and any other features were noted on standardised recording sheets;
- Photos were taken of each completed test pit (TP);
- Scale-drawn records of the stratigraphy/soil profile were completed for each TP;
- A sort through the residual gravels and material retained in the sieve was conducted in the field;
- Any suspected cultural material was retained and bagged according to pit and spit details for later recording in the lab; and
- All TPs were backfilled with the excavated deposit.

The recording and analysis of the artefacts recovered from the test excavations was undertaken at the NGH office in Newcastle. The artefacts had a range of variables and technological attributes recorded including the following:

- Provenance (pit number, spit number);
- Raw material;
- Technological category;
- Dimensions (maximum dimensions);
- Platform details (including type and presence of overhang removal);
- Cortex (type and %);
- Scar count and location;
- Usewear/retouch type and location; and
- General comments.

 Plate 5-201 View north towards location of TP1	 Plate 5-202 View west towards location of TP2
 Plate 5-203 View east to location of TP11	 Plate 5-204 View north to location of TP12

5.2.2. Testing Results

A total of 16 test pits were excavated during subsurface testing program undertaken at the proposed Tilbuster Solar Farm proposal site, from which 30 artefacts were recovered. The pits were excavated across two areas: near AS24 (Pits 1 to 9) and AS25 (Pits 10 to 16). From the 16 test pits, a total of 1.2125m^3 was excavated and dry sieved. Test pits depth ranged from 20 centimetres to 40 centimetres, with the majority of test pits excavated to a depth of 30 centimetres below the surface.

The artefacts recovered from the testing programme were present in Pits TP1, TP2, TP3, TP5, TP6, TP7, TP8, TP9 and TP13. Pits TP4, TP10, TP11, TP12, TP14, TP15 and TP16 did not contain artefacts. Pits TP10, TP11, TP12, TP14, TP15 and TP16 were located to the north of the elevated spur above Duval Creek, adjacent to a shallow ephemeral drainage line and below the crest on which the majority of AS24 artefacts were identified. This location was tested as it appeared to have greater depth in soils compared with further up the slope, however as a result of agricultural activities such as ploughing, in addition to water movement across the slope, much of the topsoils have eroded, and silty clay subsoils are present close to the surface. Disturbances to the soil profile were evident in all pits.

From the 16 test pits, a total of 1.2125m^3 was excavated and dry sieved. Test pits depth ranged from 20 centimetres to 40 centimetres, with the majority of test pits excavated to a depth of 30 centimetres below the surface. The locations of the test pits are shown in Figure 5-5 and all soil descriptions are provided in Appendix C.

5.2.3. Deposit Characteristics

The test excavation programme revealed a relatively homogenous soil profile across the lower slope landform, with a loose grey-brown sandy clayey silt forming the topsoils between 5 and 15 centimetres in depth, atop a more compact layer of the same, before very compact silty clay was reached, which generally appeared at approximately 30 centimetres depth. No modern inclusions were identified during excavations, and no charcoal or large roots were present. Evidence of bioturbation resulting from insect activity and rootlets of small plants was noted in most pits. Significant disturbance of soils was evident as a result of the agricultural use of the land, with plough furrows still evident across the site. This is likely the reason that soils were largely indistinguishable between pits, and the soil profile was for the most part stratified by compactness rather than natural layers of sediment. Due to the effects of drought, soils were compacted and difficult to excavate, with crow bars employed to assist in soil removal from pits.

Two test pits (TP1 and TP6) were excavated to a depth of 40 centimetres, as artefacts were identified at a depth of 30cm. In TP6, one artefact was recovered between 30- and 40-centimetres depth, however due to the nature of the clay layer, which was present at the base of the pit, the pit was terminated. Ploughing practices however may have contributed to post depositional stratigraphic shifting of materials, as the vast majority of artefacts identified in all pits were recovered from the top 10 centimetres (n=23, 76.7%). It is considered likely that artefacts identified in the lower layers had been displaced as a result of extensive soil disturbance.

The characteristics of the sediments recorded on site are summarised in Table 5-4 below.

Table 5-4 Sediment units at Tilbuster Solar Farm proposal site

Unit	Image	Sediment Description	Test Pits	Landform	Artefacts Present?
1		Grey-brown sandy clayey silt, with gravel inclusions, generally 0-15cm	All	Lower slope and spur	23
2		Compact grey-brown sandy clayey silt, generally 15-30cm, max 40cm	All	Lower slope and spur	6
3		Very compact/concreted, light grey silty clay	All	Lower slope and spur	1

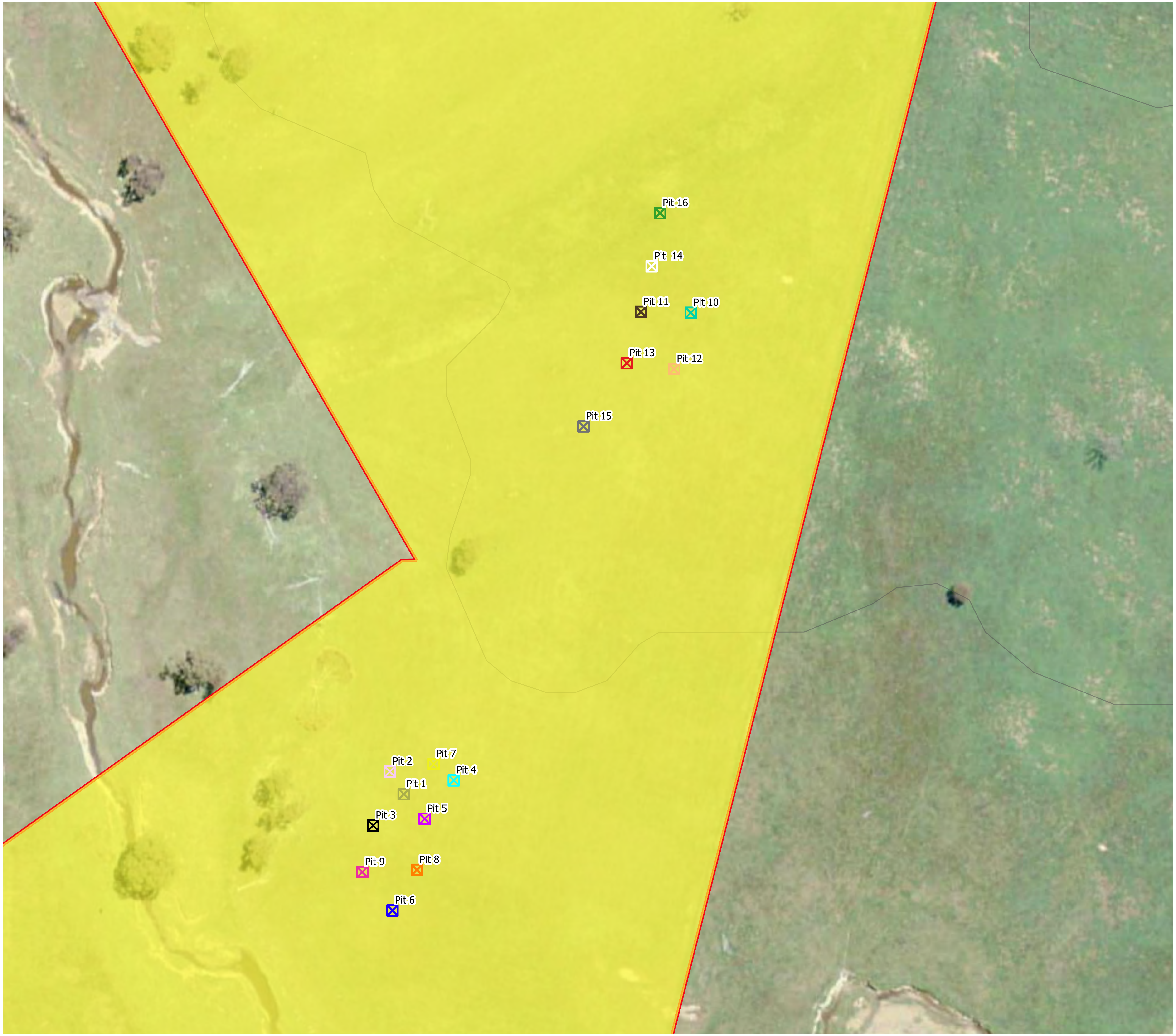


Figure : Location of Test Pits with Landform

Legend

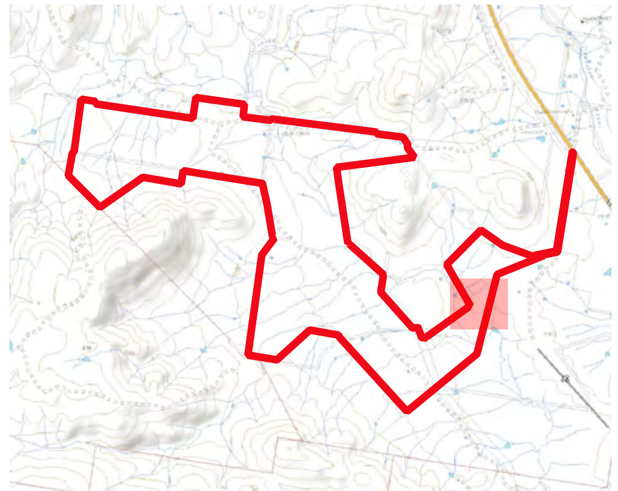
- Proposal site location
- Contours

Survey Units

- Lower Slopes
- Swamp/Low-lying Areas
- Upper Slopes

Test Pits

- Pit 1
- Pit 2
- Pit 3
- Pit 4
- Pit 5
- Pit 6
- Pit 7
- Pit 8
- Pit 9
- Pit 11
- Pit 12
- Pit 13
- Pit 14
- Pit 15
- Pit 16
- Pit 10



0 25 50 75 100 m

Data Attribution

Ref: 18-645 Tillbuster SF Workspace 20191218_qfield.qgs \ a3 land
Author: Chelsea. J
Date created: 11.03.2020

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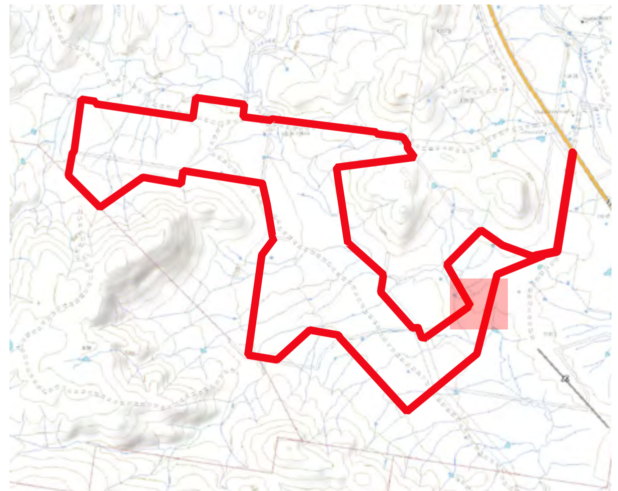
Figure 5-6: Location of Test Pits

Legend

- Proposal site location
- Contours

Test Pits Excavated

- Pit 1
- Pit 2
- Pit 3
- Pit 4
- Pit 5
- Pit 6
- Pit 7
- Pit 8
- Pit 9
- Pit 11
- Pit 12
- Pit 13
- Pit 14
- Pit 15
- Pit 16
- Pit 10



0 25 50 75 100 m

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5.2.4. Material Recovered from Test Pits

As noted above, seven out of the 16 test pits did not contain artefacts, with a total of 30 artefacts recovered from the remaining nine pits. The artefact data is provided in Appendix B, and a breakdown of the data has been provided in Table 5-5 and Table 5-6. The spatial distribution of the subsurface cultural material recovered during the current testing programme at the proposed Tilbuster Solar Farm is shown in Figure 5-9.

The distribution through the soil profile as shown in Table 5-5 indicates that the majority of artefacts were retrieved from spit 1 (0 to 10 centimetres below the surface) (n=23, 76.7%), with artefact numbers decreasing drastically below 10 centimetres depth, with four artefacts recovered from between 10 to 20 centimetres (n=4, 13.3%), two artefacts recovered from between 20 to 30 centimetres (n=2, 6.67%) and one artefact recovered from between 30 to 40 centimetres (n=1, 3.33%). The compaction of soils from a shallow depth combined with the agricultural disturbance is likely to explain the general presence of artefacts on the ground surface and in the top 10 centimetres in comparison with the limited numbers in deeper layers.

When the data is separated by pit location and associated landform unit it is noted that only one pit (TP13) of those excavated near AS24, on the slope adjacent to an ephemeral drainage line, contained artefacts (n=2), which were both within spit 1 (10 to 20 centimetres). The remainder of the artefacts were recovered from the pits located on the spur overlooking Duval Creek near AS25. Of nine pits excavated near AS25, only one did not contain any artefacts (TP4), while all others on this landform contained at least one artefact.

Table 5-5. Distribution of artefacts by test pit and spit

Spit	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP12	TP13	TP14	TP15	TP16	TOTAL
1 (0-10 cm)	5	2	4	0	1	2	2	5	0	0	0	0	2	0	0	0	**23**
2 (10-20 cm)	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	**4**
3(20-30 cm)	2	0	0	0	0	0	0	0	0	0	0	0	n/a	0	n/a	0	**2**
4 (30-40 cm)	0	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**1**
Total	**7**	**2**	**6**	**0**	**1**	**3**	**2**	**5**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**30**

While the vast majority of artefacts were retrieved from the upper 10 centimetres, some few artefacts were recovered between 10- and 40-centimetres depth. Specifically, TP3 and TP9 contained artefacts in spit 2 (10-20 centimetres), while TP1 contained an artefact in spit 3 (20-30 centimetres) and TP6 contained an artefact in spit 4 (30-40 centimetres). These pits were generally located lower down the spur landform unit than the pits which contained only artefacts in spit 1. Pits with artefacts only in spit 1 were generally located on the more level portion of the spur. It is likely that the ploughing of the paddock has resulted in movement of topsoil further down the slope and may have therefore resulted in the covering of already disturbed artefacts with additional sediment.

It is considered unlikely that any of the artefacts identified were in situ, as the soils were shallow and exhibited evidence of disturbances throughout, as a result of agricultural activities and bioturbation. The limited number of subsurface artefacts and absence of *in situ* material prevents any meaningful analysis of technology, distribution or density but the data in combination with the surface artefact data does provide an indication of the distribution of archaeological material across the lower slopes in a broader sense within the proposal site.

Table 5-6 shows the technological characteristics of the artefacts recovered from the test pits. The majority of artefacts as shown in Figure 5-7 were flakes (n=14, 46.67%); followed by flake fragments including proximal fragments (n=7, 23.33%), distal fragments (n=3, 10%), medial fragments (n=3, 10%); as well as geometric microliths (n=2, 6.67%) and split flakes (n=1, 3.33%). The technological characteristics of the artefacts would suggest they were for the most part discarded pieces formed as collateral during the manufacture of a general-purpose toolkit. Such tools would likely have been manufactured as required, with some blade manufacturing potentially occurring onsite. This is consistent with the core and flake industry as outlined by Witter (1990) and consistent with observations made in the region and local area by Godwin (1993), Davidson and Appleton (1990) and Burke et al (2000). It is also worth noting that the high number of flake fragments is likely a result of damage sustained as a result of ploughing.

Table 5-6 Breakdown of lithology and artefact types by pit

Test pit	Lithologies					Typologies						Total
	Silcrete	Chert	Chalcedony	Greywacke	Quartz	Flake	Proximal frag	Distal frag	Medial frag	Geometric microlith	Split flake	
TP1	5	2				3	1	1	1	**1**		**7**
TP2			1		1		1	1				**2**
TP3	4	2				3	3					**6**
TP5				1		1						**1**
TP6	2	1				1	1				**1**	**3**
TP7	2					1				**1**		**2**
TP8	3	1			1	2	1	1	1			**5**
TP9	2					2						**2**
TP13		1		1		1			1			**2**
Total	**18**	**7**	**1**	**2**	**2**	**14**	**7**	**3**	**3**	**2**	**1**	**30**

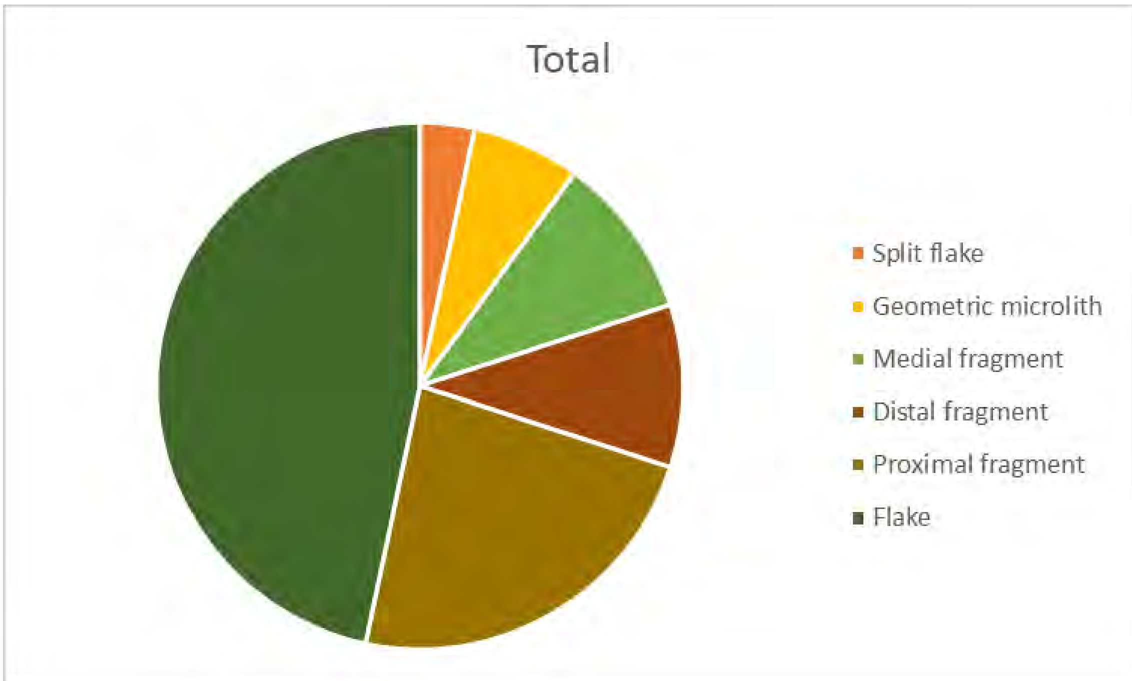


Figure 5-7 Artefact types by quantity, recovered from test excavation

The excavated artefacts were predominantly manufactured from silcrete (n=18, 60%), however it should be noted that in the New England region, and specifically in the area around Armidale, a variety of 'silcretes' are present and the classification of silcrete here does not mean that all artefacts were manufactured from identical raw material. The next most commonly occurring raw material within the subsurface assemblage was chert (n=7, 23.33%), followed by greywacke (n=2,6.67%) and quartz (n=2, 6.67%) and one artefact manufactured from chalcedony (n=1, 3.33%). This is shown in Table 5-6 and Figure 5-8.

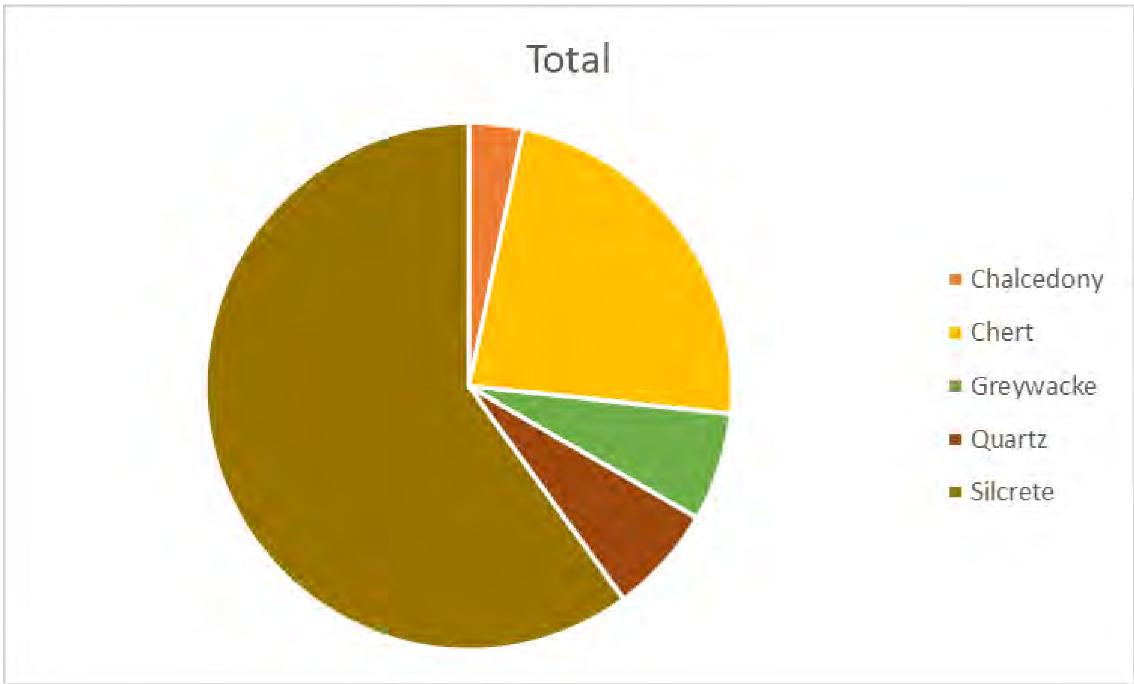


Figure 5-8 Raw materials recovered from subsurface excavation

Plate 5-205 Artefacts recovered from TP1 near AS25, including one chert distal fragment and a medial fragment, flake and geometric microlith all manufactured from silcrete

Plate 5-206 Silcrete geometric microlith recovered from TP1, image showing backing on lateral edge

Plate 5-207 Artefacts recovered from TP3, two silcrete proximal fragments

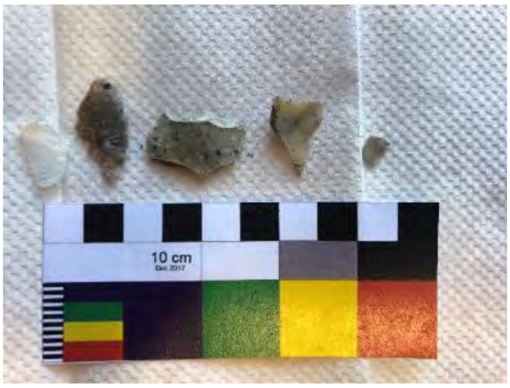


Plate 5-208 Artefacts recovered from TP8, including proximal, distal and medial fragments of silcrete, a quartz flake and a chert flake

Plate 5-209 Artefacts from TP9, including a grey silcrete flake and a red yellow silcrete flake containing 50% cortex. Note difference between two materials, both "silcrete".

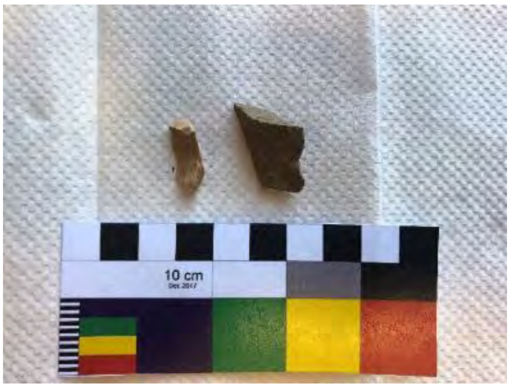


Plate 5-210 Artefacts from TP13, including one chert flake and one greywacke flake

Within the subsurface assemblage, two artefacts contained cortex (n=2, 6.67%), one of which exhibited up to 50% cortex, suggesting primary reduction stages for that artefact, while the other contained only 5% cortex. Both artefacts were manufactured from silcrete, however each was made using different silcrete types.

The subsurface density of artefacts recovered from the test pits during the current assessment averaged 23.52/m^3, ranging from 13.33/m^3 (excluding pits with zero artefacts) up to 80/m^3 (average calculations only – based on the quantity of artefacts recovered from the 500mmx500mm test pits). The subsurface archaeological material appears to occur at the highest densities on the spur overlooking Duval Creek. This landform unit contained a moderate density of artefacts, which ranged from 80/m^3 (TP3) to 13.33/m^3 (TP5). The area in the north of the PAD, near AS24, contained only one pit with artefacts, with an average density calculated to be 36.36/m^3. Where the calculations are separated by area (AS24 and AS25), the average number of artefacts per m^3 at AS25 is calculated to be 37.77/m^3 and the average for AS24 is calculated to be 5.19/m^3.

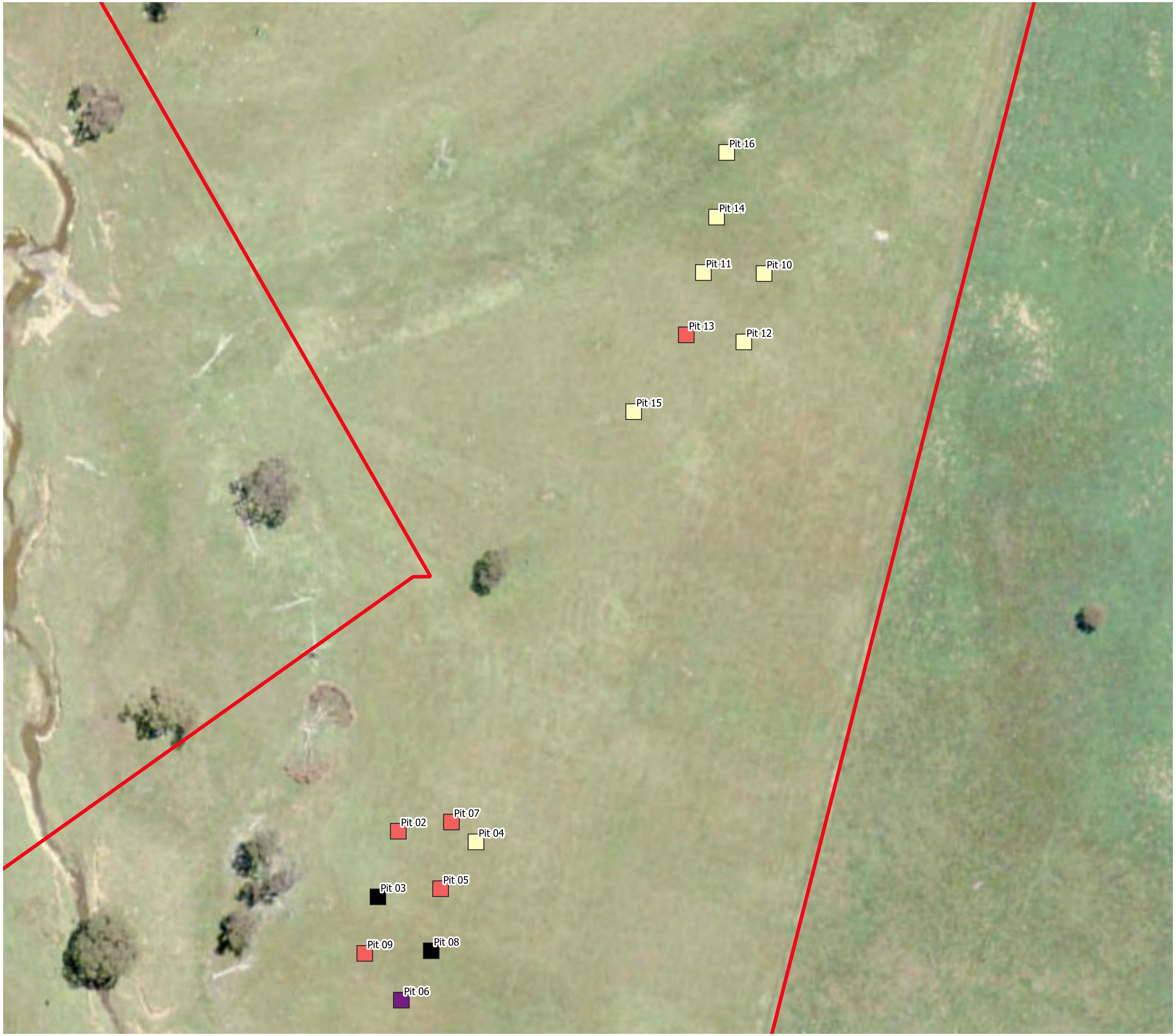
The presence of the artefact assemblage on the lower slope spur overlooking Duval Creek is in keeping with modelling for the region, with particular reference to Godwin (1993) and Appleton (2000), whereby occupation sites are identified in open woodlands and lower slopes, and in association with permanent watercourses (noting that Duval Creek is usually a permanent watercourse and has dried up only as a result of extreme drought conditions at the time of writing).

The artefacts recovered from the current subsurface testing program are likely to be waste materials from the flaking process, particularly as few formal tool types were recorded. The low number of cores may be representative of the low discard rate of raw materials brought into the area or merely a sampling bias. The artefacts themselves however are typical of the region and do not appear to represent any departure from the basic toolkit used by Aboriginal people.

The artefacts identified during the current survey and the subsurface testing programme are previously unrecorded sites. The artefacts identified during the test excavation are likely to have formed part of a subsurface deposit which has now been significantly affected by the ploughing activities, resulting in an absence of *in situ* material. Figure 5-9 shows the test pits with subsurface artefacts recorded during the current testing programme. The pattern and density of the stone artefacts recorded along Duval Creek and its tributaries suggest that the area was visited frequently by Aboriginal people. Although the range of stone artefact types recorded is limited, the occurrence of at least moderate densities of surface and subsurface artefacts, including formal tool types such as hand axes and hammerstones across the area suggests people stopped at this location to undertake tool maintenance and resource procurement or such activities.

It should also be noted that as a consequence of the concreted clayey silt and clay sediment, pits were excavated to a maximum of 40 centimetres, with most being terminated at 30 centimetres depth and two pits were terminated at just over 20 centimetres depth. Excavation to those depths was in accordance with the Code of Practice, as B horizon clays are generally archaeologically sterile.

Figure 5-9: Artefact Distribution in Test Excavation Program



Legend

Proposal site location

Contours

Test Pit Counts

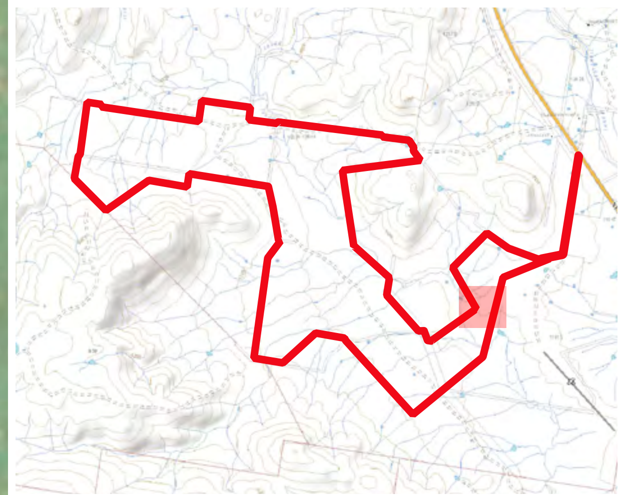
0-0

0-2

2-3

3-9

Count	Site
9	Pit 01
2	Pit 02
6	Pit 03
0	Pit 04
1	Pit 05
3	Pit 06
2	Pit 07
5	Pit 08
2	Pit 09
0	Pit 10
0	Pit 11
0	Pit 12



0 25 50 75 m

Data Attribution
© NGH 2020
© LPI 2019

Ref: 18-645 Tillbuster SF Workspace
20191218_qfield.qgs \ a3 land
Author: Chelsea. J
Date created: 11.03.2020

NGH

5.3. ARTEFACT DATA - DISCUSSION

Based on the site modelling it was generally predicted that stone artefacts were the most likely evidence of past Aboriginal occupation to be present across the proposed Tilbuster Solar Farm proposal site. Such evidence was most likely to occur along lower slope landforms including landform units such as low elevated spurs and creek terraces in proximity to Duval Creek and its tributaries. The identification of surface and subsurface artefacts at the previously unrecorded sites across the proposal site within lower slope landforms associated with Duval Creek has substantiated the modelling of the area.

Three pits excavated as part of the testing programme contained five (5) artefacts or more (TP1, TP3 and TP8), however due to the extensive disturbances this data cannot be extrapolated to conclude that activities were concentrated at the locations of these pits. It can, though, be shown that in general the concentration of artefacts on the spur above Duval Creek, though no longer in situ, is indicative of the central activity area which may have been visited a number of times or for an extended period of time.

The broad low gently sloping to level lower slopes would once have provided suitable space for occupation by past Aboriginal people. In general, the evidence suggests that the lower slopes along Duval Creek may have been a focus of Aboriginal occupation within the landscape, particularly given its location adjacent to a number of known culturally significant sites. Furthermore, the availability of raw stone materials suitable for manufacturing stone tools, and the likelihood that the proposal site was once vegetated by open woodlands which would have contained an abundance of flora and fauna (also attracted by the water source) which formed important resources for past Aboriginal people.

Consistent with the findings of the test excavations, the surface artefacts recorded were predominantly silcrete artefacts including flakes, and portions of flakes including proximal, distal and medial fragments, broken flakes, split flakes and flaked pieces. However, while no cores were identified in the subsurface assemblage, over 10% of the surface artefacts were recorded as cores. In general, this is likely because cores are *generally* bulkier than flake type artefacts, making them less susceptible to vertical movement both during ploughing and during the natural contraction of the clay subsoils. A number of tools were identified including ground edge axes, scrapers and backed blades. The presence of ground edge axes indicates that there was likely a suitable surface for the grinding of such tools in the local area, though grinding groove sites were not identified within the proposal site. Furthermore, axes would likely have been utilised for the purpose of removing wood and bark and wood from trees for the purposes of construction of shelters, shields, canoes, and coolamons, forming scars on the trees such as those recorded on site. The presence of a hammerstone at AS25 indicates that raw material reduction processes and stone tool manufacture was likely to have occurred at this site and at other site locations within the proposal site too. The presence of backed artefacts provides a broad range date for the sites. The process of ‘backing’ is characterised by unidirectional or bidirectional retouch of one lateral edge of a flake. This technique, while present in assemblages as old as 40,000 years before present elsewhere in the world, appeared on the Australian continent approximately 5,000 years ago and forms part of the Australian small tool tradition (Holdaway and Stern 2004:259-260). As such it can be concluded that the sites identified within the proposal site are less than 5,000 years in age. In the same way, the presence of ground-edge stone axes in in the southern parts of Australia are thought to date to no earlier than a few thousand years ago (Hiscock 2008:110).

A previous investigation which included a portion of the current proposal site identified no artefact scatters and one isolated find only within the proposal site (Burke et al 2000). As such, the quantity of surface artefacts identified across the site was somewhat unexpected. However, in general, previous archaeological surveys confirm the presence of sites and artefacts across the landscape within the broader Tilbuster area. The predictive modelling indicates that the most common site types likely to be present in the proposal site would be stone artefact sites, which would occur in proximity to geological outcrops of suitable raw stone materials, adjacent to watercourses and on ridges and spurs with views over watercourses. The survey and test excavation programme confirmed these predictions, with the majority of high-density surface scatters located adjacent to Duval Creek, and one located overlooking a third order tributary of Duval Creek.

Material composition of the artefacts recorded was predominantly characterised by silcrete material, which is also in keeping with the findings of past investigations for the Armidale region. The Armidale region also contains sources of a number of other suitable raw materials which were represented to lesser degrees, such as quartz, chert, greywacke, basalt and other unidentified volcanic types. This is likely due to the high quality and readily available silcrete varieties, which are favourable for the manufacture of stone tools due to the siliceous nature of the fabric. The presence of cores, hammer stones and flakes indicate that tool manufacture likely occurred onsite.

As noted above, silcrete occurs in a number of forms and is generally defined on the basis of micromorphology. As such the classification of artefacts identified during the survey and test excavation programme as 'silcrete' does not allow for the variation in this stone raw material type. Silcrete is a sedimentary rock formed from the concretion of sediments by a quartz-like cement. Varieties identified on site ranged from fine matrix-supported silcretes through to coarser grain-supported types, with colours from white and cream through to grey, yellow and brown. It is therefore considered that the variety of raw materials suitable for stone tool manufacture available in the region was extensive. The dominance of silcrete types suggests that these materials were locally available, potentially as both cobbles available from nearby waterways including Duval Creek and Tilbuster Ponds, as well as primary source outcrops, which would explain the variety of silcrete types as well as its abundance. However, the near absence of cortex within the assemblage indicates that primary and secondary production stages may have been happening elsewhere, which correlates with the results of previous studies such as Burke et al (2000).

Comparisons with past studies are limited to information retrieved from survey work, as few test excavation programmes have been undertaken in the immediate vicinity of the proposal site. In general, the number of artefacts identified in the proposal site in comparison with sites such as the quarries identified by Davidson and Appleton (1990) is low, however it is significantly higher than previous studies undertaken more local to Tilbuster, and is nonetheless indicative of land use by medium to large groups of Aboriginal people in the past. Appleton's (1990) observation regarding the presence of artefact sites in secondary context on erosion features are also consistently demonstrated within the Tilbuster Solar Farm proposal site. It should also be noted that predictions regarding the occurrence of silcrete types made by Appleton (1990) and refuted by Burke et al (2000) were also refuted by the results of this assessment within the current proposal site, where fine-grained cream coloured silcretes were identified within a number of scatters and as isolated finds across the landscape, in addition to the coarse-grained grey types.

While it is necessary to consider the impact of agricultural activities and erosional processes on the artefact distribution across the proposal site, the pattern of distribution clearly demonstrates that artefacts are likely to be spread over the lower slopes in close proximity to creeks and tributaries even where some disturbance has occurred. Based on this conclusion, there is every chance that there are similar artefact scatters across similar topographic features along Duval Creek wherever the lower slopes allow the formation of flats and terraces.

The distribution of cultural material across the landscape, including the presence of artefact sites, provide an indication that the site was revisited on multiple occasions. The site types, artefacts and raw materials are common for the region and it should be noted that this investigation has increased the number of sites recorded in the local area significantly. The dominance of artefacts as a common site type within the area is further supported by the results of the survey and testing programme. The implications for this relate to significance assessments and the appraisal of site representativeness. The results of the current archaeological programme have provided an opportunity for the characterisation of the archaeology and disturbance across the landscape, largely due to the proposal site shape in comparison with the linear nature of the Qld Interconnection Project survey undertaken by Burke et al (2000). The nature of the current proposal site was such that a broader insight into land use patterns could be gained.

It is likely that there are many more similar sites within the local area on properties which have not yet been subject to archaeological survey, however not all such sites would have an association with an important cultural site.

6. CULTURAL HERITAGE VALUES AND STATEMENT OF SIGNIFICANCE

The assessment of the significance of Aboriginal archaeological sites is currently undertaken largely with reference to criteria outlined in the ICOMOS Burra Charter (Marquis-Kyle and Walker 1994). Criteria used for assessment are:

- ***Social or Cultural Value:*** In the context of an Aboriginal heritage assessment, this value refers to the significance placed on a site or place by the local Aboriginal community – either in a contemporary or traditional setting.
- ***Scientific Value:*** Scientific value is the term employed to describe the potential of a site or place to answer research questions. In making an assessment of scientific value issues such as representativeness, rarity and integrity are addressed. All archaeological places possess a degree of scientific value in that they contribute to understanding the distribution of evidence of past activities of people in the landscape. In the case of flaked stone artefact scatters, larger sites or those with more complex assemblages are more likely to be able to address questions about past economy and technology, giving them greater significance than smaller, less complex sites. Sites with stratified and potentially in situ sub-surface deposits, such as those found within rock shelters or depositional open environments, could address questions about the sequence and timing of past Aboriginal activity, and will be more significant than disturbed or deflated sites. Groups or complexes of sites that can be related to each other spatially or through time are generally of higher value than single sites.
- ***Aesthetic Value:*** Aesthetic values include those related to sensory perception and are not commonly identified as a principal value contributing to management priorities for Aboriginal archaeological sites, except for art sites.
- ***Historic Value:*** Historic value refers to a site or place's ability to contribute information on an important historic event, phase or person.
- ***Other Values:*** The Burra Charter makes allowance for the incorporation of other values into an assessment where such values are not covered by those listed above. Such values might include Educational Value.

All sites or places have some degree of value, but of course, some have more than others. In addition, where a site is deemed to be significant, it may be so on different levels or contexts ranging from local to regional to national, or in very rare cases, international. Further, sites may either be assessed individually, or where they occur in association with other sites the value of the complex should be considered.

Social or cultural value

While the true cultural and social value of Aboriginal sites can only be determined by local Aboriginal people, as a general concept, all sites hold cultural value to the local Aboriginal community. An opportunity to identify cultural and social value was provided to all the registered Aboriginal stakeholders for this proposal through the draft reporting process. The following information has been provided to NGH regarding cultural significance of the proposal site.

A number of cultural sites have been identified in proximity to the proposal site, particularly to the south of the proposal site near Sunnyside Road. Duval Mountain itself, located to the south of the proposal site, has been identified as a place of cultural significance relating to spiritual beliefs of Aboriginal people. The following information was provided by Iwatta Aboriginal Corporation regarding cultural significance in the proposal site:

[redacted]

[redacted]

[redacted]

[redacted]

In addition to this information, a number of maps were provided indicating the locations of culturally significant locations mentioned in this text. These maps have not been provided for reasons of confidentiality.

Nunnawanna Aboriginal Corporation also noted that Mt Duval is a place of high cultural significance to the local Aboriginal people.

Nyakka Aboriginal Culture Heritage Corporation Archaeological & Cultural Heritage Consultants also noted that the local area around the Tilbuster Solar Farm development area contains a number of important women's sites and the significance of the area as part of the cultural landscape with regard to these sites must be considered.

Therefore the cultural significance of the proposal site is therefore assessed by the registered Aboriginal parties to be high for its association with a number of significant spiritual and cultural activity sites, in addition to the archaeological evidence for the use of the area as a campsite.

In particular, scarred tree site ST5, which contains two scars, is significant for its association with cultural activities.

Scientific (archaeological) value.

The archaeological value of the site has been assessed as an overall complex, as well as by individual site. The details of this assessment are outlined below and in Table 6-1.

The low number of subsurface artefacts recovered during the current investigation restricts the ability to extrapolate other aspects of Aboriginal site use. The absence of cultural charcoal from the testing program means that there is no potential for dating of the site using radiocarbon. The lack of temporal context of the assemblage diminishes much of the research potential. While individually the artefacts are interesting, the sites are considered typical of the local and broader archaeological record. Nevertheless, this assemblage is larger than many previously identified in local studies and contains a number of significant formal tool types including axes, scrapers and backed blades. The relationship between Duval Creek (and its tributaries) and the archaeological sites is of some significance for the modelling of site occurrences in the locality, as it correlates with the landscape predictions made by previous studies. Furthermore, the presence of a variety of material types, including several silcrete types, may provide further information about the accessibility of favoured raw materials. Unfortunately, no portion of these sites is assessed to be undisturbed and as such further detail about the sites is based only on assumptions.

The presence of six scarred trees bearing scars of differing sizes and apparent purposes are assessed to have moderate to high scientific significance as they are an archaeological manifestation of the use of the area for resource gathering as well as for navigation and communication.

Therefore, research potential, representativeness and rarity of the overall proposal site is considered moderate.

Table 6-1 Individual scientific significance of each site

Site Name	Site Type	Individual significance
Tilbuster Solar Farm IF1	Isolated find	Low
Tilbuster Solar Farm IF2	Isolated find	Low
Tilbuster Solar Farm IF3	Isolated find	Low
Tilbuster Solar Farm IF4	Isolated find	Low
Tilbuster Solar Farm IF7	Isolated find	Low
Tilbuster Solar Farm IF8	Isolated find	Low
Tilbuster Solar Farm IF9	Isolated find	Low
Tilbuster Solar Farm IF10	Isolated find	Low
Tilbuster Solar Farm IF11	Isolated find	Low
Tilbuster Solar Farm IF12	Isolated find	Low
Tilbuster Solar Farm IF13	Isolated find	Low
Tilbuster Solar Farm IF14	Isolated find	Low
Tilbuster Solar Farm IF15	Isolated find	Low
Tilbuster Solar Farm IF16	Isolated find	Low
Tilbuster Solar Farm IF18	Isolated find	Low
Tilbuster Solar Farm IF19	Isolated find	Low
Tilbuster Solar Farm IF21	Isolated find	Low
Tilbuster Solar Farm IF22	Isolated find	Low
Tilbuster Solar Farm IF23	Isolated find	Low
Tilbuster Solar Farm IF24	Isolated find	Low
Tilbuster Solar Farm IF25	Isolated find	Low
Tilbuster Solar Farm IF26	Isolated find	Low
Tilbuster Solar Farm IF27	Isolated find	Low
Tilbuster Solar Farm IF28	Isolated find	Low

Tilbuster Solar Farm IF29	Isolated find	Low
Tilbuster Solar Farm IF30	Isolated find	Low
Tilbuster Solar Farm IF31	Isolated find	Low
Tilbuster Solar Farm IF32	Isolated find	Low
Tilbuster Solar Farm IF33	Isolated find	Low
Tilbuster Solar Farm IF34	Isolated find	Low
Tilbuster Solar Farm IF35	Isolated find	Low
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Tilbuster Solar Farm IF40	Isolated find	Low
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Tilbuster Solar Farm IF42	Isolated find	Low
Tilbuster Solar Farm IF43	Isolated find	Low
Tilbuster Solar Farm IF44	Isolated find	Low
Tilbuster Solar Farm IF45	Isolated find	Low
Tilbuster Solar Farm IF46	Isolated find	Low
Tilbuster Solar Farm IF47	Isolated find	Low
Tilbuster Solar Farm IF48	Isolated find	Low
Tilbuster Solar Farm IF49	Isolated find	Low
Tilbuster Solar Farm IF50	Isolated find	Low
Tilbuster Solar Farm IF51	Isolated find	Low
Tilbuster Solar Farm IF52	Isolated find	Low
Tilbuster Solar Farm IF53	Isolated find	Low
Tilbuster Solar Farm AS1	Artefact scatter	Moderate

Tilbuster Solar Farm AS2	Artefact scatter	Low
Tilbuster Solar Farm AS3	Artefact scatter	Low
Tilbuster Solar Farm AS4	Artefact scatter	Moderate
Tilbuster Solar Farm AS5	Artefact scatter	Low
Tilbuster Solar Farm AS6	Artefact scatter	Low
Tilbuster Solar Farm AS7	Artefact scatter	Low
Tilbuster Solar Farm AS8	Artefact scatter	Low
Tilbuster Solar Farm AS9	Artefact scatter	Low
Tilbuster Solar Farm AS10	Artefact scatter	Low
Tilbuster Solar Farm AS11	Artefact scatter	Low
Tilbuster Solar Farm AS12	Artefact scatter	Low
Tilbuster Solar Farm AS13	Artefact scatter	Low
Tilbuster Solar Farm AS14	Artefact scatter	Low
Tilbuster Solar Farm AS15	Artefact scatter	Low
Tilbuster Solar Farm AS16	Artefact scatter	Moderate
Tilbuster Solar Farm AS17	Artefact scatter	Low
Tilbuster Solar Farm AS18	Artefact scatter	Low
Tilbuster Solar Farm AS19	Artefact scatter	Low
Tilbuster Solar Farm AS20	Artefact scatter	Low
Tilbuster Solar Farm AS21	Artefact scatter	Low
Tilbuster Solar Farm AS22	Artefact scatter	Low
Tilbuster Solar Farm AS23	Artefact scatter	Moderate
Tilbuster Solar Farm AS24	Artefact scatter	Moderate
Tilbuster Solar Farm AS25	Artefact scatter	Moderate
Tilbuster Solar Farm AS26	Artefact scatter	Low
Tilbuster Solar Farm AS27	Artefact scatter	Low

Tilbuster Solar Farm AS28	Artefact scatter	Low
Tilbuster Solar Farm ST1	Scarred tree	Moderate - High
Tilbuster Solar Farm ST2	Scarred tree	Moderate - High
Tilbuster Solar Farm ST3	Scarred tree	Moderate - High
Tilbuster Solar Farm ST4	Scarred tree	Moderate - High
Tilbuster Solar Farm ST5	Scarred tree	Moderate - High
Tilbuster Solar Farm ST6	Scarred tree	Moderate - High
Tilbuster Solar Farm CT1	Cultural tree	Low
Tilbuster Solar Farm CT2	Cultural tree	Low
Tilbuster Solar Farm CT3	Cultural tree	Low

Aesthetic value

There are no specific aesthetic values associated with the archaeological sites, apart from the presence of Aboriginal artefacts and modified trees in the landscape and the outlook of some site locations over Duval Creek.

Historic Value

There are no known historic values associated with the proposal site or the sites identified.

Other Values

There are no other known heritage values associated with the proposal site. The area may have some educational value (not related to archaeological research) through possible provision of educational material to the public about the Aboriginal occupation and use of the area. Educational material could be presented as an information board. The presentation of educational material about the Aboriginal occupation and use of the area could be developed in consultation with the local Aboriginal community.

7. PROPOSED ACTIVITY

7.1. HISTORY AND LANDUSE

The proposal site was originally part of land purchased by the Bank of New South Wales and since the mid-nineteenth century has been subjected to extensive vegetation clearing to accommodate pastoral and agricultural activities, as well as the creation and maintenance of the electricity easements which crisscross the property. Additionally, a number of small-time gold mining ventures have occurred along Duval Creek and may have included disturbances such as dredging and diversion of the creek, modifying the landscape.

Land disturbances within the proposal site are largely those commonly associated with farming practices and the construction of a residential dwelling within the proposal site. These ground disturbance activities have resulted in a disturbed landscape that however still retains its larger pre-European landforms which are readily identifiable as lower slope, upper slope and low-lying swamp landforms. However, the soils in the proposal site have been impacted by broad scale vegetation clearance, succeeded by grazing and cropping, which in combination with severe drought conditions, has culminated in the near-total removal of topsoils. Despite disturbances and impacts, Aboriginal artefacts remain in the crest landform and evidence attesting to the presence of archaeological sites and the Aboriginal use of the area has been retained despite the severe erosion. While the archaeological integrity of the area has been compromised through land use practises, the presence of the stone artefacts attests to their resilience and abundance, though contextual information is for the most part lost.

7.2. PROPOSED DEVELOPMENT ACTIVITY

As noted above in section 1.1, the proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 152 Megawatts (AC) to be supplied directly to the national electricity grid.

Key development and infrastructure components would include:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8km in length
- Perimeter security fencing
- Security camera poles
- Construction of creek crossing as required
- Native vegetative screening as required

7.3. ASSESSMENT OF HARM

The archaeological assessment has identified a total of 49 isolated finds, 26 artefacts scatters, six scarred trees and three cultural trees within the proposal site. The assessment of the significance of Aboriginal archaeological sites is currently undertaken largely with reference to criteria outlined in the ICOMOS Burra Charter (Marquis-Kyle and Walker 1994). The survey participants agreed that all sites hold cultural value to the Aboriginal community, with particular reference to a number of significant cultural sites located close to the proposal site in association with Mt Duval and other landmarks. The impact to the scientific values of the 75 artefact sites and nine trees if they were to be impacted by the proposal is considered moderate to high. There were no aesthetic values and no historic values identified in association with the proposal site however the location does present an opportunity for education of the general public to the Aboriginal occupation and use of the area.

An assessment of the proposed development footprint has identified that of the total number of sites, 45 are within the proposed impact zones of the array and site facilities, including 23 isolated finds, 18 artefact scatters and three scarred trees and one cultural tree. It should be noted however that an additional 16 sites are located immediately adjacent to impact areas and it is considered likely that there may be incidental or indirect impacts to these locations. Table 7-1 outlines the impacts to the known sites within the proposal site, based on the information provided. The information provided in the table is based on the footprint as shown in Figure 7-1.

7.3.1. No Impact Zones

The development footprint does not include the total proposal site, as indicated in Figure 1-1 and Figure 1-2. The archaeological survey included the entirety of the proposal site in order to meet best practice requirements and ensure that all potential impacts to Aboriginal heritage could be adequately assessed. However, this assessment considers that where Aboriginal objects have been recorded outside the proposed development footprint, this represents an opportunity to establish “no impact” zones, whereby access to these areas would be restricted to use of existing vehicle tracks by light vehicles *only* or access by pedestrians. No plant, heavy machinery, laydown areas, excavation or other ground surface disturbance works would be permitted within these areas.

Figure 7-2 has been prepared to indicate the areas for which “no impact” zones must be designated, based on the development footprint and overall design for the proposal. This includes locations where existing fences must be maintained. This information should be included in the site inductions and any relevant management plans for the site.

Where additional impacts not illustrated on this figure, such as access roads, easements, laydown areas or other infrastructure or facilities may impact areas outside those assessed, further assessment will be required.

7.4. IMPACT TO VALUES

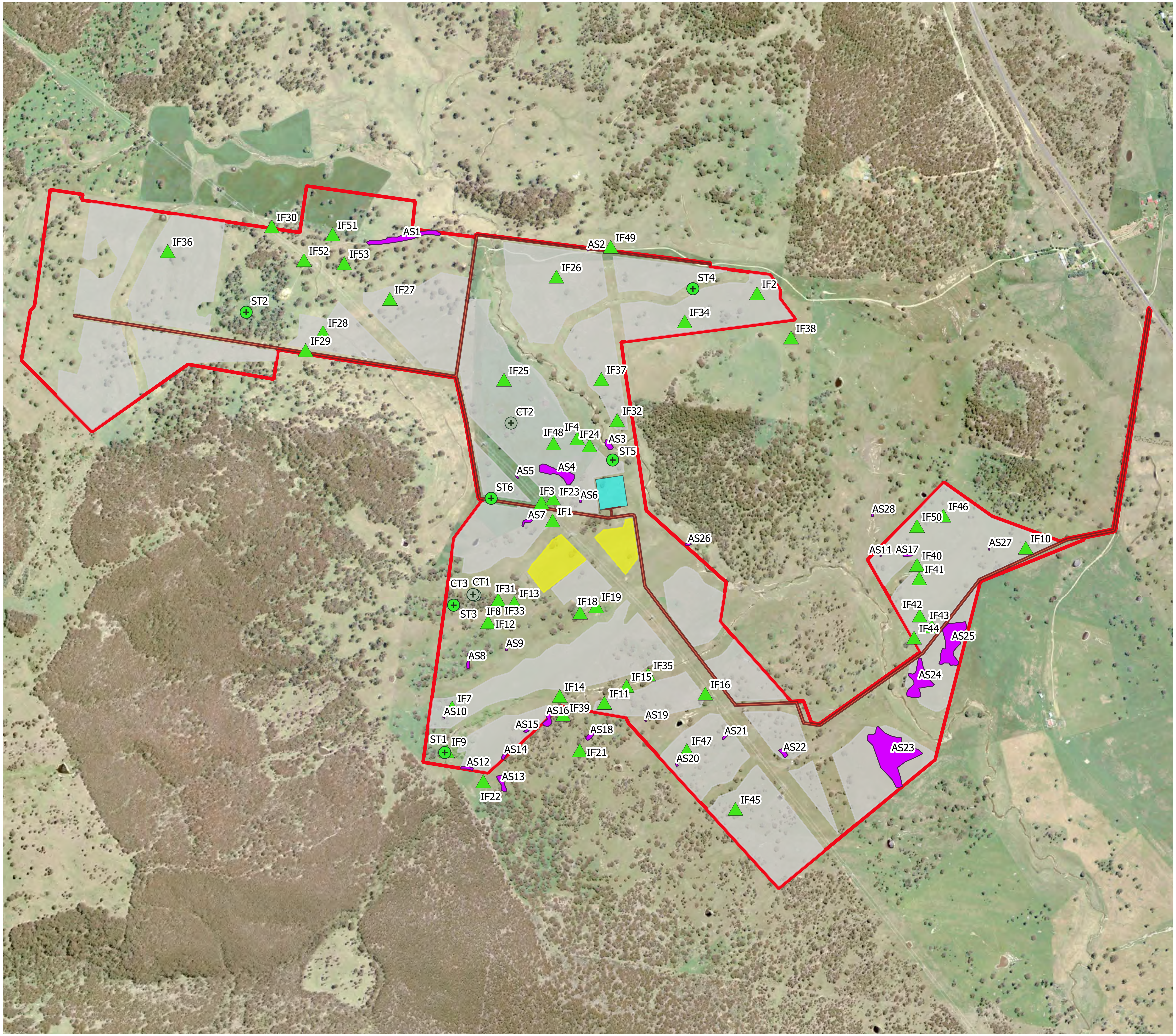
The values potentially impacted by the development are any social and cultural values attributed to the artefacts and the sites by the local Aboriginal community. The extent to which the total or partial loss of the sites would impact on the community is only something the Aboriginal community can articulate. In particular, it must be noted that a number of scarred and cultural trees are currently within the impact zone of proposed works.

The scarred trees have been assessed to have high cultural significance and moderate to high scientific significance (cultural trees have low scientific significance but high cultural significance). The cultural significance of the trees is supported by comments supplied by RAPs and outlined in Section 6.

The impact to the scientific values if the artefacts were to be impacted by the current proposal is considered moderate. This is due to the sheer number of sites which will be subject to direct and indirect impacts as a result of the proposal. While the site integrity of the majority of artefact sites has been significantly compromised by historic land use, compounded by the drought conditions, the quantity of artefacts present within this landscape have significantly increased the recorded data for the Armidale region and provided further insight into use of raw materials and occupation patterns during the mid- to late Holocene. The intrinsic values of the artefacts themselves may be affected by the development of the proposal site. Any removal of the artefacts, or their breakage would reduce the low to moderate scientific value they retain.

The current assessed scientific impact to the scarred trees recorded within the area is moderate, as two of the six, or one third, of the recorded scarred trees will be destroyed by the proposal.

Figure 7-1: Sites In Relation to Development Envelope



Legend

Proposal site location

Recorded Trees

Cultural Tree (CT)

Scarred Tree (ST)

Isolated Finds

Artefact Scatters

Development Footprint

Access Road

Indicative Location of Site Office, Laydown Area, Car Parking and Battery Storage

Solar Array

Substation

0 250 500 750 m

Data Attribution
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Ref: 18-645 Tillbuster SF Workspace
20191218_qfield.qgs \ a3 land
Author: Chelsea. J
Date created: 11.03.2020

Table 7-1 Identified risk to known sites

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0280	Tilbuster Solar Farm IF1	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0325	Tilbuster Solar Farm IF2	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0279	Tilbuster Solar Farm IF3	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0324	Tilbuster Solar Farm IF4	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0273	Tilbuster Solar Farm IF7	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0274	Tilbuster Solar Farm IF8	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0275	Tilbuster Solar Farm IF9	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	Include within fencing of ST1. To be included as no impact zone in CHMP and site inductions.
21-1-0276	Tilbuster Solar Farm IF10	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0277	Tilbuster Solar Farm IF11	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0326	Tilbuster Solar Farm IF12	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0278	Tilbuster Solar Farm IF13	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0321	Tilbuster Solar Farm IF14	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0322	Tilbuster Solar Farm IF15	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0323	Tilbuster Solar Farm IF16	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0281	Tilbuster Solar Farm IF18	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0282	Tilbuster Solar Farm IF19	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0283	Tilbuster Solar Farm IF21	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. Current fencing must remain.
21-1-0284	Tilbuster Solar Farm IF22	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. Current fencing must remain.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0285	Tilbuster Solar Farm IF23	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0286	Tilbuster Solar Farm IF24	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0287	Tilbuster Solar Farm IF25	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0288	Tilbuster Solar Farm IF26	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0289	Tilbuster Solar Farm IF27	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0290	Tilbuster Solar Farm IF28	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0291	Tilbuster Solar Farm IF29	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0292	Tilbuster Solar Farm IF30	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0293	Tilbuster Solar Farm IF31	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0294	Tilbuster Solar Farm IF32	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0295	Tilbuster Solar Farm IF33	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0296	Tilbuster Solar Farm IF34	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0297	Tilbuster Solar Farm IF35	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0298	Tilbuster Solar Farm IF36	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0299	Tilbuster Solar Farm IF37	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0300	Tilbuster Solar Farm IF38	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0301	Tilbuster Solar Farm IF39	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0302	Tilbuster Solar Farm IF40	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0303	Tilbuster Solar Farm IF41	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0304	Tilbuster Solar Farm IF42	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0305	Tilbuster Solar Farm IF43	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0306	Tilbuster Solar Farm IF44	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0307	Tilbuster Solar Farm IF45	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0308	Tilbuster Solar Farm IF46	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0309	Tilbuster Solar Farm IF47	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0310	Tilbuster Solar Farm IF48	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0311	Tilbuster Solar Farm IF49	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0312	Tilbuster Solar Farm IF50	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0313	Tilbuster Solar Farm IF51	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Nil	N/a	N/a	No action required. To be included as no

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					impact zone in CHMP and site inductions.
21-1-0314	Tilbuster Solar Farm IF52	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0315	Tilbuster Solar Farm IF53	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0337	Tilbuster Solar Farm AS1	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0336	Tilbuster Solar Farm AS2	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0335	Tilbuster Solar Farm AS3	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0334	Tilbuster Solar Farm AS4	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0333	Tilbuster Solar Farm AS5	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Indirect	Total	Total loss of value	Salvage objects prior to development.
21-1-0332	Tilbuster Solar Farm AS6	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0331	Tilbuster Solar Farm AS7	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0330	Tilbuster Solar Farm AS8	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0329	Tilbuster Solar Farm AS9	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0328	Tilbuster Solar Farm AS10	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0327	Tilbuster Solar Farm AS11	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0349	Tilbuster Solar Farm AS12	Poor – The landform has been heavily disturbed due to the agricultural uses and significant	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		erosion of sediment has modified soil profiles					
21-1-0348	Tilbuster Solar Farm AS13	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. Current property fencing must remain. To be included as no impact zone in CHMP and site inductions.
21-1-0347	Tilbuster Solar Farm AS14	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0346	Tilbuster Solar Farm AS15	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0345	Tilbuster Solar Farm AS16	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Direct	Partial	Partial loss of value	Salvage objects within footprint prior to development. Property fencing must remain to

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
							protect remainder of site.
21-1-0344	Tilbuster Solar Farm AS17	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0343	Tilbuster Solar Farm AS18	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0342	Tilbuster Solar Farm AS19	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0357	Tilbuster Solar Farm AS20	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0358	Tilbuster Solar Farm AS21	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0356	Tilbuster Solar Farm AS22	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0355	Tilbuster Solar Farm AS23	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0354	Tilbuster Solar Farm AS24	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0353	Tilbuster Solar Farm AS25	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Moderate	Direct	Total	Total loss of value	Salvage objects prior to development.

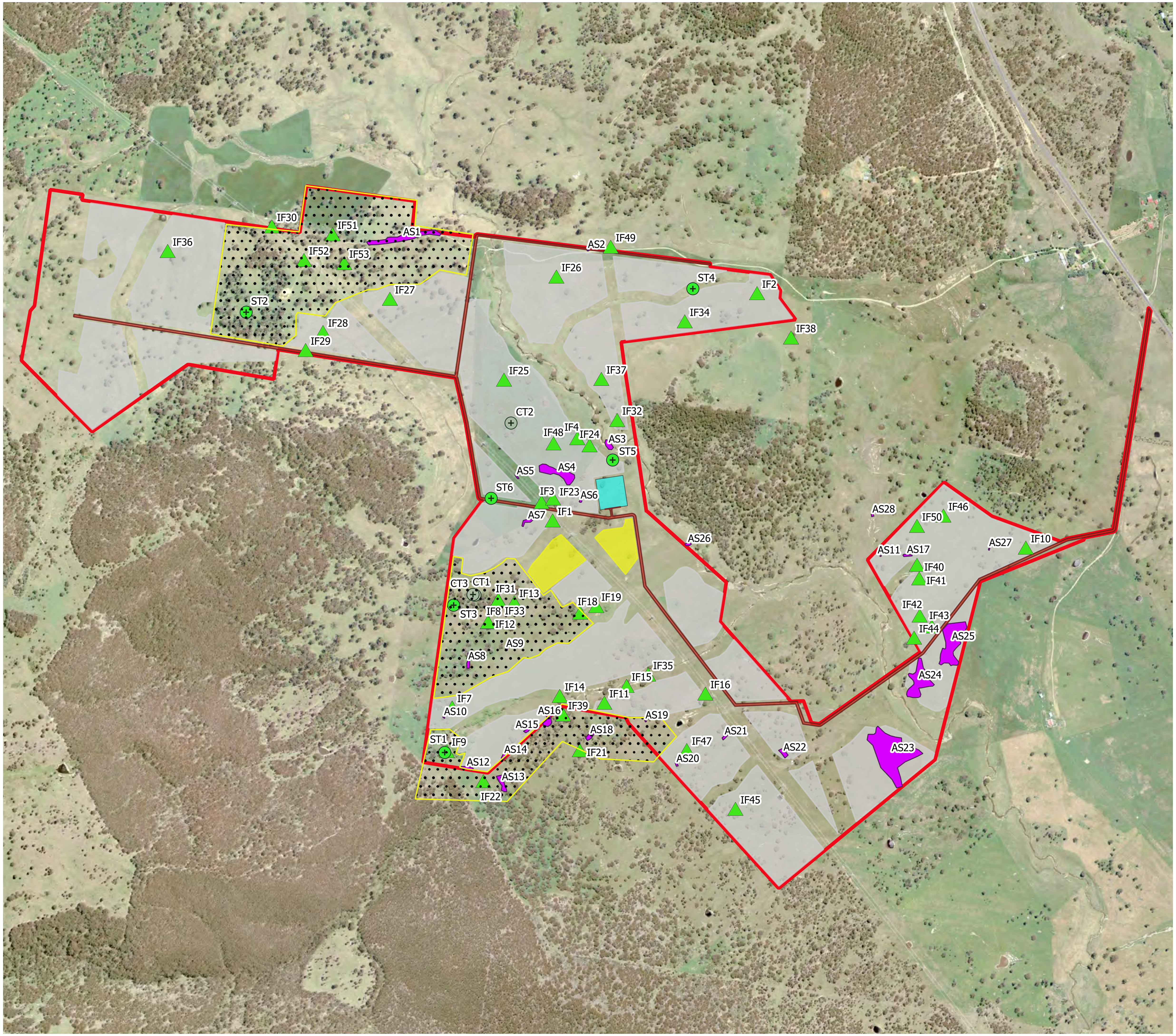
AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0352	Tilbuster Solar Farm AS26	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0351	Tilbuster Solar Farm AS27	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Direct	Total	Total loss of value	Salvage objects prior to development.
21-1-0350	Tilbuster Solar Farm AS28	Poor – The landform has been heavily disturbed due to the agricultural uses and significant erosion of sediment has modified soil profiles	Low	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0338	Tilbuster Solar Farm ST1	Poor – the tree is dead though still standing	Moderate-High	Nil	N/a	N/a	Fencing with a buffer of 5m minimum to be placed around site (including IF9).
21-1-0317	Tilbuster Solar Farm ST2	Fair – the tree is alive and in good condition, but some deterioration	Moderate-High	Nil	N/a	N/a	No action required. To be included as no

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		of the dry face has the scar in poor condition					impact zone in CHMP and site inductions.
21-1-0318	Tilbuster Solar Farm ST3	Poor – the tree is dead though still standing	Moderate-High	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0319	Tilbuster Solar Farm ST4	Good – the tree is alive, and the scar shows minor signs of deterioration	Moderate-High	Indirect	Total	Total loss of value unless fencing clearly demarcates a 5m buffer protecting this area	Fencing with a buffer of 5m minimum to be placed around site
21-1-0320	Tilbuster Solar Farm ST5	Poor – the tree is dead though still standing	High	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
21-1-0339	Tilbuster Solar Farm ST6	Fair – the tree is alive, and the scars are somewhat deteriorated but overall, in fair condition	Moderate-High	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.
21-1-0340	Tilbuster Solar Farm CT1	Poor – the tree is dead though still standing	Low (note the site is of cultural significance)	Nil	N/a	N/a	No action required. To be included as no impact zone in CHMP and site inductions.
21-1-0316	Tilbuster Solar Farm CT2	Fair – the tree is alive however exhibits damage from sheep activity	Low (note the site is of cultural significance)	Direct	Total	Total loss of value	Further negotiation with the RAPs required to address. Preferred option is to amend design to avoid this site.
21-1-0341	Tilbuster Solar Farm CT3	Very poor – the tree is dead and has fallen	Low (note the site is of cultural significance)	Nil	N/a	N/a	No action required. To be included as no

AHIMS #	Site name	Site integrity	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
							impact zone in CHMP and site inductions.

Figure 7-2" 'No Impact Zones' to be established for the protection of Aboriginal objects in relation to recorded sites



Legend

- Proposal site location

Recorded Trees

- Cultural Tree (CT)
- Scarred Tree (ST)
- Isolated Finds
- Artefact Scatters

Development Footprint

- Access Road
- Indicative Location of Site Office, Laydown Area, Car Parking and Battery Storage
- Solar Array
- Substation
- No Impact Zones

0 250 500 750 m

Data Attribution
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Ref: 18-645 Tillbuster SF Workspace
20191218_qfield.qgs \ a3 land
Author: Chelsea. J
Date created: 11.03.2020

NGH

8. AVOIDING OR MITIGATING HARM

8.1. CONSIDERATION OF ESD PRINCIPLES

Consideration of the principles of Ecologically Sustainable Development (ESD) and the use of the precautionary principle was undertaken when assessing the harm to the sites and the potential for mitigating impacts to the sites recorded during the survey for the proposed Tilbuster Solar Farm. The main consideration was the cumulative effect of the proposed impact to the sites and the wider archaeological record. The precautionary principle in relation to Aboriginal heritage implies that development proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

In broad terms, the archaeological material located during this investigation is similar to what has been found previously within the Armidale region. Currently there are a number of suggested models for the nature, number, extent and content for archaeological sites within the Armidale-Dumaresq LGA. Nevertheless, given the size of the geographical area and results of previous studies, it is certain that there would be similar Aboriginal objects and sites present within the region.

The results of this Aboriginal heritage assessment have confirmed the proposed model of site location and site distribution whereby sites could be expected to occur across the landscape and in particular in proximity to a water source, even in ploughed areas. The results of this Aboriginal heritage assessment suggest that more sites could be expected to occur in the area than was previously envisaged.

The implications for ESD principles are that in fact more sites are likely to be present in the region than previously thought. This may reduce the individual value of individual sites within the proposal site as they are likely to be represented elsewhere and potentially with better integrity. However, it must be recognised that large parts of the region have been heavily cleared, mined, farmed and developed through the construction and maintenance of roads and residential structures and therefore other sites are also likely to have been subjected to heavy disturbance. The sites present within the proposal area generally have low integrity due to the historical disturbances and exacerbated by the current drought conditions; furthermore, they conform to site types associated with modelling for the area. These sites, therefore, are heavily disturbed and not considered to be unique reducing their representativeness across the broader Armidale landscape. It should also be noted that not all sites recorded during this survey fall within the proposed development footprint and that the sites outside the development footprint will not be impacted by the proposed solar farm development.

As noted above, the archaeological values of the sites within the development footprint, considering the scientific, representative and rarity values, was assessed to be moderate. It is believed therefore that the proposed impacts to the sites through the development would not significantly adversely affect the broader archaeological record for the local area or the region.

The sustainability principle of inter-generational equity as applied to the archaeological resource requires that the present generation takes measures to ensure that the health and diversity of the archaeological record is maintained or enhanced for the benefit of future generations. It is assessed that the diversity of the archaeological record with reference to the artefact sites in the proposal site would not be compromised by the proposed development, particularly given the existing disturbed nature of the sites. Furthermore, stone artefacts are the most common site type so far recorded within the local area. However, the impacts as a result of the removal of scarred tree sites ST5 and ST6 would be considered to compromise the diversity of the archaeological record as few scarred tree sites are currently recorded in the region, based on the current records of scarred trees in the area which indicate that few are present. However, it should be noted that most archaeological studies undertaken (and publicly available) in the Armidale region have covered previously cleared land, while the remaining forested areas such as Mount Duval and Black Mountain have not been subject to survey to date, as such it is likely that more scarred trees are present in areas where remnant vegetation remains.

We estimate, that while the current development proposal will impact the majority of sites identified, the overall cumulative impact on the archaeological record for the region is likely to be minimal, assuming a similar density of artefact sites remain across the wider region, and perhaps greater numbers of scarred trees where land clearing has been less extensive. Additionally, the artefact scatter containing a number of formal tools, Tilbuster Solar Farm AS2, as well as scarred trees ST1-4 and cultural trees CT1 and 3 will not be impacted by the proposal. Therefore, it is argued that the cumulative impacts of the proposal are not enough to reject outright the development proposal. It is noted however that there are strong concerns regarding the removal or destruction of scarred trees Tilbuster Solar Farm ST5 and ST6.

Three no impact zones have been designated within the proposal area, which will result in the protection of 15 isolated find sites, 8 artefact scatters and one partial artefact scatter, three scarred trees and two cultural trees. These no impact zones have been identified based on the design of the development footprint, which does not include any proposed works within these areas. The outcomes of these no impact zones includes the preservation of a portion of the overall archaeological record within this locality.

8.2. CONSIDERATION OF HARM

Avoiding harm to all the sites within the proposal site is possible only via a significant reduction in the footprint of the arrays and associated facilities and infrastructure, which would also result in a significant reduction in the production levels of the solar farm. This is not considered to be practical and has therefore not been assessed as an option.

Given the current avoidance of three scarred trees, two cultural trees, 8 artefact scatters and 15 isolated finds it is not considered necessary to prevent all development at this location, however it is highly recommended that amendments be made to the design in order to avoid a further three sites, Tilbuster Solar Farm ST5, ST6 and CT2.

The sites with stone artefacts have been shown to be highly disturbed with much of the scientific value removed as a result. Cultural value has been determined by the local Aboriginal community to be high due to the connection between these artefacts, representing former campsites, and the local cultural sites including women's and men's sites, as well as known songlines.

Seventeen of the 26 artefact scatters and 23 of the 49 isolated finds, two scarred trees and one cultural tree are situated within the development footprint area of the proposed transmission line, solar arrays, tracks, cables, office parking and facilities. The most likely cause of harm to the artefacts will be through ground preparation activities such as topsoil stripping, installation of posts and arrays, tracks and underground cabling, as well as movement by construction vehicles and plant. Fifteen of the recorded sites are likely to be indirectly impacted through vehicle movement, vibration or other indirect construction activities.

Furthermore, it is considered possible that additional artefacts not identified and recorded during the archaeological survey will be present, most likely in the form of isolated artefacts or very small, low density scatters. Without knowing their exact locations, it is difficult to manage the impacts. We do not consider that the risk of such disturbances means the development should be abandoned.

The registered Aboriginal parties have indicated that the artefacts collected during the subsurface test excavation programme undertaken as part of this assessment, in addition to artefacts salvaged prior to construction works, should be stored at the Armidale Cultural Centre and Keeping Place where possible. In the event that storage of all artefacts at this location is not possible, formal tools and artefacts of particular cultural or scientific significance should be stored in a display case at the cultural centre and the remainder of the artefacts should be buried on Country, outside of the proposed impact area of the Tilbuster Solar Farm.

8.3. MITIGATION OF HARM

Mitigation of harm to cultural heritage sites generally involves some level of detailed recording to preserve the information contained within the site. Mitigation can be in the form of minimising harm, through slight changes in the development plan or through direct management measures of the sites and Aboriginal objects.

It is argued here that further mitigation in the form of minor amendments to the design are feasible to protect the locations of Tilbuster Solar Farm ST5, ST6 and CT2. Further alteration beyond this is not considered feasible or warranted within the solar farm development footprint for the artefact scatters and isolated find sites. Due to it not being feasible to modify the proposal site footprint to a large degree, it is recommended that all sites within the development footprint that will not be managed by other mitigation strategies, be salvaged as part of a surface collection programme. This recommendation was proffered by the Aboriginal community representative onsite during the field survey.

Mitigation in the form of a surface salvage programme is therefore recommended for all artefact sites located within the proposal site that will be impacted by the proposed development footprint. This measure may increase knowledge of the Aboriginal use of raw materials in the area along with the employment and preference for specific tool types through a more detailed study of the stone artefacts in the lab (rather than field recording). Furthermore, artefacts not recorded during the archaeological survey may be identified and collected during the surface salvage.

The salvage program for sites recorded within the proposed Tilbuster Solar Farm development footprint should be undertaken by an archaeologist accompanied by representatives of the registered Aboriginal parties, prior to the proposed development commencing. The artefacts should be collected and moved to a safe area within the property that will not be subject to any ground disturbance. An option to undertake monitoring during topsoil stripping at the locations of artefact scatters AS4, AS23, AS24 and AS25 was requested by the registered Aboriginal party representatives on site.

The registered Aboriginal parties noted their preference for the salvaged artefacts to be stored at the Armidale Cultural Centre and Keeping Place where possible. In the event that storage of all artefacts at this location is not possible, formal tools and artefacts of particular cultural or scientific significance should be stored in a display case at the cultural centre and the remainder of the artefacts should be buried on Country, outside of the proposed impact area of the Tilbuster Solar Farm.

9. RECOMMENDATIONS

The recommendations are based on the following information and considerations:

- Results of the current archaeological survey and subsurface testing of the area;
- Results of the previous archaeological survey and subsurface testing of the area;
- Consideration of results from other local archaeological studies;
- Results of consultation with the registered Aboriginal parties;
- The assessed significance of the sites;
- Appraisal of the proposed development, and
- Legislative context for the development proposal.

It is recommended that:

1. The Tilbuster Solar Farm development avoids the three scarred tree sites (Tilbuster Solar Farm ST1, Tilbuster Solar Farm ST 2 and Tilbuster Solar Farm ST3) as well as the cultural trees (Tilbuster Solar Farm CT1and Tilbuster solar Farm CT3), which are located within the proposed development footprint. A minimum of a five-metre buffer should be established by placing high visibility bunting (or similar) around each of these trees to avoid impacts. Additionally, the locations of the trees have now been designated within a 'No Impact Zone' for further protection measures.
2. Tilbuster Solar Farm ST5, Tilbuster ST6 and Tilbuster CT2 are located within the proposed development footprint. It is strongly recommended that development footprint excises the location of Tilbuster Solar Farm ST5, Tilbuster ST6 and Tilbuster CT2 as well as an additional 10m buffer surrounding each tree location to preserve the root system. In addition to the modification to the footprint, each tree should be fenced using high visibility bunting (or similar) demarcating a five-metre buffer around the trees in order to avoid impacts. .
3. Tilbuster Solar Farm ST4 is located between two areas proposed for solar arrays. It is recommended that a minimum of a five-metre buffer should be established by placing high visibility bunting (or similar) around this tree to avoid impacts.
4. No Impact Area 1 and No Impact Area 2 (Figure 7 2), which are based on the areas outside the development footprint, but inside the proposal site, must be fenced or otherwise clearly delineated and included in all onsite inductions and management plans. The development should avoid any direct or indirect impacts to the sites located within these no impact zones, including: Tilbuster Solar Farm IF8, IF12, IF13, IF18, IF30, IF31, IF33, IF51, IF52, IF53; Tilbuster Solar Farm AS1, AS8, AS9; Tilbuster Solar Farm ST2, ST3, CT1 and CT3.
5. In accordance with Figure 7 2, No Impact Zone 3 located to the south and west of the proposal site boundary must not be subject to any impacts, for the protection of Tilbuster Solar Farm IF9, IF21, IF22, IF39, Tilbuster Solar Farm AS13, part of AS16, AS18, AS19; and Tilbuster Solar Farm ST1. The existing fences must remain in place. Further assessment will be required if any impacts will occur within this area, including replacement of existing fencing.
6. There are three sites which were recorded during the survey which are located outside the proposal site boundary (and not included within the No Impact Area): Tilbuster Solar Farm IF38, AS26 and AS28. These must not be subject to indirect or direct impacts as a result of activities relating to the construction, operation or decommissioning of the solar farm.
7. With the exception of the access road from the main house along the northern boundary of the proposal site (refer to Figure 1 2), existing farm tracks not within the development footprint may not be used for the purposes of the solar farm, with specific reference to access by large vehicles or plant. If use of such tracks is required, these tracks must be assessed including archaeological survey and amendments or addendums to this report.

8. Salvage of the isolated finds and artefact scatters within the development footprint and not within a designated No Impact Zone must be undertaken in the form of surface collection. This would include the collection of the artefacts to be temporarily stored at the NGH Newcastle office for further analysis, with permanent storage to be at Armidale and Region Aboriginal Cultural Centre & Keeping Place for all artefacts, or where storage of all artefacts cannot be achieved, formal tools will be stored / displayed at the Cultural Centre, and the remaining artefacts will be buried on site, outside of the development footprint.
9. Monitoring of topsoils stripping by representatives of the RAPs should be undertaken for sites AS4, AS23, AS24 and AS25, with reference to similar programs undertaken at other sites in the region.
10. A minimum five (5) metre buffer should be observed around all sites that are to be avoided and that are not within the designated No Impact Zones 1, 2 and 3.
11. Enerparc Australia should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal objects during the construction of the solar farm and management of known sites and artefacts. The CHMP should include an unexpected finds procedure to deal with construction activity. The preparation of the CHMP should be completed in consultation with RAPs.
12. In the unlikely event that human remains are discovered during the development works, all work must cease in the immediate vicinity. DPIE, the local police and the RAPs should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.
13. Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the registered Aboriginal parties and may include further field survey and subsurface testing.

Enerparc are reminded that it is an offence under the National Parks and Wildlife Act to harm an Aboriginal object without a valid AHIP.

10. REFERENCES

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APPENDIX A CONSULTATION LOG AND DOCUMENTATION

Date	Description of Action	Method of Contact	Details	Sent/Received By (NGH Personnel)
Stage 1 (Agencies)				
10/07/2019	Letters sent to BCD (North East), Armidale Council, North Eastern Local Land Services, Armidale LALC, Native Title Services, The Registrar of Aboriginal Owners, NNTT.	Email	Responses due 31/07/2019	AB
18/07/2019	Response received from Registrar	Email	No Aboriginal Owners known for the project, suggest contacting Armidale LALC	AB
16/07/2019	Response received from DPIE	Email	Provided list of stakeholders	AB
10/07/2019	Response received from NNTT	Email	No relevant entries - no NT determination applications, determinations or ILUAs	AB
Stage 1 (Advert and Registrations)				
10/07/2019	Advertisement placed in Armidale Express	Advert	Responses due 24/07/2019	AB
29/07/2019	Requests for registrations sent to all identified RAPS including: Lorraine Towney, Anaiwan Traditional Owners Ac (David Ahoy), AT Gomilaroi Cultural Consultancy (Aaron Talbott), Indigenous Outcomes (Cheryl Kitchener), Nyakka AC (Rhonda Kitchener), Armidale Aboriginal Elders Congress, Brian Draper, DFTV Enterprises (Derrick Vale), Michael Long, Ronald Long, Ron Smith, Roslyn Smith, Scott Smith, Armidale LALC, Nulla Nulla Boongutti AC (c/o Willawarrun PO), Paul Moodie, Thawan (Jennifer Hampton), Craig Archibald, Aaron Broad, Garby Elders (Anthony Dootson, Deborah Dootson), Steven Ahoy, Colin Ahoy, Marunng Baalijin (Michael Donovan), Gomeroi People (c/-Mishka Holt NTSCorp Ltd), Larissa Ahoy	Email/mail	Responses due 27/08/2019	AB
11/07/2019	Registration received from Nunnawanna (Colin Ahoy)	Email		AB
12/07/2019	Registration received from Iwatta AC (Steven Ahoy)	Email		AB
12/07/2019	Registration received from Nyakka Aboriginal Cultural Heritage Corporation & Cultural Heritage Consultants (Rhonda Kitchener)	Email		AB
16/07/2019	Registration received from Indigenous Outcomes (Cheryl Kitchener)	Email		AB
24/07/2019	Registration received from Anaiwan TOAC (David Ahoy)	Email		AB

1/08/2019	Registration received from Larissa Ahoy	Email		AB
1/08/2019	Registration received from Garby Elders (Tony Dootson)	Email		AB
Stage 2_3 (Methodology)				
13/08/2019	Methodology sent to Nunnawanna, Iwatta, Nyakka, Indigenous Outcomes, Anaiwan TOAC, Larissa Ahoy and Garby Elders	Email/mail	Responses due 10/09/2019	AB
13/08/2019	Response received from Nunnawanna	Email	No comments on methodology	AB
13/08/2019	Response received from Iwatta	Email	No direct comments on methodology - provided information regarding Iwatta AC's previous experience on projects. A later email received 16/08/2019 from Stephen notes that he has been speaking to his elders who have a lot of information.	AB
13/08/2019	Response received from Cheryl Kitchener	Email	Agrees with methodology	AB
14/08/2019	Response received from Nyakka	Email	Agrees with methodology	AB
14/08/2019	Response received from Garby Elders	Email	No comments on methodology, indicated willingness to contribute to fieldwork if needed, with cultural knowledge associated with resources	AB
26/08/2019	Response received from Larissa Ahoy	Email	No comments on methodology	AB
Stage 2_3 (Fieldwork)				
10/09/2019	Invitatons for fieldwork to Armidale LALC, Nunnawanna, Iwatta and Nyakka	Email/phone	Armidale LALC uncontactable, other RAPS available for fieldwork	AB
	Fieldwork - survey undertaken 24 and 25/09/2019			
4/10/2019	Amended methodology provided to all RAPs	Email/mail	Responses due 1/09/2019	AB
4/11/2019	Invitations for fieldwork to Nunnawanna, Iwatta, Nyakka	Email/phone	Confirmed availability for fieldwork 11 to 15/11/2019	AB
	Fieldwork - survey and testing undertaken 11 to 15/11/2019			
9/12/2019	Cultural information provided by Iwatta	Email	Included information and maps regarding mens, womens and camping sites, as well as songlines, in the area. Incorporated into unredacted version of final report (Section 3 and 6)	AB
Project Update				
30/04/2020	Update on project provided to all RAPs	Email	No response required	CJ

Stage 4 (Draft Report)				
1/06/2020	Draft report provided to all RAPS	Email/mail	Responses due 29 June 2020	CJ
27/06/2020	Request for kml file of artefact data from Steven	Email		CJ - please find attached (30/6)
30/06/2020	Issues opening kml, can you resend from Steven	Email		CJ - Data corrected and attached (7/07), steven replied thank you and comments on draft from Iwatta would be returned by the end of the week (8/07)
8/07/2020	Reminder to provide responses	Email	Responses due 10 July 2020	AB
9/07/2020	Response received from Colin Ahoy of Nunnawanna	Email	Noted that, as Mt Duval is of high cultural significance, a RAP should be present during the installation of the fence. Also indicated that salvaged artefacts should be placed into a display case at Armidale Cultural Centre and Keeping Place.	AB
12/07/2020	Response received from Rhonda Kitchener of Nyakka Culture Heritage Corporation	Email	Noted that the report omits that there are known women's sites within the local area, and that this information should be noted in the report. Requested that the axes be stored at the Armidale Cultural Centre and other artefacts should be buried on Country, outside the development area.	AB

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Public Notices

ARMIDALE LOCAL ABORIGINAL LAND COUNCIL

MEMBERS MEETING

Date: Monday 5th August 2019

Time: 1:00pm

Venue: Legacy Hall, 89 Faulkner St Armidale

Members of the Armidale Local Aboriginal Land Council are advised that a Members Meeting is to be held at Legacy Hall, Faulkner Street Armidale at 1pm on Monday August 5th.

$3 insertion

Public Notices

Notification for registration of interest for Aboriginal stakeholders

NGH Environmental has been contacted by Enerparc Australia Pty Ltd (223 Liverpool St Darlinghurst NSW 2010) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) to support an Environmental Impact Statement addressing the proposed Tilbuster Solar Farm on the New England Highway near Tilbuster, NSW. The proposal is to be assessed as a State Significant Development under Part 4 of the NSW *Environmental Planning & Assessment Act 1979.*

The proposed solar farm is located within the Armidale local government area and consists of part of 11915 New England Highway and part of 12029-12049 New England Highway, Black Mountain, NSW. The total site has an area of 150ha.

The purpose of consultation with Aboriginal people is to provide an opportunity to assist in the preparation of the ACHA; to be involved in consultation regarding Aboriginal cultural heritage; and to be involved in the assessment and management of potential impact to Aboriginal cultural heritage values in accordance with the Secretary's Environmental Assessment Requirements for the project.

In order to fulfil the requirements set out in the NSW Office of Environment and Heritage *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, NGH is seeking interested Aboriginal parties who hold cultural knowledge of the assessment area to register their interest in the consultation process for the project and to assist in the determination of cultural significance of any Aboriginal objects or places located there.

Registrations should be provided in writing to:

NGH Environmental Pty Ltd
Unit 2, 54 Hudson Street
HAMILTON NSW 2303

Or via email to: **ali.b@nghenvironmental.com.au**

Closing date for registration is Wednesday 24th July 2019

Those registering an interest will be contacted to discuss the project further. Those who do register are advised that their details will be provided to OEH and the LALC, unless they specifically advise that their details are not to be forwarded.

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AW3770829

From: Ali Byrne
To: "adminofficer[redacted]
Subject: Request for Aboriginal stakeholder - Tilbuster Solar Farm
Date: Wednesday, 10 July 2019 8:28:00 AM
Attachments: 18-465_TilbusterSF__OfficeOfTheRegistrar_20190710.pdf
image001.jpg

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

nghenvironmental
[redacted]

From:	Ali Byrne
To:	"geospatialsearc[redacted]
Subject:	Request for Aboriginal stakehold[redacted]rs - Tilbuster Solar Farm
Date:	Wednesday, 10 July 2019 8:33:00 AM
Attachments:	18-465_TilbusterSF_NationalNativeTitleTribunal_20190710.pdf image001.jpg

---

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

nghenvironmental
[redacted]

From: Ali Byrne
To: information@ntscor[redacted]
Subject: Request for Aboriginal stakeholders - Tilbuster Solar Farm
Date: Wednesday, 10 July 2019 8:33:00 AM
Attachments: 18-465_TilbusterSF_NativeTitleServiceCorporationLimited_20190710.pdf
image001.jpg

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

nghenvironmental
[redacted]

From:	Ali Byrne
To:	"admin.northerntablelands@l[redacted]
Subject:	Request for Aboriginal stakeholders - Tilbuster Solar Farm
Date:	Wednesday, 10 July 2019 8:34:00 AM
Attachments:	18-465_TilbusterSF_NorthernTablelands Services_20190710.pdf image001.jpg

---

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |
[redacted]

From:	Ali Byrne
To:	"rog.ne[redacted]
Cc:	"roger.mehr[redacted]
Subject:	Request for Aboriginal stakeholders - Tilbuster Solar Farm
Date:	Wednesday, 10 July 2019 8:36:00 AM
Attachments:	18-465_TilbusterSF_OEHNorthEastPlanningTeam_20190710.pdf image001.jpg

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

nghenvironmental
[redacted]

From:	Ali Byrne
To:	[redacted]
Subject:	Request for Aboriginal stakeho[redacted]ers - Tilbuster Solar Farm
Date:	Wednesday, 10 July 2019 8:31:00 AM
Attachments:	18-465_TilbusterSF_ArmidaleRegionalCouncil_20190710.pdf image001.jpg

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

nghenvironmental
[redacted]

Planning, Industry & Environment

Our Ref: DOC19/607065
Your Ref: Letter dated 10 July 2019

Ali Byrne
NGH Environmental Pty Ltd
[redacted]

Dear Ms Byrne

Subject: 18-465 Notification for registration of interest for Aboriginal stakeholders for proposed Tilbuster Solar Farm.

Thank you for your letter of 10 July 2019 about Aboriginal cultural heritage consultation for an assessment for the proposed subdivision in the Armidale Regional local government area. I appreciate the opportunity to provide input.

Please find enclosed a list of known Aboriginal parties for the Armidale Regional local government area (Attachment 1) that we consider likely to have an interest in the proposal. Note this is not an exhaustive list of all interested Aboriginal parties. Receipt of this list does not remove the requirement for a proponent/consultant to advertise the proposal in the local print media and contact other bodies and community groups seeking interested Aboriginal parties, in accordance with the '*Aboriginal cultural heritage consultation requirements for proponents 2010*' (the CRs).

The Department of Planning, Industry and Environment would also like to take this opportunity to remind the proponent and consultant to:

- Ensure the project documents the full consultation process in the Aboriginal Cultural Heritage Assessment Report and to include copies of all correspondence sent to or received from all relevant stakeholders (including Aboriginal stakeholders and the agencies listed in section 4.1.2 of the CRs). Omission of these records in the final report may cause delays in the assessment of the Aboriginal Heritage Impact Permit application or require parts of the consultation process to be repeated if the evidence provided to us does not demonstrate that the consultation process has been fair, equitable and transparent.

- Ensure we are provided with evidence that reasonable attempts have been made to contact the relevant parties associated with the CRs. If this is not provided, then we will deem that the consultation process has not complied with the CRs. We consider evidence of reasonable efforts to contact relevant parties would include, but not be limited to, multiple forms of communication; faxes (with confirmation slips demonstrating successful transmission), an e-mail log, registered post details, copies of letters and a phone call log.

[redacted]

- Forward to us any changes to the contact details of interested Aboriginal parties, or information regarding additional parties, so that we can update its records.

- Ensure that consultation is fair, equitable and transparent. If the Aboriginal parties express concern or are opposed to parts of or the entire project, we expect that evidence will be provided to demonstrate the efforts made to find common ground between the opponents and the proponent.

If you have any further questions about this issue, Mr Roger Mehr, Archaeologist, Biodiversity and Conservation, can be contacted on 6773 7005 or at Roger.Mehr@environment.nsw.gov.au.

Yours sincerely

16 July 2019

RACHEL LONIE
A/Senior Team Leader Planning,
North East Branch, Biodiversity and Conservation

Contact officer: ROGER MEHR
[redacted]

Enclosure: Attachment A - Known Aboriginal Parties for the Armidale Regional LGA

ABORIGINAL PARTIES IN THE AREA OF INTEREST
ARMIDALE REGIONAL LGA

1. Lorraine Towney
[redacted]

2. Anaiwan Traditional Owners Aboriginal Corporation
David Ahoy
[redacted]

3. AT Gomilaroi Cultural Consultancy
Aaron Talbott
[redacted]

4. Indigenous Outcomes
Cherly Kitchener
[redacted]

5. Nyakka Aboriginal Corporation
Chairperson
[redacted]

6. Armidale Aboriginal Elders Congress
Chairperson
[redacted]

7. Brian Draper
[redacted]

8. D F T V Enterprises
Derrick Vale
[redacted]

9. Michael Long
[redacted]

10. Ronald Long
[redacted]

11. Ron Smith
[redacted]

11. Roslyn Smith
[redacted]

12. Scott Smith
[redacted]

13. Armidale LALC
[redacted]

14. Nulla Nulla Boongutti Aboriginal Corporation
[redacted]

15. Paul Moodie
[redacted]

16 Thawan Heritage Consultant
Jennifer Hampton
[redacted]

17. Mr Craig Archibald
[redacted]

18. Aaron Broad
[redacted]

19 Larissa Ahoy
[redacted]

19. Garby Elders
Anthony Dootson
[redacted]

20. Steven Ahoy
[redacted]

21. Colin Ahoy
[redacted]

22. Maruung Baalijin
Michael Donovan
[redacted]

23. Gomeroi People
[redacted]

OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

18 July 2019

By email: Ali.B@nghenvironmental.com.au

Ali Byrne
Archaeologist
NGH Environmental
[redacted]

Dear Ali,

Request - Search for Registered Aboriginal Owners

We refer to your letter dated 10 July 2019 regarding an Aboriginal Cultural Heritage Assessment for the proposed development at 11915 New England Highway and part of 12029-12049 New England Highway, Black Mountain, NSW.

Under Section 170 of the *Aboriginal Land Rights Act 1983* the Office of the Registrar is required to maintain the Register of Aboriginal Owners (RAO). A search of the RAO has shown that there are not currently any Registered Aboriginal Owners in the project area.

We suggest you contact Armidale Local Aboriginal Land Council on 02 6772 2447 as they may be able to assist you in identifying Aboriginal stakeholders who wish to participate.

Yours sincerely

ELoane

Elizabeth Loane
Project Officer, Aboriginal Owners
Office of the Registrar, ALRA

[redacted]

From:	Geospatial Search Requests
To:	Ali Byrne
Subject:	RE: SR6066 - Request for Aboriginal stakeholders - Tilbuster Solar Farm - SR6066
Date:	Wednesday, 10 July 2019 12:48:22 PM

UNCLASSIFIED

Native title search – *NSW Parcels – DP392067 and DP585523*
Your ref: *18-465* - **Our ref:** *SR6066*

Dear Chelsea Jones,

Thank you for your search request received on 10 July 2019 in relation to the above area. Based on the records held by the National Native Title Tribunal as at 10 July 2019 it would appear that there are no Native Title Determination Applications, Determinations of Native Title, or Indigenous Land Use Agreements over the identified area.

Search Results
The results provided are based on the information you supplied and are derived from a search of the following Tribunal databases:

- Schedule of Native Title Determination Applications
- Register of Native Title Claims
- National Native Title Register
- Register of Indigenous Land Use Agreements
- Notified Indigenous Land Use Agreements

At the time this search was carried out, there were **no relevant entries** in the above databases.

Please note: There may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed with the Federal Court may not appear on the Tribunal's databases.

The Tribunal accepts no liability for reliance placed on enclosed information
The enclosed information has been provided in good faith. Use of this information is at your sole risk. The National Native Title Tribunal makes no representation, either express or implied, as to the accuracy or suitability of the information enclosed for any particular purpose and accepts no liability for use of the information or reliance placed on it.

If you have any further queries, please do not hesitate to contact us on the free call number 1800 640 501.

Regards,

Geospatial Searches
National Native Title Tribunal | Perth
Email: GeospatialSearch@nntt.gov.au | **www.nntt.gov.au**

From: Ali Byrne <ali.b@nghenvironmental.com.au>
Sent: Wednesday, 10 July 2019 6:33 AM
To: Geospatial Search Requests <GeospatialSearch@NNTT.gov.au>
Subject: SR6066 - Request for Aboriginal stakeholders - Tilbuster Solar Farm

Good morning,

Please find attached a request for the details of any Aboriginal people who may hold an interest in the region of Tilbuster Solar Farm near Armidale NSW.

Kind regards,
Ali

Alexandra Byrne | Senior Heritage Consultant, Hunter and North Coast Region
BAarch |

[redacted]

29 July 2019

SAMPLE ONLY

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

ngh@nghconsulting.com.au
www.nghconsulting.com.au

Dear SAMPLE ,

RE – 18-465 Notification for registration of interest for Aboriginal stakeholders for proposed Tilbuster Solar Farm

NGH Pty Ltd (NGH) has been contracted by Enerparc Australia Pty Ltd (223 Liverpool St Darlinghurst NSW 2010) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) to support an Environmental Impact Statement addressing the proposed Tilbuster Solar Farm on the New England Highway near Tilbuster, NSW. The proposal is to be assessed as a State Significant Development under Part 4 of the *NSW Environmental Planning and Assessment Act 1979*.

The proposed solar farm is located within Armidale Local Government Area and consists of part of 11915 New England Highway and part of 12029-12049 New England highway, Black Mountain, NSW. The total site has an area of 150ha (Figure 1).

The purpose of the consultation with Aboriginal people is to provide an opportunity to assist in the preparation of the ACHA; to be involved in consultation regarding Aboriginal cultural heritage; and to be involved in the assessment and management of potential impact to Aboriginal cultural heritage values in accordance with the Secretary's Environmental Assessment Requirements for the project.

In order to fulfil the requirements set out in the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, NGH is seeking interested Aboriginal parties who hold cultural knowledge of the assessment area to register their interest in the consultation process for the project and to assist in the determination of cultural significance of any Aboriginal objects or places located there.

NGH, on behalf of the proponent, is seeking expressions of interest from Aboriginal parties who hold cultural knowledge for the Tilbuster and surrounding area to participate in the consultation process for the proposed works and to assist in the determination of cultural significance of any Aboriginal objects or places located within the proposal area.

If you would like to register an interest in this project or know of any Aboriginal parties who may hold cultural knowledge, could you please respond in writing by 27 August 2019:

[redacted]

Or via email to: ali.b@nghconsulting.com.au
If you have any questions, please do not hesitate to contact me [redacted]

[redacted]

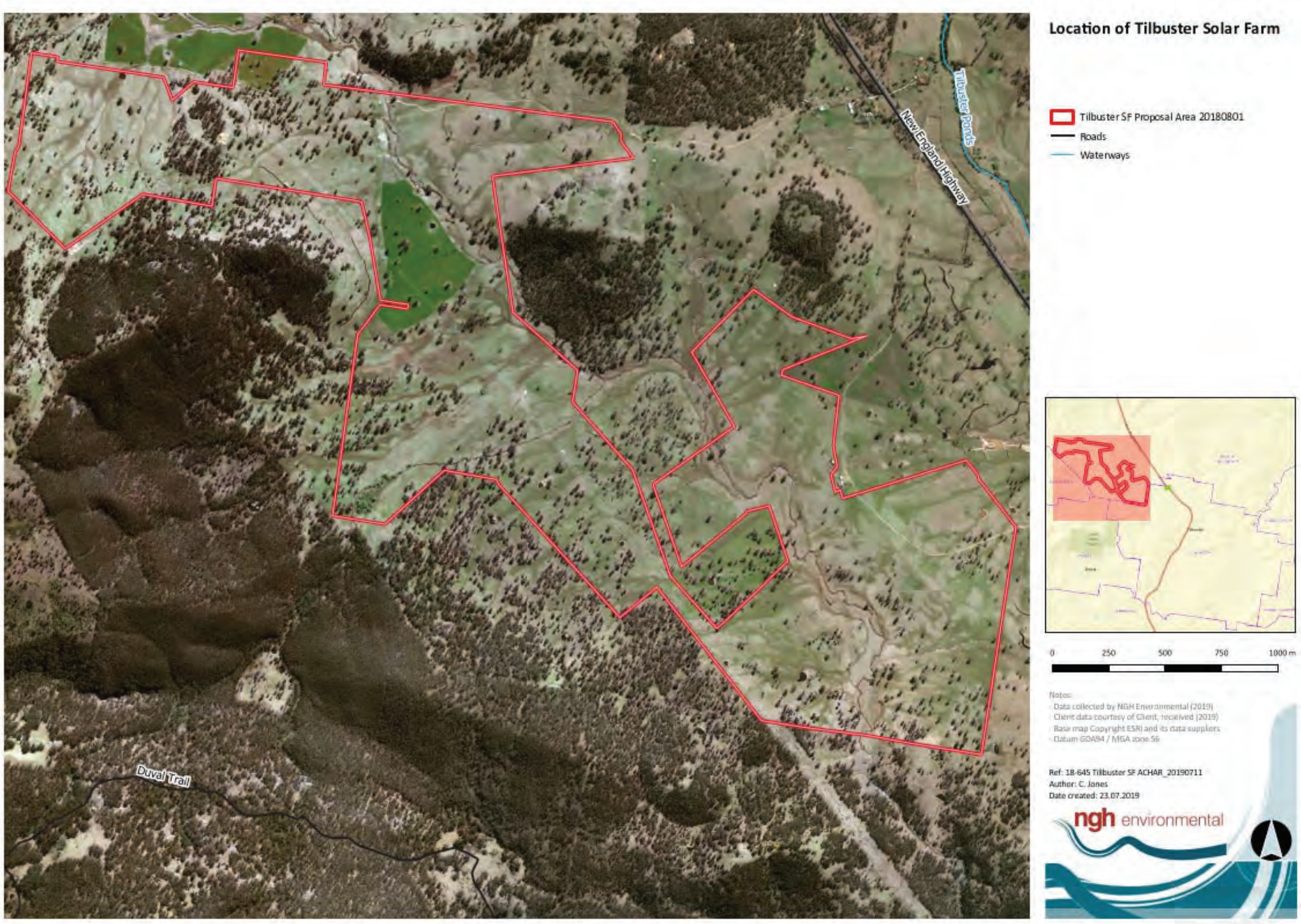

Figure-1 Location of Tilbuster SF Proposal Area

Nunawanna Aboriginal Corporation
[redacted]

NGH Environment Pty Ltd

[redacted]

11/07/2019

Dear NGH,

I am writing to you in response of the proposed development as advertised in the Armidale Express local paper in the local tablelands on Wednesday, July 10, 2019.

I would kindly ask if you would put my organization's name Nunawanna Aboriginal Corporation to your list as a Aboriginal stake holder in the proposed work area.

As a Aboriginal stake holder we would appreciate if our organization be involved in the Aboriginal cultural and heritage and preparation of the environmental impact report for the proposed Tilbuster Solarfarm on the New England Highway near Tilbuster.

I have a long asscioation with the country where the proposed work will take place (part of 11915 New England Highway and part of 12029-12049 of New England Highway, Black Mountain, NSW) which is on the Songline for the Anaiwan Custodians. having lived in this community for many years, I have a strong connection to the Anaiwan land.

I have worked with many archeologists in the New England Area over the years and I have the trust and respect from those Archeologists. I worked on other major projects in the area.

Archeologist reference:

Greaham Knuckey Remnant Archeaology

Wendy Beck Assciote professor at the University of New England

John Appleton Consultant

Sincerely

Colin Ahoy

Chairperson

Previous experience has been on multiple Archealogical digs and surveys the most recent being the New England Solarfarm, UNE solarfarm, Metz Solarfarm.

From:	Anaiwan TOAC
To:	Ali Byrne
Subject:	Solar Farm
Date:	Tuesday, 23 July 2019 10:04:45 PM

Hi

On behalf of ATOAC I would like to register an interest in the Tilbuster Solar Farm.

--

Thank You David Ahoy
Director
ATOAC
[redacted]

Yugga danya Ngawanya
(I am a Man of the Anaiwan people.)
Roonyahra tanya tampida Ngawanya
(This is the ancestral land of the Ngawanya.)
Ootila tanya yoonyarah
(I welcome you to this land.)

From: Anaiwan TOAC
To: Ali Byrne
Subject: Solar Farm
Date: Tuesday, 23 July 2019 10:04:45 PM

Hi

On behalf of ATOAC I would like to register an interest in the Tilbuster Solar Farm.

--

Thank You David Ahoy
Director
ATOAC
[redacted]

Yugga danya Ngawanya
(I am a Man of the Anaiwan people.)
Roonyahra tanya tampida Ngawanya
(This is the ancestral land of the Ngawanya.)
Ootila tanya yoonyarah
(I welcome you to this land.)

Iwatta Aboriginal Corporation

[redacted]

June 26, 2019

HI,
Iwatta Aboriginal Corporation would like to express interest in taking part with the ACHA to be carried out as part of the Tilbuster Solar Farm development.There are non-recorded Aboriginal sites very close to the project area, that suggest a high potential for Cultural Artefacts to be present. I have cultural knowledge of the area and would like to request participation in the Aboriginal Cultural Heritage Assessment.

Notification for registration of interest for Aboriginal stakeholders

NGH Environmental has been contacted by Enerparc Australia Pty Ltd (223 Liverpool St Darlinghurst NSW 2010) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) to support an Environmental Impact Statement addressing the proposed Tilbuster Solar Farm on the New England Highway near Tilbuster, NSW. The proposal is to be assessed as a State Significant Development under Part 4 of the NSW *Environmental Planning & Assessment Act 1979.*

The proposed solar farm is located within the Armidale local government area and consists of part of 11915 New England Highway and part of 12029-12049 New England Highway, Black Mountain, NSW. The total site has an area of 150ha.

The purpose of consultation with Aboriginal people is to provide an opportunity to assist in the preparation of the ACHA; to be involved in consultation regarding Aboriginal cultural heritage; and to be involved in the assessment and management of potential impact to Aboriginal cultural heritage values in accordance with the Secretary's Environmental Assessment Requirements for the project.

In order to fulfil the requirements set out in the NSW Office of Environment and Heritage *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010,* NGH is seeking interested Aboriginal parties who hold cultural knowledge of the assessment area to register their interest in the consultation process for the project and to assist in the determination of cultural significance of any Aboriginal objects or places located there.

Registrations should be provided in writing to:

NGH Environmental Pty Ltd
Unit 2, 54 Hudson Street
HAMILTON NSW 2303

Or via email to: **ali.b@nghenvironmental.com.au**

Closing date for registration is Wednesday 24th July 2019

Those registering an interest will be contacted to discuss the project further. Those who do register are advised that their details will be provided to OEH and the LALC, unless they specifically advise that their details are not to be forwarded.

Yours sincerely
Steven Ahoy
Senior sites officer.
[redacted]

From: Emily Nagy
To: Ali Byrne
Subject: FW: Tilbuster/Solar farm
Date: Wednesday, 31 July 2019 5:07:07 PM
Attachments: IMG_4389.jpg
image001.png

EMILY NAGY
PROJECT ADMINISTRATION OFFICER
BEnvSci
[redacted]

BEGA · BRISBANE · CANBERRA · GOLD COAST · NEWCASTLE · SYDNEY · WAGGA WAGGA
WWW.NGHCONSULTING.COM.AU

From: david ahoy [redacted]
Sent: Wednesday, 31 July 2019 5:05 PM
To: Emily Nagy [redacted]
Subject: Tilbuster/Solar farm

Re: Tilbuster/Solar Farm

Hi Emily,

Please accept my response to your email.

Sincerely
Larissa Ahoy

NYAKKA ABORIGINAL CULTURE HERITAGE CORPORATION ARCHAEOLOGICAL & CULTURAL HERITAGE CONSULTANTS

12/07/2019

TILBUSTER SOLAR FARM NEW ENGLAND HIGHWAY VIA ARMIDALE, NEW SOUTH WALES

Attention: NGH ENVIRONMENTAL

I would like to formally register an interest in the above project.

Nyakka Aboriginal Cultural Heritage Corporation was established by Aboriginal people who have direct connection to Anaiwan country. Surrounding areas mentioned form part of the Anaiwan country therefore, we would like to register our group as interested stakeholders and Aboriginal Owners within Armidale and Hillgrove area.

Rhonda Kitchener is our Senior Sites Officer and Knowledge Holder who can assist you with cultural information in the Anaiwan country.

Can you please ensure that Rhonda is placed on your data base as a registered Knowledge Holder and Aboriginal Owner in Anaiwan Country

Yours sincerely

Rhonda Kitchener

Chairperson

From:	Cheryl Kitchener
To:	Ali Byrne
Subject:	Fwd: Tilbuster Solar Farm
Date:	Tuesday, 16 July 2019 10:56:57 AM

Please see email I unfortunately sent the previous email to the wrong address

Cheryl

Cheryl Kitchener
[redacted]

---------- Forwarded message ---------
From: **Cheryl Kitchener** [redacted]
Date: Tue, Jul 16, 2019 at 10:52 AM
Subject: Tilbuster Solar Farm
To: <ali@nghenvironmental.com.au>

Dear Sir/Madam

I would like to register an interest in the Tilbuster Solar Farm project. I understand that this is a late request but I've only been notified of the project.

I am a registered Anaiwan Aboriginal Owner is which the Solar Farm is being proposed, I was raised in Armidale and have worked in and around Anaiwan Country for approximately 40 years. I am a qualified archaeologist and have not only worked but studied under Elders both past and present on cultural issues and values within Country. I have previously worked in the Tilbuster area, notably on the Sunnyside Women's site in early 2000's and the Tilbuster bridge in the early 1990's. I continue to work as a cultural officer for Culturally Aware in Anaiwan Country.

I am a Knowledge Holder is the local community and sit on a variety of committees that involve the protection and preservation of Anaiwan Culture.

I would like to be considered for this project.

Regards

Cheryl

Cheryl Kitchener
[redacted]

From:	tony dootson
To:	Ali Byrne
Subject:	RE: Tilbuster/Solar Farm OUR REF:18-645
Date:	Wednesday, 14 August 2019 8:33:10 PM
Attachments:	image001.png

Ali ,

Can you please advise that I will be available for consultation on ground's of walking track's and a source called citrean (arh) from the ocean ? will talk soon .

Thank you very much cant wait to catch up , love ya work

Sent from Mail for Windows 10

From: Ali Byrne
Sent: Tuesday, 13 August 2019 9:05 AM
Subject: Tilbuster/Solar Farm OUR REF:18-645

Good morning
Thank you for registering your interest in this project.

Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.

We welcome your questions or comments on the methodology and any cultural information you might be willing to provide to aid us in the assessment.

Please provided your response in writing (email or mail) by Tuesday 10 September 2019.

Kind regards,
Ali

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)
[redacted]

NGH

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ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Tilbuster Solar Farm

August 2019

Project Number: 18-645

DOCUMENT VERIFICATION

Project Title:	Tilbuster Solar Farm
Project Number:	18-645
Project File Name:	18-645 Tilbuster SF Report

Revision	Date	Prepared by	Reviewed by	Approved by
Draft	9/08/2019	Ali Byrne	Chelsea Jones	Ali Byrne

NGH Consulting prints all documents on environmentally sustainable paper including paper made from bagasse (a by-product of sugar production) or recycled paper.

W. www.nghconsulting.com.au

BEGA - ACT & SOUTH EAST NSW
Suite 11, 89-91 Auckland Street (PO Box 470) Bega NSW 2550 **T.** (02) 6492 8333

BRISBANE
Suite 4, Level 5, 87 Wickham Terrace
Spring Hill QLD 4000 **T.** (07) 3129 7633

CANBERRA - NSW SE & ACT
8/27 Yallourn Street (PO Box 62)
Fyshwick ACT 2609 **T.** (02) 6280 5053

GOLD COAST
PO Box 466
Tugun QLD 4224 **T.** (07) 3129 7633

E. ngh@nghconsulting.com.au

NEWCASTLE - HUNTER & NORTH COAST
Unit 2, 54 Hudson Street
Hamilton NSW 2303 **T.** (02) 4929 2301

SYDNEY REGION
Unit 18, Level 3, 21 Mary Street
Surry Hills NSW 2010 **T.** (02) 8202 8333

WAGGA WAGGA - RIVERINA & WESTERN NSW
Suite 1, 39 Fitzmaurice Street (PO Box 5464)
Wagga Wagga NSW 2650 **T.** (02) 6971 9696

TABLE OF CONTENTS

FIGURES

TABLE

1. INTRODUCTION

NGH has been contracted by Enerparc Australia Pty Ltd (Enerparc) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to investigate and examine the presence, extent and nature of Aboriginal heritage for the proposed State Significant Development Tilbuster Solar Farm, located at:

- Lot 1 DP225170
- Lot 1 DP585523
- Lot 3 DP800611

The proposal area comprises approximately 150 hectares (ha) of agricultural land within the Armidale Local Government Area (LGA).

The solar farm proposal will involve ground disturbance works that have the potential to impact Aboriginal cultural heritage sites and objects, protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the ACHA is therefore to investigate the presence of any Aboriginal sites and their values; and to assess the potential impacts to these values, providing recommendations for management measures which may mitigate, reduce or prevent impact.

The Secretary’s Environmental Assessment Requirements (SEARs) for the project identify that Aboriginal heritage must be addressed by the Environmental Impact Statement (EIS). The SEARs identify that the following codes and guides should be followed in relation to Aboriginal heritage assessment.

- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
- Code of Practice for Archaeological Investigations of Objects in NSW http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
- Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf

The above codes and guidelines are issued by the Department of Planning, Industry and Environment’s (DPIE) Biodiversity and Conservation Division (BCD) (formerly OEH) and are followed for most Aboriginal heritage assessments. The approach undertaken by NGH will be consistent with other heritage assessments undertaken in NSW.

2. ABORIGINAL COMMUNITY CONSULTATION

NGH will consult with the Aboriginal community throughout the project, in line with the requirements outlined in the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* This has included the following steps:

- Advertising for interested parties by placing a public notice advertisement in *The Armidale Express* on 10 July 2019;
- Writing to required agencies, including OEH, advising of the project and seeking known interested parties; and
- Writing to any additional identified parties from OEH, seeking their interest.

This methodology is now being provided for comment to the registered Aboriginal parties as the next step in the consultation process.

A site survey of the proposal area is recommended as part of this ACHA methodology and this fieldwork component will proceed with assistance from representatives of the Aboriginal community. Once fieldwork is completed, a draft Aboriginal Cultural Heritage Assessment Report will be written, and this will be provided to registered Aboriginal parties for comment.

The final report will incorporate information provided by the Aboriginal community and a copy will be provided to each party for their records.

3. BACKGROUND INFORMATION

3.1. PROJECT BACKGROUND

The proposed solar farm at Tilbuster, NSW (see Figure 1), is a State Significant Development and therefore includes the following requirements for the Aboriginal Cultural Heritage Assessment (SEARS):

- Identify and describe the Aboriginal cultural heritage values that exist across the whole area that would be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). The identification of cultural heritage values must be conducted in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (DECCW 2010), and guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- Consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR; and
- Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.

Figure 3-1. General location of project area.

4. ARCHAEOLOGICAL BACKGROUND

4.1.1. Aboriginal Heritage Information Management System – Identified Aboriginal Heritage Sites

The purpose of the Aboriginal cultural heritage assessment is to investigate the presence and extent of any Aboriginal sites within or adjacent to the project area and to assess their significance and any possible impacts from the proposed works. As part of the desktop assessment for this project, an extensive search was undertaken of the Aboriginal Heritage Information Management System (AHIMS), which is maintained by NSW BCD (formerly OEH). This search identified 15 previously recorded Aboriginal heritage sites in an approximately 2.5 x 3-kilometre zone centred on the project area.

4.2. AHIMS – PREVIOUSLY RECORDED SITES NEAR THE STUDY AREA

The AHIMS is maintained by the NSW BCD (formerly OEH) and provides a database of previously recorded Aboriginal heritage sites. A search provides basic information about any sites previously identified within a search area. However, a register search is not conclusive evidence of the presence or absence of Aboriginal heritage sites, as it requires that an area has been inspected and details of any sites located have been provided to BCD to add to the register. As a starting point, the search will indicate whether any sites are known within or adjacent to the investigation area.

A search of the AHIMS database was conducted on 30 July 2019 by NGH, centred around the project area using the following parameters:

- Client Service ID: 437091
- GDA Zone 56
- Eastings 366386 – 375450
- Northings: 6634815 – 6641601
- Buffer: 200 metres
- Aboriginal objects: 15

The results of the AHIMS search are shown in Figure 4-1and Table Table 4-1. Table 4-2lists the registered sites located less than one kilometre from the project area.

Table 4-1 AHIMS Registered sites

Site Type	Number
Open Camp Site / Artefact Scatter	13
Isolated Find	1
Aboriginal Ceremony and Dreaming	1
TOTAL	15

There are six registered sites within one kilometre of the project area, with the closest sites (identified as an artefact) located on the southern boundary of the project area (AHIMS ID 21-1-0058 and 21-2-0066).

Table 4-2below, shows the sites located within 1km of the project area.

Table 4-2 AHIMS registered sites within 1km of the Project Area

No.	AHIMS ID	Status	Site Type
1	21-1-0058	Valid	Open camp site / artefact scatter
2	21-1-0066	Valid	Open camp site / artefact scatter
3	21-1-0074	Valid	Open camp site / artefact scatter
4	21-1-0075	Valid	Open camp site / artefact scatter
5	21-1-0068	Valid	Open camp site / artefact scatter
6	21-1-0069	Valid	Open camp site / artefact scatter

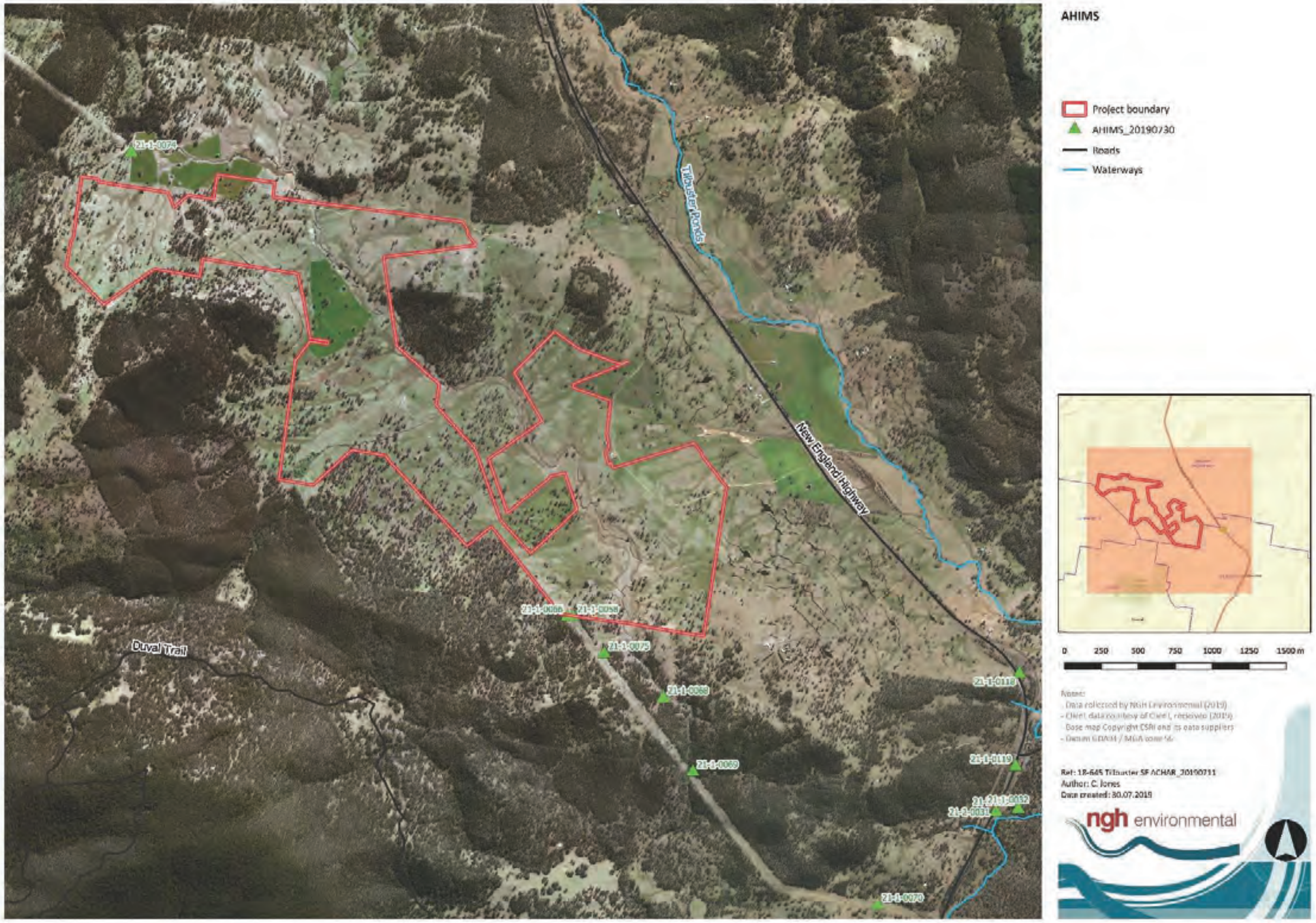

Figure 4-1 Location of AHIMS sites near project area

4.3. PROJECT AREA ENVIRONMENTAL BACKGROUND

4.3.1. General Description

The project area is located within the locality of Tilbuster in the Armidale LGA. The site has a total area of 150ha and is proposed to include 12,171 panels, with a total capacity of 300 MW.

Land within the project area is predominately cleared, with some scattered trees, and several more thickly wooded areas, and disturbances are limited to farming activities including livestock grazing, dam construction and fencing.

4.3.2. Geology and Topography

The landscape context assessment is based on a number of classifications that have been made at national and regional level for Australia. The national IBRA system identifies the proposal area as located within the NSW New England Tableland Bioregion (DE&E 2016). The dominant IBRA subregion affected by the proposal is the Armidale Plateau subregion.

The bioregion comprises part the north eastern section of the New England Fold Belt consisting of extensively faulted Carboniferous and Permian age sedimentary rocks. The majority of bedrock is superimposed by Tertiary basalt underlain by gravels, sands and lake sediments. Within the sands, beneath the basalt, inclusions of gold, diamond, tin ore and sapphires have been mined.

The Armidale Plateau subregion is characterised by and undulating plateau at around 1100m with broad valleys, stepped landscape across basalt flows with valleys steepening towards the Great Escarpment Gorges. Geology of the plateau is characterised by fine grained permo-carboniferous sedimentary rocks, multiple tertiary basalt flows and granites. A contrast in soils of the subregion is evident through the friable well drained soils on the upper slopes and compact poorly drained soils of the lower slopes. Soil types vary between black earths along valley floors, inconstant stony loams and dark loamy alluvium in swampy valleys (DE&E 2016).

The New England Geological Map (1:500 000 1973/333) indicates the geology underlying the proposal area consists of Permian and Carboniferous Geological sequences. The northern component of the Proposal Area is within the Dummy Creek Conglomerate (Pd) and the southern component in the Sandon Beds Formation (cs).

- Pd Dummy Creek conglomerate: comprising pebble conglomerate, coarse sandstone and massive mudstone
- Cs Sandon Beds: comprising greywacke, claystone, chert, jasper and black volcanic.

Water supply is often suggested as being the most significant factor influencing peoples' prior land-use strategies. Tilbuster Ponds runs adjacent to the proposal area to the east but is still approximately 900m away with Dumaresq Creek four kilometres to the west.

The proposal area is encompassed by the Dingo Spur Meta-sediments (Dsm) soil landscape type. The Mitchell Landscape descriptions are provided in Table 3.

Table 3 Dingo Spur Meta-sediments soil landscape

Mitchell Landscape
Dingo Spur Meta-sediments

“Steep ranges and hills intersected by a dendritic drainage pattern leading into deep gorges with high waterfalls on the Great Escarpment, extends west onto the tablelands. Gorges incised into faulted, steep dipping Devonian quartzose sandstone, greywacke, massive argillite and slate. Tablelands area on Permo-Carboniferous mudstone, lithic sandstone, tuff, slate, hornfels and some schist. General elevation 300 to 1400m, local relief 600m. Shallow stony loam on steep scree slopes with moderate organic content. Shallow gradational loam and sandy loam elsewhere with deeper uniform profiles in low valleys.

A very complex vegetation environment encompassing coastal closed forests, dry hardwood forests and cold high plateau components. Open forest of New England blackbutt *(Eucalyptus andrewsii ssp. campanulata*), messmate *(Eucalyptus obliqua*), silvertop stringybark (*Eucalyptus laevopinea*) with New England peppermint (*Eucalyptus cinerea*), snow gum (*Eucalyptus pauciflora*) and black sallee (*Eucalyptus stellulata*) in high cool environments. Dry closed forest species such as; shatterwood (Backhousia sciadophora), giant stinging tree (*Dendrocnide excelsa*), shiny-leaved stinging tree (*Dendrocnide photinophylla*), and yellow tulip (*Drypetes australasica*) in lower moister environments and in patches on scree slopes where protected from fire. Riveroak (*Casuarina cunninghamiana*) along all streams and dry hardwood forests of; yellow box (*Eucalyptus melliodora*), Blakely’s red gum (*Eucalyptus blakelyii*), broad-leaved stringybark (*Eucalyptus caliginosa*) and cabbage gum (*Eucalyptus amplifolia*) on valley floors. “(DECC 2002)

4.3.3. Climate

The climate of the New England Tableland is temperate to cool temperate comprising warm summers with uniform rainfall. The man annual temperature is between 9 and 17 degrees, with a mean annual rainfall between 653-1765mm.

4.3.4. Flora and Fauna

Vegetation characteristic of basalt-derived soils within the New England Tableland bioregion include open forests and woodland of black sallee, snow gum and manna gum. Additionally, community’s characteristic of these soils and this bioregion include New England peppermint (*Eucalyptus nova-anglica*), wattle-leaved peppermint (*Eucalyptus acaciiformis*), narrow-leaved peppermint (*Eucalyptus radiata*), yellow box, New England stringybark (*Eucalyptus calignosa*) and New England blackbutt (*Eucalyptus campanulata*).

The Bioregions also supports ninety-two fauna species listed under the TSC Act, included 18 endangered species, 72 vulnerable species and some now extinct (NSW NPWS 2001).

4.4. PREVIOUS STUDIES AND ARCHAEOLOGICAL MODELS

The Tilbuster area is within a region identified as part of the Nganyaywana (Anaiwan) language group. This name defines an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1996, Tindale 1974 and Horton 1996). The borders are, however, not static but rather fluid, expanding and contracting over time with relation to the movements of smaller family or clan groups. Boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought or abundance.

As a result of the archaeological research of the wider New England Tablelands region, there are a number of theoretical stances which are important to outline—the majority of these are mainly based on the quantity of stone artefact concentrations present. This is due to their ability to survive in the record more commonly than other archaeological features or objects – stone does not break down as organics such as wood and bone do. Many research questions surrounding the analysis of stone artefacts are concerned with the interpretation of stone artefacts as representations of occupational histories in the landscape. Researchers have asked questions such as:

- How did Aboriginal people use the landscape?
- How did Aboriginal people use the resources and landscape available to them?
- What patterns of occupation can we see?
- Did Aboriginal people stay in some places longer than others?
- What is the age of the deposit and what time duration does the deposit represent?

Limited dating information regarding occupation of the New England region by Aboriginal people is available. Excavations undertaken in the Hunter Valley and Nepean region further to the south east have indicated dates at least as far back as 20,000 years and up to 40,000 years before present (Koettig 1987, McDonald 2005; Nanson et al. 1987; Stockton 1993; Stockton & Holland 1974). Dates retrieved from New England are detailed in Table 4-3.

Table 4-3 Dated sites in greater New England region (Source: McBryde 1977, in RPS 2010)

Site	Date	Laboratory Reference
Seelands (near Grafton)	6444 ±74 BP	V-27
Graman Shelter B1 (near Inverell)	5450 ±100 BP	Gak-806
Moore Creek (near Tamworth)	3820 ±110 BP	Gak-1631

This is consistent with the majority of dates retrieved from other sites throughout south eastern NSW, with a number of theories posited to explain this. One such theory suggests that an increase in occupation density during the last 3,000 to 5,000 years is responsible for the higher number of sites identified which date to this period, while another theory suggests that sites which were concentrated along the coast were inundated during sea level rise and therefore lost from the archaeological record (Kohen 1986; McDonald 1994; McDonald & Rich 1993).

Analysis from excavations at Bendemeer Rockshelters 1 and 2 and Graman Rockshelters by McBryde (1974; 1977, in Davies 2002), revealed occupation dates of 4,400 and 9,000 years before present respectively. The Graman rockshelters are located on the western edges of the tablelands, where the underlying geological formations comprise basalt and sandstone. Of four sites excavated, two contained evidence of backed blade industries dating to 4,960 and 5,450 years before present. Grindstones were also present, suggesting some reliance on grass seeds as part of the diet. Faunal remains, likely remains of food consumption, include brush-tailed possum, bandicoot, grey kangaroo, lizard, fish and shellfish. The upper layers of one of the shelters, GB4, contained a marked increase in the presence of bandicoot remains, coinciding with a decrease in kangaroo remains, a change which was accompanied by greater quantities of edge-ground axes.

The Bendemeer shelters, sites 1 and 2, were located west of Bendemeer, and yielded sequences of approximately 3,000 to 300 years before present, and 4,350 to 950 years before present respectively. Evidence from these sites suggests that yam was a more common food source than grass seeds, grindstones being absent. Backed blades were also common (McBryde 1976 in Davies 2002). As a result of the analysis of the excavated material, it was noted that stone tool assemblages on the Tablelands and the coast were distinct from one another after 3,000 years before present, and McBryde indicated that determining whether this difference was representamen of a cultural boundary or rather indicated assemblages specialised to the environments in which they were used and the associated resources available, was an important question for New England (1974, in Davies 2002).

Later research by Hall and Lomax (1991, in Davies 2002), suggested that the separation of technologies may not have been as distinct in the north eastern parts of the tablelands.

McBryde’s research also indicated that there were no recorded artefacts, stratified archaeological deposits or surface Bondaian sites above 1,000 metres above sea level. However, research by Godwin resulted in the identification of sites above 1,000 metres, citing a bias in McBryde’s survey methodology (1983, in Davies). Godwin’s results indicated that while there was some interaction between the people of the tablelands and the people of the western slopes, there was little evidence to suggest that the people of the tablelands interacted much with the coastal people, which had been theorised by Belshaw (1978) and Bowdler (1981) (Godwin 1993, in Davies 2002:33).

It has been noted by Appleton (1990) that a number of predictive models, specifically those of McBryde (1974;1977) and Bowdler (1981), for the New England region, formulated in the 1970s and 1980s, were based on discussions with local knowledge holders during field work, and not necessarily on the results of systematic survey. Appleton suggests that Godwin’s research was the first to include intensive surveys which provided suitable data for the preparation of an accurate model for the region (Appleton 1993: 7). Godwin’s observations included that many relatively dense artefact scatters are located on woodland (or formerly wooded) ridges, parallel to and at a short distance from water courses. He also observed that the two site types, near water or in woodland settings, exhibited differing characteristics, both in density of artefacts and in distinctive characteristics of stone tool.

In the Armidale area and surrounds, Sutton (1988, in Appleton 1990) recorded a number of artefact sites at locations around the township. These sites included three surface scatters and five isolated surface artefacts; material was primarily silcrete, with porcellanite and mudstone also present at one site.

Davies (2002) was engaged to complete an assessment at Tilbuster in 2002, and a review of previous literature for the local and regional area indicated that the area had low to moderate archaeological potential. Davies’ survey identified no Aboriginal objects or sites within the 5.15ha project area, however the report indicated that there was some potential for sites to be present on the terrace of a creek within the project area.

Davidson and Appleton (1990) recorded a number of artefact locations along Cluny Road to the north of Armidale. These were also surface sites dominated by artefacts manufactured from silcrete materials. A silcrete quarry was identified by Piper (nd, in Appleton 1990), containing upwards of 100 artefacts per square metre. Appleton and Davidson also identified a chert / silcrete quarry and sandstone boulder with grinding grooves was recorded to the northeast of Armidale Airport.

Appleton states that with the exception of the two quarries, and two other sites, the artefacts were all recorded on erosion features in a secondary context (Appleton 1990:11).

4.5. PREDICTIVE MODEL

A detailed understanding of Aboriginal land use of the region is lacking, as few in depth studies have been completed in close proximity to the proposal area. It is possible, however, to ascertain that proximity to water sources and raw materials was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the current archaeological record of that activity is limited.

Solar farm developments are proceeding throughout the south eastern Australian landscape. The majority of these projects are based in landscapes similar in topography to the current project area. These landscapes also mainly consist of grids of panels located on broad, level paddocks, set away from the riparian zone, though they are still within less than 200 metres of water courses.

Per the results of Godwin's studies, it is noted that proximity to water is one of the defining factors for the presence of sites containing higher densities of artefacts (Godwin, in Appleton 1990). Results from the work of Appleton and predecessors including McBryde (1977) indicate that the most common site type in the region is surface artefact sites, with closed sites such as shelters occurring only on the scarps and slopes of the upper slopes areas.

Based on the results of these previous archaeological investigations in the local area, it is possible to provide the following model of site location in relation to the proposed Tilbuster Solar Farm project area.

Stone artefact scatters – representing camp sites these sites can occur across the landscape, usually in association with some form of resource or landscape unit such as broad ridgelines which were used for travel through the mountainous landscape. Creek lines and small water holding bodies can also be a focus of Aboriginal occupation. Boundaries between changes in vegetation can also be a focus for occupation. Within the solar farm project area, gently sloping simple slopes and low ridgelines, with small creek line crossings are present. As such, there is moderate to high potential for this site type to be present.

Burials – are generally found in sandy contexts or in association with rivers and major creeks. No such features exist with the solar farm project area and therefore such sites are unlikely to occur.

Scarred Trees – these require the presence of mature trees and are likely to be concentrated along major ridgelines, flat level open areas in the landscape or in association with water courses. Much of the project area has been cleared for use as agricultural land, however there are some wooded areas still extant. If mature trees exist in the area, there is moderate potential for scarred trees to occur in the study area.

Stone resources – are areas where people used natural stone outcrops as a source material for flaking. This requires geologically suitable material outcropping so as to be accessible. The solar farm project area may contain some natural outcropping stone including silcrete. There is therefore moderate potential for this site type to occur.

Isolated Artefacts – are present across the entire landscape, in varying densities. As Aboriginal people traversed the entire landscape for thousands of years, such finds can occur anywhere and indicate the presence of isolated activity, dropped or discarded artefacts from hunting or gathering expeditions or the ephemeral presence of short-term camps. Discarded single artefacts are most likely to be present in the vicinity of creeks.

In summary, the presence of low gently clopping simple slopes, and Duval Creek and its tributaries, may have made the area attractive to past Aboriginal people for camping or resource procurement. This suggests that there is a moderate to high probability for site types such as artefact scatters or isolated finds to be present. Repeated use of these areas would increase the probability of leaving archaeological traces and increasing the significance of the site location. Nonetheless, given that Aboriginal people have lived in the region for tens of thousands of years, there is some potential for archaeological evidence to occur in all areas. This low density, dispersed material away from loci is most likely to be in the form of isolated stone artefacts or scarred trees.

5. ASSESSMENT METHODOLOGY

5.1. AIMS

Broadly, the aims of the Aboriginal Cultural Heritage Assessment are to:

- Verify known Aboriginal sites within the proposal area and within a 200-metre buffer zone, and determine if these sites will be impacted by the proposed works;
- Consult with the Aboriginal community about the project;
- Record any Aboriginal sites/objects identified within the study area;
- Determine any areas of potential Aboriginal heritage sensitivity;
- Assess the significance of any sites, and
- Develop recommendations for options on how to manage identified Aboriginal heritage sites and objects.

5.2. METHODOLOGY OUTLINE

The following is an outline of the steps that would be involved in completing the Aboriginal Cultural Heritage Assessment for the project area. This forms the methodology for the assessment:

- Consultation with Aboriginal parties;
- Notification of the project and registration of interest – obtain names of people who may hold cultural knowledge through written requests to relevant bodies and authorities and advertising in the local paper (**Completed**);
- Provide details of the project and the heritage assessment methodology to registered parties for comment (**This document**);
- Seek any information on whether there are any known places or objects of cultural significance to the Aboriginal people (**This document and ongoing until finalisation of report**);
- Involvement of selected representatives of the registered parties in survey fieldwork;
- Provide opportunity for the registered parties to review and comment on the draft cultural heritage assessment;
- Incorporate any comments from Aboriginal parties into the cultural heritage assessment;
- Review of background information relevant to the subject area. Request an AHIMS register search to identify the location of previously recorded sites and review any archaeological reports or site records of the immediate area (**Completed**);
- Undertake field assessment. The project area has been identified as an agricultural property primarily comprising cleared paddocks, with some farm structures and dams;
- It is our intention to assess the area to identify the boundaries of any PADs and to establish if there are artefacts present through surface survey;
- Field survey will involve the following elements:
    - Walking across the project area in a systematic way to identify Aboriginal objects. The survey would aim to provide enough surface coverage to be confident of assessing the area for the presence of Aboriginal sites. Survey transect participants would be staged 20 metres apart.
    - Recording all Aboriginal heritage objects using standard archaeological techniques including: location, environmental context, extent, content, disturbance level.
    - Photograph sites.
    - Record stone artefacts, collecting standard information including: type, raw material, dimensions, note of technical attributes. The GPS location of individual stone artefacts would

be recorded up to a point but for higher density sites or clusters of artefacts, we would record them as a polygon. If large sites were identified, we would record samples of artefacts;

- Undertake a significance assessment of any Aboriginal cultural objects, sites or places;
- To the extent possible with information available, assess the impact of the proposed development on the archaeological sites and devise ways to avoid or mitigate any impact, if possible;
- Prepare a draft ACHAR. The report will be a cultural heritage assessment of the subject area and include the results of the steps outlined above. The draft ACHAR will be provided to registered Aboriginal parties for comment;
- Prepare final report. Consider all comments and finalise report.

5.3. REPORT

A report detailing the results of the survey and assessment will be prepared. The report will be structured to provide the following information:

- Introduction
- Aboriginal consultation
- Project setting
- Archaeological setting
- Archaeological methods
- Results
- Discussion
- Significance assessment
- Conclusions
- Recommendations

The report will include descriptions of sites, artefact attributes and photographs. A draft copy of the report will be provided to the registered Aboriginal parties for comment. The report will then be finalised.

6. CULTURAL KNOWLEDGE

As part of assessing the potential impact of the development on Aboriginal cultural values, NGH is seeking any information from the local Aboriginal community that will assist in this process. The significance of any archaeological sites identified within the project area will be assessed for their scientific values. We would also seek the input from the Aboriginal community on the cultural values of any sites found.

In addition, we also seek information about any other values that may be attributed to the land identified for development.

Information can be held confidentially if that is required, although such information would be used in providing an assessment of any impacts to Aboriginal values by the project.

Information should be forwarded to the project manager, senior heritage consultant Ali Byrne, or to heritage consultant, Chelsea Jones, either prior to the field survey, at the time of the field survey, or prior to the finalisation of the report. The contact details for Ali and Chelsea are included below.

7. PERSONNEL

This cultural heritage assessment will be managed by the NGH senior heritage consultant, Ali Byrne.

Contact details for Ali are:

Postal: Unit 2, 54 Hudson Street, Hamilton NSW 2303

Email: ali.b@nghenvironmental.com.au

Phone: (02) 4917 3971

Contact details for Chelsea are:

Postal: Suite 4, Level 5, 87 Wickham Terrace Spring Hill QLD 4000

Email: Chelsea.j@nghenvironmental.com.au

Phone: (07) 3129 7683

8. NEXT STEPS

As part of the consultation program, set out in the OEH Consultation Requirements, this methodology is provided to the registered Aboriginal parties. There is a 28-day period for comment on the assessment methodology. If any member of the organisation has any comments about the project, the cultural heritage assessment or has information that may be of assistance, please contact Ali Byrne (details included above in section 7.).

We are also seeking information on the experience your representatives may have in the field, and your association or knowledge of the project area, in order to put together the field team. It would be appreciated if you could provide the following information via email:

- • Insurance cover certificates of currency (Workers Compensation/Injury Insurance);
- • Fee rates for fieldwork,
- • Field experience and information about cultural connections to the area, and
- • Any other relevant information.

The closing date for comments for this methodology is the 10th of September 2019.

9. REFERENCES

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APPENDIX A AHIMS BASIC SEARCH

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : 18-645

Client Service ID : 437091

NGH Heritage - Fyshwick

Date: 24 July 2019

17/27 Yallourn St
Fyshwick Australian Capital Territory 2609

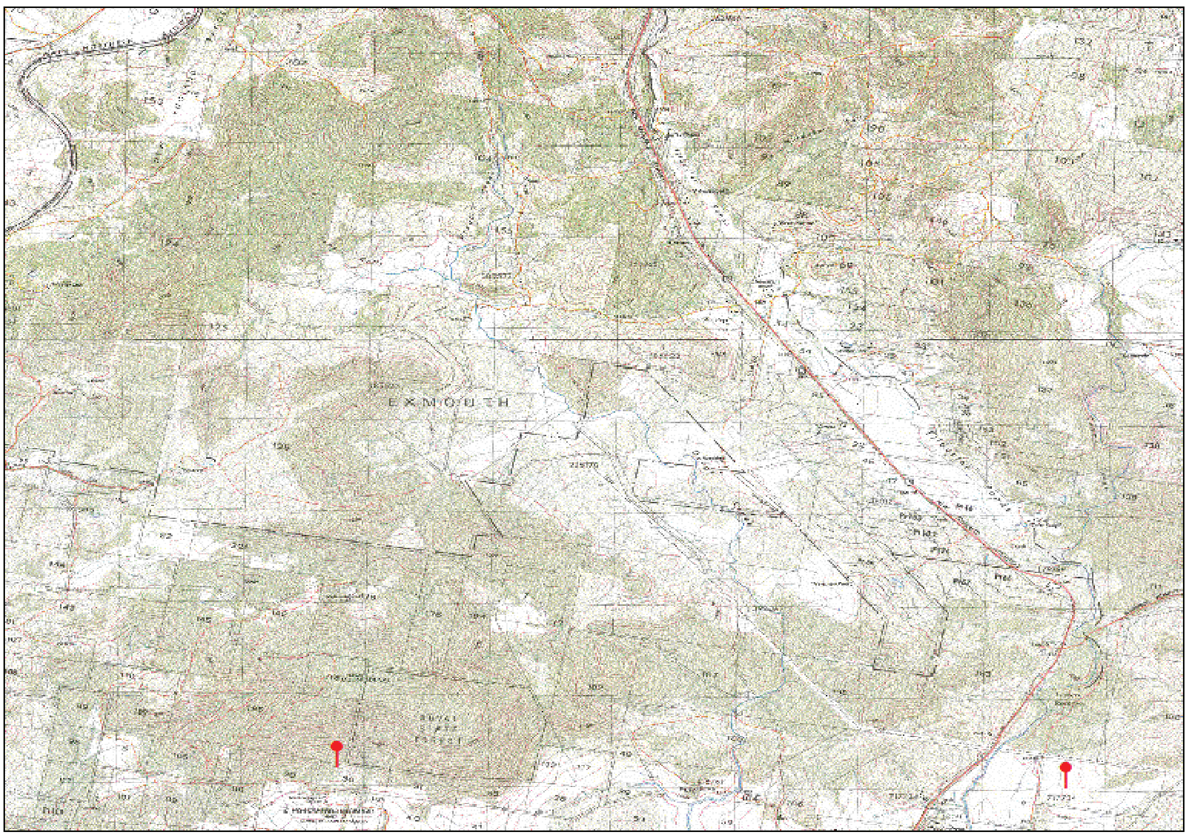
Attention: Chelsea Jones

Email: chelsea.j@nghenvironmental.com.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 366386 - 375450, Northings : 6634815 - 6641601 with a Buffer of 200 meters, conducted by Chelsea Jones on 24 July 2019.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

15	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

APPENDIX B AHIMS EXTENSIVE SEARCH

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 18-645

Client Service ID : 437091

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
21-2-0031	JADS2;TSR;	AGD	56	374450	6635180	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.John Appleton,Clive Ahoy					**Permits**		
21-2-0032	JADS1;TSR;	AGD	56	374600	6635200	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.John Appleton,Clive Ahoy					**Permits**		
21-1-0129	Sunnyside Women's site	GDA	56	374770	6636230	Open site	Valid	Aboriginal Ceremony and Dreaming : -, Artefact : 20		
	Contact Ms.Rhonda Kitchener	**Recorders**	Mrs.Karen Potter					**Permits**		
21-1-0070	S61	AGD	56	373650	6634550	Open site	Valid	Artefact : -	Isolated Find	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0071	S62	AGD	56	374950	6635250	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Alice Gorman					**Permits**		
21-1-0074	S55	AGD	56	368600	6639640	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0075	S58	AGD	56	371800	6636250	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0066	S57	AGD	56	371550	6636500	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Alice Gorman					**Permits**		
21-1-0068	S59	AGD	56	372200	6635950	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0069	S60	AGD	56	372400	6635450	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0058	S56	AGD	56	371590	6636500	Open site	Valid	Artefact : -	Open Camp Site	99974
	Contact	**Recorders**	Janice Wilson					**Permits**		
21-1-0118	Sunnyside AS2 (NE Highway, Armidale)	AGD	56	374609	6636115	Open site	Valid	Artefact : 2		100859,100861
	Contact	**Recorders**	Archaeological Surveys and Reports					**Permits**		
21-1-0119	Sunnyside EAS1 (NE Highway, Armidale)	AGD	56	374583	6635487	Open site	Valid	Artefact : 16		100859,100860,100861
	Contact	**Recorders**	Archaeological Surveys and Reports					**Permits**	2942,2953	
21-1-0031	JASD2	AGD	56	374950	6635250	Open site	Valid	Artefact : -	Open Camp Site	2489,100859,100861
	Contact	**Recorders**	Mr.John Appleton					**Permits**		
21-1-0032	jasd 1;	AGD	56	374600	6635200	Open site	Valid	Artefact : -	Open Camp Site	2489
	Contact	**Recorders**	Mr.John Appleton					**Permits**		

Report generated by AHIMS Web Service on 30/07/2019 for Chelsea Jones for the following area at Datum :GDA, Zone : 56, Eastings : 366386 - 375450, Northings : 6634815 - 6641601 with a Buffer of 200 meters. Additional Info : ACHAR. Number of Aboriginal sites and Aboriginal objects found is 15

From:	Cheryl Kitchener
To:	Ali Byrne
Subject:	Re: Tilbuster/Solar Farm OUR REF:18-645
Date:	Tuesday, 13 August 2019 12:10:15 PM
Attachments:	image001.png

Good Morning Ali,

I'm happy with the methodology.

Kind Regards

Cheryl

Cheryl Kitchener
[redacted]

On Tue, Aug 13, 2019 at 9:04 AM Ali Byrne <ali.b@nghconsulting.com.au> wrote:

> Good morning,
>
> Thank you for registering your interest in this project.
>
> Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.
>
> We welcome your questions or comments on the methodology and any cultural information you might be willing to provide to aid us in the assessment.
>
> Please provided your response in writing (email or mail) by Tuesday 10 September 2019.
>
> Kind regards,
> Ali
>
> **ALEXANDRA BYRNE**
> **SENIOR HERITAGE CONSULTANT**
> BA(Archaeology)
>
> [redacted]
>
> NGH
>
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From: Colin Ahoy
To: Ali Byrne
Subject: AAGG
Date: Tuesday, 13 August 2019 7:16:02 PM
Attachments: Newsletter 2(ColinAhoy).docx
Expression of interest for Tilbuster.pdf

Hello Ali,

I am currently involved with UNE in a project located 10 east of Uralla.

Kind Regards.

Colin Ahoy
[redacted]
Sent from Mail for Windows 10

Nunawanna Aboriginal Corporation
[redacted]

NGH

14/08/2019

Dear Ali Byrne,

I am writing to you in response of the proposed methodology.

As a registered Aboriginal stake holder, I would kindly ask if you would put my organization's name **Nunawanna Aboriginal Corporation** to your list as an Aboriginal stake holder in the proposed work area.

Nunawanna Aboriginal Corporation has a long association with the area where the proposed work will take place on and around Tilbuster area, which is on the Song line for the Nunawanna people. Having lived in this community for many years, I have a strong cultural connection to the Anaiwan country.

I have has also worked with many Archaeologists in the New England Area over the years and has the trust and respect from those Archaeologists. Nunawanna Aboriginal Corporation has worked on other major projects in the area.

Archaeologist reference:

Wendy Beck, Associate professor at the University of New England

John Appleton, Consultant

Graham Knuckey, Remnant Archaeology

Ryan Desic, EMM consulting

Sincerely

Colin Ahoy

Chairperson

Nunawanna Aboriginal Corporation experience has been on multiple Archaeological digs and surveys, the most recent being the New England solar farm, UNE solar farm, Metz solar farm.

From:	tony dootson
To:	Ali Byrne
Subject:	RE: Tilbuster/Solar Farm OUR REF:18-645
Date:	Wednesday, 14 August 2019 8:33:10 PM
Attachments:	image001.png

Ali ,

Can you please advise that I will be available for consultation on ground's of walking track's and a source called citrean (arh) from the ocean ? will talk soon .

Thank you very much cant wait to catch up , love ya work

Sent from Mail for Windows 10

From: Ali Byrne
Sent: Tuesday, 13 August 2019 9:05 AM
Subject: Tilbuster/Solar Farm OUR REF:18-645

Good morning
Thank you for registering your interest in this project.

Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.

We welcome your questions or comments on the methodology and any cultural information you might be willing to provide to aid us in the assessment.

Please provided your response in writing (email or mail) by Tuesday 10 September 2019.

Kind regards,
Ali

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)
[redacted]

NGH

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From: Iwatta Aboriginal Corporation
To: Ali Byrne
Subject: Re: Tilbuster/Solar Farm OUR REF:18-645
Date: Tuesday, 13 August 2019 12:50:15 PM
Attachments: image001.png
tillbuster.pdf
2019INSURANCE.pdf

Hi Ali,
Attached you will find our information, please feel free to contact me if you have any questions.

Thank You

On Tue, Aug 13, 2019 at 9:04 AM Ali Byrne <ali.b@nghconsulting.com.au> wrote:

> Good morning,
>
> Thank you for registering your interest in this project.
>
> Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.
>
> We welcome your questions or comments on the methodology and any cultural information you might be willing to provide to aid us in the assessment.
>
> Please provided your response in writing (email or mail) by Tuesday 10 September 2019.
>
> Kind regards,
> Ali
>
> **ALEXANDRA BYRNE**
> **SENIOR HERITAGE CONSULTANT**
> BA(Archaeology)
>
> NGH
>
> [redacted]
>
> [redacted] · GOLD COAST · NEWCASTLE · SYDNEY · WAGGA WAGGA
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Iwatta Aboriginal Corporation

[redacted]

Aug 13, 2019

HI,

For the past 20years Iwatta Aboriginal Corporation (IAC) have been involved with all ACHA projects that have been conducted in the borders of the Anaiwan Nation, such as-
: The Metz Solar Farm
: The New England Solar Farm
: The Glenn Innes Wind Farm
: Armidale Regional Council Road Upgrades and Developments
: The Armidale Airport
: The UNE Solar Farm
: Hillgrove Mine
ECT……

Our field Rates are: $120ph with a minimum of 4hours a day. we are open to Negotiation base on the projects budget.

: IAC are Currently developing a Cultural Map of all of the University of New England's properties, some of these properties are next to your proposed development and have very little recorded sites on the AHIMS database. Our experienced Sites officers have Cultural Knowledge/information that will be invaluable to your development.

Yours sincerely

Steven Ahoy
Senior sites officer.
[redacted]

From:	Iwatta Aboriginal Corporation
To:	Ali Byrne
Subject:	Re: Tilbuster/Solar Farm OUR REF:18-645
Date:	Friday, 16 August 2019 7:24:13 AM
Attachments:	image001.png

I have been talking to my Elders about the known Aboriginal sites at Tilbuster and they have a lot of information

On Tue, Aug 13, 2019 at 1:06 PM Iwatta Aboriginal Corporation [redacted]> wrote:

> Thank you, looking forward to it.
>
> On Tue, Aug 13, 2019 at 1:02 PM Ali Byrne <ali.b@nghconsulting.com.au> wrote:
>
>> Hi Stephen,
>>
>> Thanks for the response. We'll be in touch.
>>
>> Ali
>>
>> **ALEXANDRA BYRNE**
>> **SENIOR HERITAGE CONSULTANT**
>> BA(Archaeology)
>>
>> [redacted]
>>
>> **BEGA · BRISBANE · CANBERRA · GOLD COAST · NEWCASTLE · SYDNEY · WAGGA WAGGA**
>> WWW.NGHCONSULTING.COM.AU
>>
>> **From:** Iwatta Aboriginal Corporation [redacted]
>> **Sent:** Tuesday, 13 August 2019 12:50 PM
>> **To:** Ali Byrne <ali.b@nghconsulting.com.au>
>> **Subject:** Re: Tilbuster/Solar Farm OUR REF:18-645
>>
>> Hi Ali,
>>
>> Attached you will find our information, please feel free to contact me if you have any questions.

Thank You

On Tue, Aug 13, 2019 at 9:04 AM Ali Byrne <ali.b@nghconsulting.com.au> wrote:

Good morning,

Thank you for registering your interest in this project.

Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.

We welcome your questions or comments on the methodology and any cultural information you might be willing to provide to aid us in the assessment.

Please provided your response in writing (email or mail) by Tuesday 10 September 2019.

Kind regards,
Ali

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)

[redacted]

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From:	david ahoy
To:	Ali Byrne
Subject:	Methodology- Solar Farm
Date:	Monday, 26 August 2019 3:26:03 PM

Hi Ali,

Please accept my reply.

Sincerely
Larissa Ahoy

Larissa Ahoy

[redacted]

NGH

26/08/2019

Dear Ali Byrne,

I am writing to you in response of the proposed methodology.

As a registered Aboriginal Stakeholder, I would kindly ask if you would put my organization's name Larissa Ahoy to your list as an Aboriginal Stake Holder in the proposed work area.

I have had a long association with the area where the proposed work will take place on and around Tilbuster area, which is on the song line for the Nunawanna People.

Having lived in this community for many years, I have a strong cultural connection to the Anaiwan Country.

I have also worked with a few archaeologists in the New England area over the years.

I have worked on other major projects within the area.

Archaeologist's reference:

Wendy Beck, Associate Professor at the University of New England.

John Appleton, Consultant

Graham Knuckey, Remnant Archaeology

Ryan Desic, EMM Consulting

Sincerely

Larissa Ahoy

Sent from my iPhone

From:	rhonda kitchener
To:	Ali Byrne
Subject:	Re: Tilbuster/Solar Farm OUR REF:18-645
Date:	Wednesday, 14 August 2019 10:43:27 AM
Attachments:	image001.png

Hi Ali

Nyakka agrees with the methodology.

Thanks

Rhonda

Sent from my iPad

On 13 Aug 2019, at 9:04 AM, Ali Byrne <ali.b@nghconsulting.com.au> wrote:

> Good morning,
>
> Thank you for registering your interest in this project.
>
> Please find attached the proposed methodology for the Aboriginal Cultural Heritage Assessment for a proposed solar farm at Tilbuster, NSW.
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> **ALEXANDRA BYRNE**
> **SENIOR HERITAGE CONSULTANT**
> BA(Archaeology)
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>
> <18-645 TilbusterSF_Methdology_Draft_190813.pdf>

ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Tilbuster Solar Farm

August 2019

Project Number: 18-645

DOCUMENT VERIFICATION

Project Title:	Tilbuster Solar Farm
Project Number:	18-645
Project File Name:	18-645 Tilbuster SF Report

Revision	Date	Prepared by	Reviewed by	Approved by
Draft	9/08/2019	Ali Byrne	Chelsea Jones	Ali Byrne
Amended	4/10/2019	Ali Byrne	Zeina Jokadar	Ali Byrne

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W. www.nghconsulting.com.au

E. ngh@nghconsulting.com.au

BEGA - ACT & SOUTH EAST NSW
Suite 11, 89-91 Auckland Street (PO Box 470) Bega NSW 2550 **T.** (02) 6492 8333

BRISBANE
Suite 4, Level 5, 87 Wickham Terrace
Spring Hill QLD 4000 **T.** (07) 3129 7633

CANBERRA - NSW SE & ACT
8/27 Yallourn Street (PO Box 62)
Fyshwick ACT 2609 **T.** (02) 6280 5053

GOLD COAST
PO Box 466
Tugun QLD 4224 **T.** (07) 3129 7633

NEWCASTLE - HUNTER & NORTH COAST
Unit 2, 54 Hudson Street
Hamilton NSW 2303 **T.** (02) 4929 2301

SYDNEY REGION
Unit 18, Level 3, 21 Mary Street
Surry Hills NSW 2010 **T.** (02) 8202 8333

WAGGA WAGGA - RIVERINA & WESTERN NSW
Suite 1, 39 Fitzmaurice Street (PO Box 5464)
Wagga Wagga NSW 2650 **T.** (02) 6971 9696

TABLE OF CONTENTS

FIGURES

TABLE

1. INTRODUCTION

NGH has been contracted by Enerparc Australia Pty Ltd (Enerparc) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to investigate and examine the presence, extent and nature of Aboriginal heritage for the proposed State Significant Development Tilbuster Solar Farm, located at:

- Lot 1 DP225170
- Lot 1 DP585523
- Lot 3 DP800611

The proposal area comprises approximately 150 hectares (ha) of agricultural land within the Armidale Local Government Area (LGA).

The solar farm proposal will involve ground disturbance works that have the potential to impact Aboriginal cultural heritage sites and objects, protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the ACHA is therefore to investigate the presence of any Aboriginal sites and their values; and to assess the potential impacts to these values, providing recommendations for management measures which may mitigate, reduce or prevent impact.

The Secretary's Environmental Assessment Requirements (SEARs) for the project identify that Aboriginal heritage must be addressed by the Environmental Impact Statement (EIS). The SEARs identify that the following codes and guides should be followed in relation to Aboriginal heritage assessment.

- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
- Code of Practice for Archaeological Investigations of Objects in NSW http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
- Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf

The above codes and guidelines are issued by the Department of Planning, Industry and Environment's (DPIE) Biodiversity and Conservation Division (BCD) (formerly OEH) and are followed for most Aboriginal heritage assessments. The approach undertaken by NGH will be consistent with other heritage assessments undertaken in NSW.

2. ABORIGINAL COMMUNITY CONSULTATION

NGH will consult with the Aboriginal community throughout the project, in line with the requirements outlined in the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.* This has included the following steps:

- Advertising for interested parties by placing a public notice advertisement in *The Armidale Express* on 10 July 2019;
- Writing to required agencies, including OEH, advising of the project and seeking known interested parties; and
- Writing to any additional identified parties from OEH, seeking their interest.

This methodology is now being provided for comment to the registered Aboriginal parties as the next step in the consultation process.

A site survey of the proposal area is recommended as part of this ACHA methodology and this fieldwork component will proceed with assistance from representatives of the Aboriginal community. Once fieldwork is completed, a draft Aboriginal Cultural Heritage Assessment Report will be written, and this will be provided to registered Aboriginal parties for comment.

The final report will incorporate information provided by the Aboriginal community and a copy will be provided to each party for their records.

3. BACKGROUND INFORMATION

3.1. PROJECT BACKGROUND

The proposed solar farm at Tilbuster, NSW (see Figure 1), is a State Significant Development and therefore includes the following requirements for the Aboriginal Cultural Heritage Assessment (SEARS):

- Identify and describe the Aboriginal cultural heritage values that exist across the whole area that would be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). The identification of cultural heritage values must be conducted in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (DECCW 2010), and guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- Consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR; and
- Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.

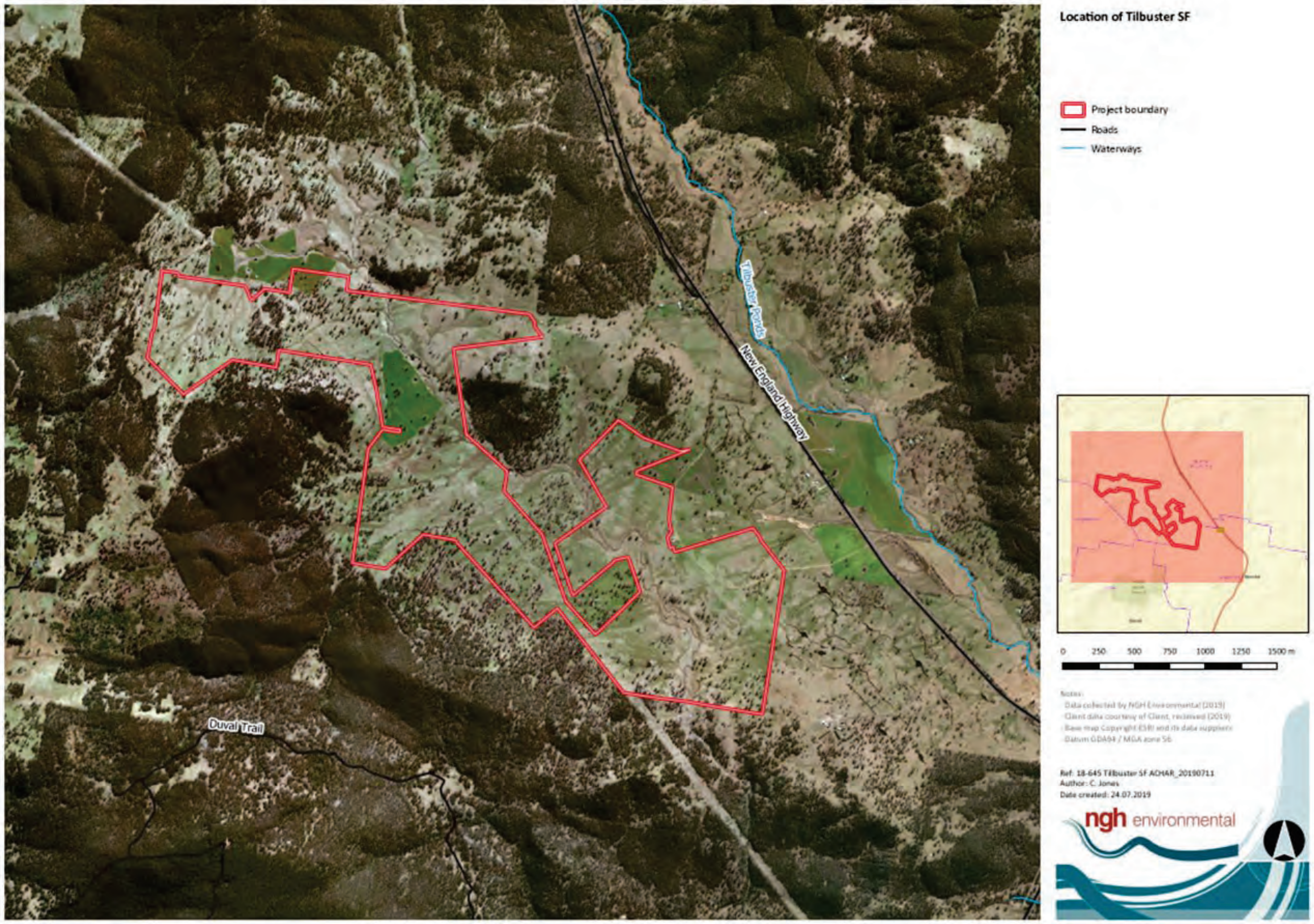

Figure 3-1. General location of project area.

4. ARCHAEOLOGICAL BACKGROUND

4.1.1. Aboriginal Heritage Information Management System – Identified Aboriginal Heritage Sites

The purpose of the Aboriginal cultural heritage assessment is to investigate the presence and extent of any Aboriginal sites within or adjacent to the project area and to assess their significance and any possible impacts from the proposed works. As part of the desktop assessment for this project, an extensive search was undertaken of the Aboriginal Heritage Information Management System (AHIMS), which is maintained by NSW BCD (formerly OEH). This search identified 15 previously recorded Aboriginal heritage sites in an approximately 2.5 x 3-kilometre zone centred on the project area.

4.2. AHIMS – PREVIOUSLY RECORDED SITES NEAR THE STUDY AREA

The AHIMS is maintained by the NSW BCD (formerly OEH) and provides a database of previously recorded Aboriginal heritage sites. A search provides basic information about any sites previously identified within a search area. However, a register search is not conclusive evidence of the presence or absence of Aboriginal heritage sites, as it requires that an area has been inspected and details of any sites located have been provided to BCD to add to the register. As a starting point, the search will indicate whether any sites are known within or adjacent to the investigation area.

A search of the AHIMS database was conducted on 30 July 2019 by NGH, centred around the project area using the following parameters:

- Client Service ID: 437091
- GDA Zone 56
- Eastings 366386 – 375450
- Northings: 6634815 – 6641601
- Buffer: 200 metres
- Aboriginal objects: 15

The results of the AHIMS search are shown in Figure 4-1and Table 4-1. Table 4-2 lists the registered sites located less than one kilometre from the project area.

Table 4-1 AHIMS Registered sites

Site Type	Number
Open Camp Site / Artefact Scatter	13
Isolated Find	1
Aboriginal Ceremony and Dreaming	1
TOTAL	15

There are six registered sites within one kilometre of the project area, with the closest sites (identified as an artefact) located on the southern boundary of the project area (AHIMS ID 21-1-0058 and 21-2-0066).

Table 4-2below, shows the sites located within 1km of the project area.

Table 4-2 AHIMS registered sites within 1km of the Project Area

No.	AHIMS ID	Status	Site Type
1	21-1-0058	Valid	Open camp site / artefact scatter
2	21-1-0066	Valid	Open camp site / artefact scatter
3	21-1-0074	Valid	Open camp site / artefact scatter
4	21-1-0075	Valid	Open camp site / artefact scatter
5	21-1-0068	Valid	Open camp site / artefact scatter
6	21-1-0069	Valid	Open camp site / artefact scatter

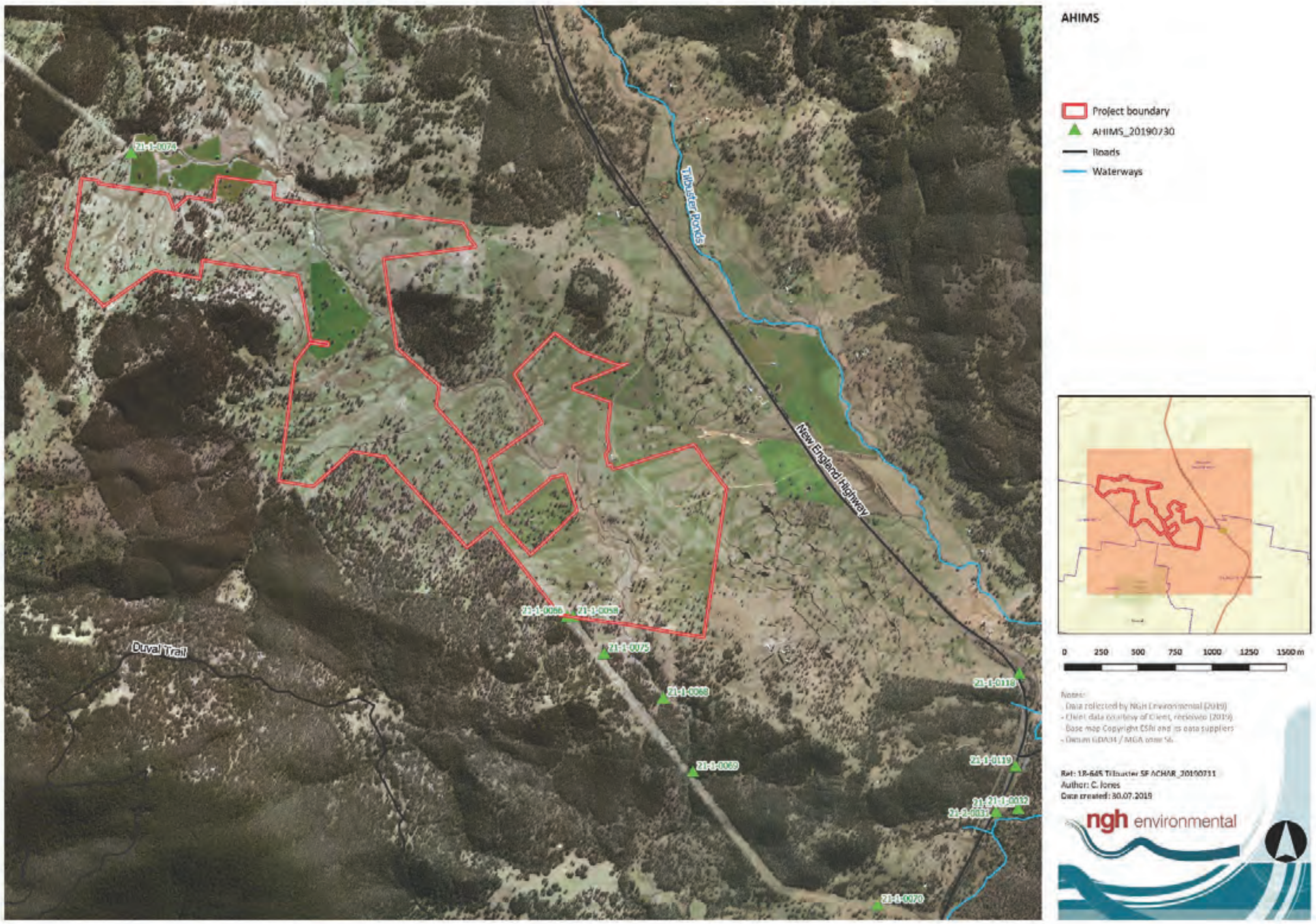

Figure 4-1 Location of AHIMS sites near project area

4.3. PROJECT AREA ENVIRONMENTAL BACKGROUND

4.3.1. General Description

The project area is located within the locality of Tilbuster in the Armidale LGA. The site has a total area of 150ha and is proposed to include 12,171 panels, with a total capacity of 300 MW.

Land within the project area is predominately cleared, with some scattered trees, and several more thickly wooded areas, and disturbances are limited to farming activities including livestock grazing, dam construction and fencing.

4.3.2. Geology and Topography

The landscape context assessment is based on a number of classifications that have been made at national and regional level for Australia. The national IBRA system identifies the proposal area as located within the NSW New England Tableland Bioregion (DE&E 2016). The dominant IBRA subregion affected by the proposal is the Armidale Plateau subregion.

The bioregion comprises part the north eastern section of the New England Fold Belt consisting of extensively faulted Carboniferous and Permian age sedimentary rocks. The majority of bedrock is superimposed by Tertiary basalt underlain by gravels, sands and lake sediments. Within the sands, beneath the basalt, inclusions of gold, diamond, tin ore and sapphires have been mined.

The Armidale Plateau subregion is characterised by and undulating plateau at around 1100m with broad valleys, stepped landscape across basalt flows with valleys steepening towards the Great Escarpment Gorges. Geology of the plateau is characterised by fine grained permo-carboniferous sedimentary rocks, multiple tertiary basalt flows and granites. A contrast in soils of the subregion is evident through the friable well drained soils on the upper slopes and compact poorly drained soils of the lower slopes. Soil types vary between black earths along valley floors, inconstant stony loams and dark loamy alluvium in swampy valleys (DE&E 2016).

The New England Geological Map (1:500 000 1973/333) indicates the geology underlying the proposal area consists of Permian and Carboniferous Geological sequences. The northern component of the Proposal Area is within the Dummy Creek Conglomerate (Pd) and the southern component in the Sandon Beds Formation (cs).

- Pd Dummy Creek conglomerate: comprising pebble conglomerate, coarse sandstone and massive mudstone
- Cs Sandon Beds: comprising greywacke, claystone, chert, jasper and black volcanic.

Water supply is often suggested as being the most significant factor influencing peoples' prior land-use strategies. Tilbuster Ponds runs adjacent to the proposal area to the east but is still approximately 900m away with Dumaresq Creek four kilometres to the west.

The proposal area is encompassed by the Dingo Spur Meta-sediments (Dsm) soil landscape type. The Mitchell Landscape descriptions are provided in Table 3.

Table 3 Dingo Spur Meta-sediments soil landscape

Mitchell Landscape
Dingo Spur Meta-sediments

"Steep ranges and hills intersected by a dendritic drainage pattern leading into deep gorges with high waterfalls on the Great Escarpment, extends west onto the tablelands. Gorges incised into faulted, steep dipping Devonian quartzose sandstone, greywacke, massive argillite and slate. Tablelands area on Permo-Carboniferous mudstone, lithic sandstone, tuff, slate, hornfels and some schist. General elevation 300 to 1400m, local relief 600m. Shallow stony loam on steep scree slopes with moderate organic content. Shallow gradational loam and sandy loam elsewhere with deeper uniform profiles in low valleys.

A very complex vegetation environment encompassing coastal closed forests, dry hardwood forests and cold high plateau components. Open forest of New England blackbutt *(Eucalyptus andrewsii ssp. campanulata*), messmate *(Eucalyptus obliqua*), silvertop stringybark (*Eucalyptus laevopinea*) with New England peppermint (*Eucalyptus cinerea*), snow gum (*Eucalyptus pauciflora*) and black sallee (*Eucalyptus stellulata*) in high cool environments. Dry closed forest species such as; shatterwood (Backhousia sciadophora), giant stinging tree (*Dendrocnide excelsa*), shiny-leaved stinging tree (*Dendrocnide photinophylla*), and yellow tulip (*Drypetes australasica*) in lower moister environments and in patches on scree slopes where protected from fire. Riveroak (*Casuarina cunninghamiana*) along all streams and dry hardwood forests of; yellow box (*Eucalyptus melliodora*), Blakely's red gum (*Eucalyptus blakelyii*), broad-leaved stringybark (*Eucalyptus caliginosa*) and cabbage gum (*Eucalyptus amplifolia*) on valley floors. "(DECC 2002)

4.3.3. Climate

The climate of the New England Tableland is temperate to cool temperate comprising warm summers with uniform rainfall. The man annual temperature is between 9 and 17 degrees, with a mean annual rainfall between 653-1765mm.

4.3.4. Flora and Fauna

Vegetation characteristic of basalt-derived soils within the New England Tableland bioregion include open forests and woodland of black sallee, snow gum and manna gum. Additionally, community's characteristic of these soils and this bioregion include New England peppermint (*Eucalyptus nova-anglica*), wattle-leaved peppermint (*Eucalyptus acaciiformis*), narrow-leaved peppermint (*Eucalyptus radiata*), yellow box, New England stringybark (*Eucalyptus calignosa*) and New England blackbutt (*Eucalyptus campanulata*).

The Bioregions also supports ninety-two fauna species listed under the TSC Act, included 18 endangered species, 72 vulnerable species and some now extinct (NSW NPWS 2001).

4.4. PREVIOUS STUDIES AND ARCHAEOLOGICAL MODELS

The Tilbuster area is within a region identified as part of the Nganyaywana (Anaiwan) language group. This name defines an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1996, Tindale 1974 and Horton 1996). The borders are, however, not static but rather fluid, expanding and contracting over time with relation to the movements of smaller family or clan groups. Boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought or abundance.

As a result of the archaeological research of the wider New England Tablelands region, there are a number of theoretical stances which are important to outline—the majority of these are mainly based on the quantity of stone artefact concentrations present. This is due to their ability to survive in the record more commonly than other archaeological features or objects – stone does not break down as organics such as wood and bone do. Many research questions surrounding the analysis of stone artefacts are concerned with the interpretation of stone artefacts as representations of occupational histories in the landscape. Researchers have asked questions such as:

- How did Aboriginal people use the landscape?
- How did Aboriginal people use the resources and landscape available to them?
- What patterns of occupation can we see?
- Did Aboriginal people stay in some places longer than others?
- What is the age of the deposit and what time duration does the deposit represent?

Limited dating information regarding occupation of the New England region by Aboriginal people is available. Excavations undertaken in the Hunter Valley and Nepean region further to the south east have indicated dates at least as far back as 20,000 years and up to 40,000 years before present (Koettig 1987, McDonald 2005; Nanson et al. 1987; Stockton 1993; Stockton & Holland 1974). Dates retrieved from New England are detailed in Table 4-3.

Table 4-3 Dated sites in greater New England region (Source: McBryde 1977, in RPS 2010)

Site	Date	Laboratory Reference
Seelands (near Grafton)	6444 ±74 BP	V-27
Graman Shelter B1 (near Inverell)	5450 ±100 BP	Gak-806
Moore Creek (near Tamworth)	3820 ±110 BP	Gak-1631

This is consistent with the majority of dates retrieved from other sites throughout south eastern NSW, with a number of theories posited to explain this. One such theory suggests that an increase in occupation density during the last 3,000 to 5,000 years is responsible for the higher number of sites identified which date to this period, while another theory suggests that sites which were concentrated along the coast were inundated during sea level rise and therefore lost from the archaeological record (Kohen 1986; McDonald 1994; McDonald & Rich 1993).

Analysis from excavations at Bendemeer Rockshelters 1 and 2 and Graman Rockshelters by McBryde (1974; 1977, in Davies 2002), revealed occupation dates of 4,400 and 9,000 years before present respectively. The Graman rockshelters are located on the western edges of the tablelands, where the underlying geological formations comprise basalt and sandstone. Of four sites excavated, two contained evidence of backed blade industries dating to 4,960 and 5,450 years before present. Grindstones were also present, suggesting some reliance on grass seeds as part of the diet. Faunal remains, likely remains of food consumption, include brush-tailed possum, bandicoot, grey kangaroo, lizard, fish and shellfish. The upper layers of one of the shelters, GB4, contained a marked increase in the presence of bandicoot remains, coinciding with a decrease in kangaroo remains, a change which was accompanied by greater quantities of edge-ground axes.

The Bendemeer shelters, sites 1 and 2, were located west of Bendemeer, and yielded sequences of approximately 3,000 to 300 years before present, and 4,350 to 950 years before present respectively. Evidence from these sites suggests that yam was a more common food source than grass seeds, grindstones being absent. Backed blades were also common (McBryde 1976 in Davies 2002). As a result of the analysis of the excavated material, it was noted that stone tool assemblages on the Tablelands and the coast were distinct from one another after 3,000 years before present, and McBryde indicated that determining whether this difference was representamen of a cultural boundary or rather indicated assemblages specialised to the environments in which they were used and the associated resources available, was an important question for New England (1974, in Davies 2002).

Later research by Hall and Lomax (1991, in Davies 2002), suggested that the separation of technologies may not have been as distinct in the north eastern parts of the tablelands.

McBryde’s research also indicated that there were no recorded artefacts, stratified archaeological deposits or surface Bondaian sites above 1,000 metres above sea level. However, research by Godwin resulted in the identification of sites above 1,000 metres, citing a bias in McBryde’s survey methodology (1983, in Davies). Godwin’s results indicated that while there was some interaction between the people of the tablelands and the people of the western slopes, there was little evidence to suggest that the people of the tablelands interacted much with the coastal people, which had been theorised by Belshaw (1978) and Bowdler (1981) (Godwin 1993, in Davies 2002:33).

It has been noted by Appleton (1990) that a number of predictive models, specifically those of McBryde (1974;1977) and Bowdler (1981), for the New England region, formulated in the 1970s and 1980s, were based on discussions with local knowledge holders during field work, and not necessarily on the results of systematic survey. Appleton suggests that Godwin’s research was the first to include intensive surveys which provided suitable data for the preparation of an accurate model for the region (Appleton 1993: 7). Godwin’s observations included that many relatively dense artefact scatters are located on woodland (or formerly wooded) ridges, parallel to and at a short distance from water courses. He also observed that the two site types, near water or in woodland settings, exhibited differing characteristics, both in density of artefacts and in distinctive characteristics of stone tool.

In the Armidale area and surrounds, Sutton (1988, in Appleton 1990) recorded a number of artefact sites at locations around the township. These sites included three surface scatters and five isolated surface artefacts; material was primarily silcrete, with porcellanite and mudstone also present at one site.

Davies (2002) was engaged to complete an assessment at Tilbuster in 2002, and a review of previous literature for the local and regional area indicated that the area had low to moderate archaeological potential. Davies’ survey identified no Aboriginal objects or sites within the 5.15ha project area, however the report indicated that there was some potential for sites to be present on the terrace of a creek within the project area.

Davidson and Appleton (1990) recorded a number of artefact locations along Cluny Road to the north of Armidale. These were also surface sites dominated by artefacts manufactured from silcrete materials. A silcrete quarry was identified by Piper (nd, in Appleton 1990), containing upwards of 100 artefacts per square metre. Appleton and Davidson also identified a chert / silcrete quarry and sandstone boulder with grinding grooves was recorded to the northeast of Armidale Airport.

Appleton states that with the exception of the two quarries, and two other sites, the artefacts were all recorded on erosion features in a secondary context (Appleton 1990:11).

4.5. PREDICTIVE MODEL

A detailed understanding of Aboriginal land use of the region is lacking, as few in depth studies have been completed in close proximity to the proposal area. It is possible, however, to ascertain that proximity to water sources and raw materials was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape, but the current archaeological record of that activity is limited.

Solar farm developments are proceeding throughout the south eastern Australian landscape. The majority of these projects are based in landscapes similar in topography to the current project area. These landscapes also mainly consist of grids of panels located on broad, level paddocks, set away from the riparian zone, though they are still within less than 200 metres of water courses.

Per the results of Godwin's studies, it is noted that proximity to water is one of the defining factors for the presence of sites containing higher densities of artefacts (Godwin, in Appleton 1990). Results from the work of Appleton and predecessors including McBryde (1977) indicate that the most common site type in the region is surface artefact sites, with closed sites such as shelters occurring only on the scarps and slopes of the upper slopes areas.

Based on the results of these previous archaeological investigations in the local area, it is possible to provide the following model of site location in relation to the proposed Tilbuster Solar Farm project area.

Stone artefact scatters – representing camp sites these sites can occur across the landscape, usually in association with some form of resource or landscape unit such as broad ridgelines which were used for travel through the mountainous landscape. Creek lines and small water holding bodies can also be a focus of Aboriginal occupation. Boundaries between changes in vegetation can also be a focus for occupation. Within the solar farm project area, gently sloping simple slopes and low ridgelines, with small creek line crossings are present. As such, there is moderate to high potential for this site type to be present.

Burials – are generally found in sandy contexts or in association with rivers and major creeks. No such features exist with the solar farm project area and therefore such sites are unlikely to occur.

Scarred Trees – these require the presence of mature trees and are likely to be concentrated along major ridgelines, flat level open areas in the landscape or in association with water courses. Much of the project area has been cleared for use as agricultural land, however there are some wooded areas still extant. If mature trees exist in the area, there is moderate potential for scarred trees to occur in the study area.

Stone resources – are areas where people used natural stone outcrops as a source material for flaking. This requires geologically suitable material outcropping so as to be accessible. The solar farm project area may contain some natural outcropping stone including silcrete. There is therefore moderate potential for this site type to occur.

Isolated Artefacts – are present across the entire landscape, in varying densities. As Aboriginal people traversed the entire landscape for thousands of years, such finds can occur anywhere and indicate the presence of isolated activity, dropped or discarded artefacts from hunting or gathering expeditions or the ephemeral presence of short-term camps. Discarded single artefacts are most likely to be present in the vicinity of creeks.

In summary, the presence of low gently clopping simple slopes, and Duval Creek and its tributaries, may have made the area attractive to past Aboriginal people for camping or resource procurement. This suggests that there is a moderate to high probability for site types such as artefact scatters or isolated finds to be present. Repeated use of these areas would increase the probability of leaving archaeological traces and increasing the significance of the site location. Nonetheless, given that Aboriginal people have lived in the region for tens of thousands of years, there is some potential for archaeological evidence to occur in all areas. This low density, dispersed material away from loci is most likely to be in the form of isolated stone artefacts or scarred trees.

5. ASSESSMENT METHODOLOGY

5.1. AIMS

Broadly, the aims of the Aboriginal Cultural Heritage Assessment are to:

- Verify known Aboriginal sites within the proposal area and within a 200-metre buffer zone, and determine if these sites will be impacted by the proposed works;
- Consult with the Aboriginal community about the project;
- Investigate and record any Aboriginal sites/objects identified within the study area;
- Determine any areas of potential Aboriginal heritage sensitivity;
- Assess the significance of any sites, and
- Develop recommendations for options on how to manage identified Aboriginal heritage sites and objects.

5.2. METHODOLOGY OUTLINE

The following is an outline of the steps that would be involved in completing the Aboriginal Cultural Heritage Assessment for the project area. This forms the methodology for the assessment:

- Consultation with Aboriginal parties;
- Notification of the project and registration of interest – obtain names of people who may hold cultural knowledge through written requests to relevant bodies and authorities and advertising in the local paper (**Completed**);
- Provide details of the project and the heritage assessment methodology to registered parties for comment (**This document**);
- Seek any information on whether there are any known places or objects of cultural significance to the Aboriginal people (**This document and ongoing until finalisation of report**);
- Involvement of selected representatives of the registered parties in survey fieldwork;
- Provide opportunity for the registered parties to review and comment on the draft cultural heritage assessment;
- Incorporate any comments from Aboriginal parties into the cultural heritage assessment;
- Review of background information relevant to the subject area. Request an AHIMS register search to identify the location of previously recorded sites and review any archaeological reports or site records of the immediate area (**Completed**);
- Undertake field assessment. The project area has been identified as an agricultural property primarily comprising cleared paddocks, with some farm structures and dams;
- It is our intention to assess the area to identify the boundaries of any PADs and to establish if there are artefacts present through surface survey;
- Field survey will involve the following elements:
    - Walking across the project area in a systematic way to identify Aboriginal objects. The survey would aim to provide enough surface coverage to be confident of assessing the area for the presence of Aboriginal sites. Survey transect participants would be staged 20 metres apart.
    - Recording all Aboriginal heritage objects using standard archaeological techniques including: location, environmental context, extent, content, disturbance level.
    - Photograph sites.
    - Record stone artefacts, collecting standard information including: type, raw material, dimensions, note of technical attributes. The GPS location of individual stone artefacts would

be recorded up to a point but for higher density sites or clusters of artefacts, we would record them as a polygon. If large sites were identified, we would record samples of artefacts;

- Undertake test excavation programme in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW*. This will include following the accepted methodology for the completion of testing at locations identified to contain potential archaeological deposits within the project area, based on landscape analysis and survey results. Indicative testing areas are shown on Figure 5-1, Figure 5-2and Figure 5-3. Note that the number and location of pits may vary and will not be determined until completion of survey. The number and extent of these will be determined in the field. Testing will include:
  - Completion of test excavation in accordance with Requirement 16 of the Code of Practice;
  - Excavation of a minimum of ten (10) test pits at between 1 and 4 locations as needed; and
  - Excavation of a maximum of fifty (50) test pits at between 1 and 4 locations as needed.
- Undertake a significance assessment of any Aboriginal cultural objects, sites or places;
- To the extent possible with information available, assess the impact of the proposed development on the archaeological sites and devise ways to avoid or mitigate any impact, if possible;
- Prepare a draft ACHAR. The report will be a cultural heritage assessment of the subject area and include the results of the steps outlined above. The draft ACHAR will be provided to registered Aboriginal parties for comment;
- Prepare final report. Consider all comments and finalise report.

5.3. REPORT

A report detailing the results of the survey and assessment will be prepared. The report will be structured to provide the following information:

- Introduction
- Aboriginal consultation
- Project setting
- Archaeological setting
- Archaeological methods
- Results
- Discussion
- Significance assessment
- Conclusions
- Recommendations

The report will include descriptions of sites, artefact attributes and photographs. A draft copy of the report will be provided to the registered Aboriginal parties for comment. The report will then be finalised.

Figure 5-1 Indicative test excavation areas (note these may be subject to change)

Figure 5-2 Indicative test excavation areas (note these may be subject to change)

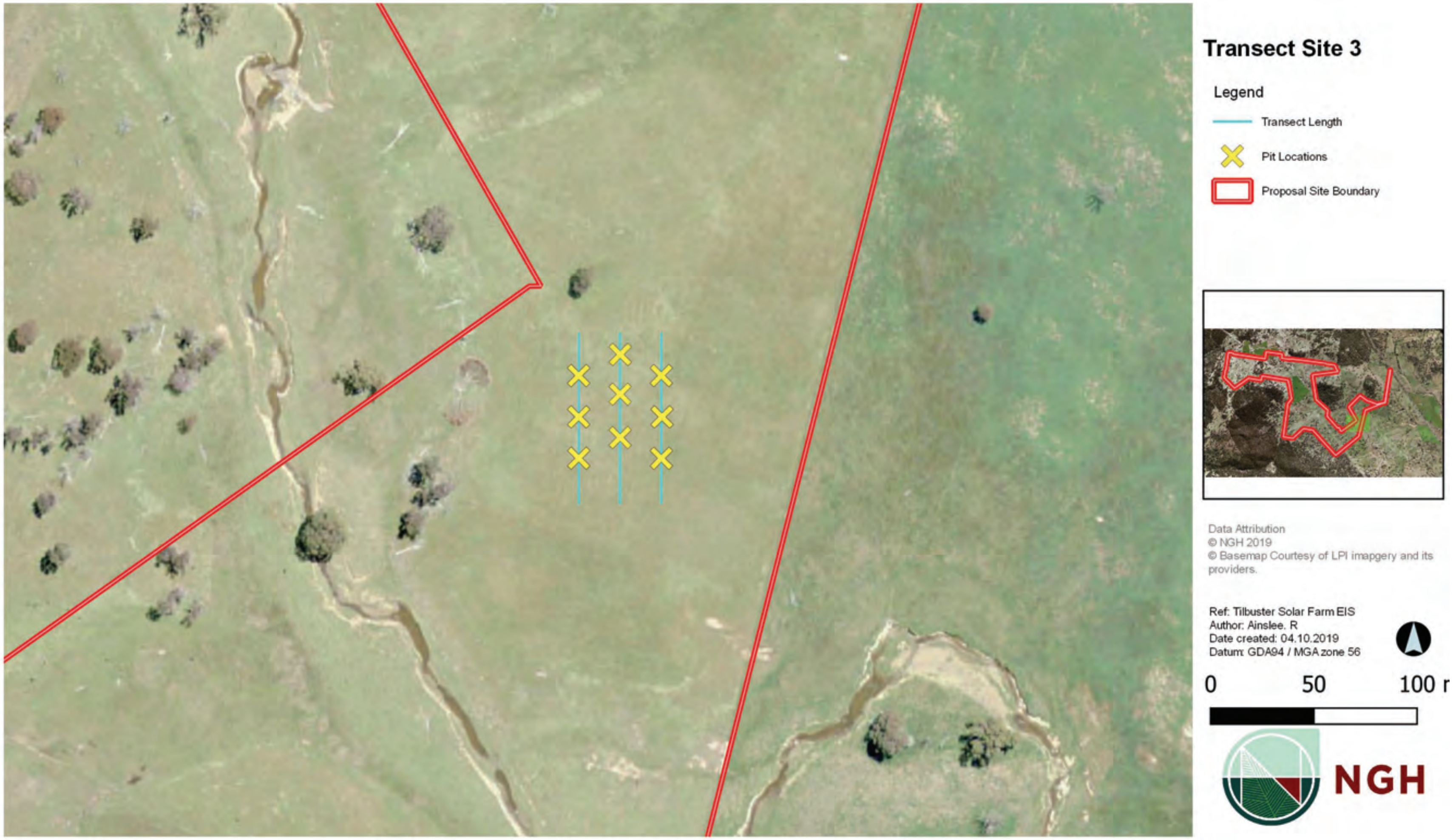

Figure 5-3 Indicative test excavation areas (note these may be subject to change)

6. CULTURAL KNOWLEDGE

As part of assessing the potential impact of the development on Aboriginal cultural values, NGH is seeking any information from the local Aboriginal community that will assist in this process. The significance of any archaeological sites identified within the project area will be assessed for their scientific values. We would also seek the input from the Aboriginal community on the cultural values of any sites found.

In addition, we also seek information about any other values that may be attributed to the land identified for development.

Information can be held confidentially if that is required, although such information would be used in providing an assessment of any impacts to Aboriginal values by the project.

Information should be forwarded to the project manager, senior heritage consultant Ali Byrne, or to heritage consultant, Chelsea Jones, either prior to the field survey, at the time of the field survey, or prior to the finalisation of the report. The contact details for Ali and Chelsea are included below.

7. PERSONNEL

This cultural heritage assessment will be managed by the NGH senior heritage consultant, Ali Byrne.

Contact details for Ali are:

Postal: Unit 2, 54 Hudson Street, Hamilton NSW 2303

Email: ali.b@nghenvironmental.com.au

Phone: (02) 4917 3971

Contact details for Chelsea are:

Postal: Suite 4, Level 5, 87 Wickham Terrace Spring Hill QLD 4000

Email: Chelsea.j@nghenvironmental.com.au

Phone: (07) 3129 7683

8. NEXT STEPS

As part of the consultation program, set out in the OEH Consultation Requirements, this methodology is provided to the registered Aboriginal parties. There is a 28-day period for comment on the assessment methodology. If any member of the organisation has any comments about the project, the cultural heritage assessment or has information that may be of assistance, please contact Ali Byrne (details included above in section 7.).

We are also seeking information on the experience your representatives may have in the field, and your association or knowledge of the project area, in order to put together the field team. It would be appreciated if you could provide the following information via email:

- Insurance cover certificates of currency (Workers Compensation/Injury Insurance);
- Fee rates for fieldwork,
- Field experience and information about cultural connections to the area, and
- Any other relevant information.

The closing date for comments for this methodology is the 1st of November 2019.

9. REFERENCES

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Belshaw, J. (1978) *Population distribution and the pattern of seasonal movement in northern New South Wales.* Record of Times Past: Ethnohistorical essays on the culture and ecology of the New England tribes. I. McBryde. Canberra, Australian Institute of Aboriginal Studies: 65-81.

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From: Iwatta Aboriginal Corporation
To: Ali Byrne
Subject: Tilbuster solarfarm
Date: Monday, 9 December 2019 1:57:08 PM
Attachments: Tillbuster Solar Farm1.pdf

Hi Ali,
Without getting in to much of the details, i have outlined some of the Cultural aspects of the proposed area.
Let me and Steven know if you need anything further.

--
Thank You
Jocelyn Blair
Sites Officer
Iwatta Aboriginal Corporation
[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

From:	Colin Ahoy
To:	Ali Byrne
Subject:	Re: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please
Date:	Wednesday, 8 July 2020 5:36:22 PM
Attachments:	image001.png

Hello Ali,

Due to the land of the solar farm being developed behind MT Duval which is of high significance to he Anaiwan people
I would like to recommend that a RAP should be present when the solar farm developers (ENPARC) are erecting there fence as the boundary of the solar farm will impact the knapping site at AS1 in figure 5.1. In the case of salvaging of all the artefacts I would like them to be stored in a display case at the Armidale Cultural Centre and Keeping Place.

From: Ali Byrne <ali.b@nghconsulting.com.au>
Sent: Wednesday, 8 July 2020 10:05 AM
To: Ali Byrne <ali.b@nghconsulting.com.au>
Cc: Chelsea Jones <chelsea.j@nghconsulting.com.au>
Subject: FW: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please

Good afternoon,

This is a reminder to provide your comments on the attached report.

We look forward to your input by Friday 10 June, at which time we will be finalise the report for submission. In particular we would appreciate input regarding the management of the artefacts which have been and will be recovered from the project area.

Kind regards,
Ali

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)
[redacted]

NGH

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Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

From: Chelsea Jones <chelsea.j@nghconsulting.com.au>
Sent: Monday, 1 June 2020 10:28 AM
To: Ali Byrne <ali.b@nghconsulting.com.au>
Subject: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please

Good morning all,

Please find attached the draft copy of the Tilbuster SF draft ACHA.

Please return any comments or feedback by COB on the 29th of June 2020.

Please feel free to contact myself or Ali if you have any comments or concerns.

Regards,

Chelsea

CHELSEA JONES
HERITAGE CONSULTANT
BA Hons (Archaeology)
Working Mon-Thurs 7am-3.30pm and Friday 7am-1.30pm
[redacted]

Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

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ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)
T. 02 4929 2301 **D.** 4917 3971 **M.**
[redacted]

CHELSEA JONES
HERITAGE CONSULTANT
BA Hons (Archaeology)
Working Mon-Thurs 7am-3.30pm and Friday 7am-1.30pm
[redacted]

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From: rhonda kitchener
To: Ali Byrne
Subject: Re: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please
Date: Sunday, 12 July 2020 3:53:00 PM
Attachments: image001.png
Comments from Tilbuster Draft.docx

Hi

Please find attached letter with comments from the report.

Thanks

Rhonda

From: Ali Byrne <ali.b@nghconsulting.com.au>
Sent: Wednesday, 8 July 2020 10:05 AM
To: Ali Byrne <ali.b@nghconsulting.com.au>
Cc: Chelsea Jones <chelsea.j@nghconsulting.com.au>
Subject: FW: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please

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We look forward to your input by Friday 10 June, at which time we will be finalise the report for submission. In particular we would appreciate input regarding the management of the artefacts which have been and will be recovered from the project area.

Kind regards,
Ali

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
[redacted]

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Subject: 18-645 Tilbuster Draft ACHA Comments Due COB 29 June 2020 Please

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Please return any comments or feedback by COB on the 29th of June 2020.
Please feel free to contact myself or Ali if you have any comments or concerns.
Regards,
Chelsea

CHELSEA JONES
HERITAGE CONSULTANT
BA Hons (Archaeology)
Working Mon-Thurs 7am-3.30pm and Friday 7am-1.30pm
[redacted]

Due to precautions around COVID-19, I am currently working from home. Email and mobile are best to contact me. Thanks for your patience.

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WWW.NGHCONSULTING.COM.AU

ALEXANDRA BYRNE
SENIOR HERITAGE CONSULTANT
BA(Archaeology)
T. 02 4929 2301 **D.** 4917 3971 **M.** 0428 747 615
E. ali.b@nghconsulting.com.au
Unit 2, 54 Hudson St
Hamilton NSW 2303

[redacted]

[redacted]

NYAKKA ABORIGINAL CULTURE HERITAGE CORPORATION ARCHAEOLOGICAL & CULTURAL HERITAGE CONSULTANTS

12/072020

Hi Ali & Chelsea,

Sorry for the late notice, but I had to provide the information to Elders and their timeframe for consultation is not the same as yours, therefore, my comments will reflect the comments from the Elders and myself.

Thanks for the report, it's very informative as a scientific report, unfortunately it's clear that the information regarding the local landscape has been omitted from the report.

Regarding Cultural Heritage Values, I would like it noted that I spoke to you about the Women's sites within the cultural landscape which Tilbuster is part of, too many times Women's sites and business is left out of the reports and our value to the cultural record is diminished or not recognised. If not too late I would at least like this to be noted in this section.

For the management of the Artefacts which will be recovered from the project area, we would like the Axes displayed at the Armidale Aboriginal Cultural Centre and other Artefacts buried on Country land outside project area.

Yours sincerely

Rhonda Kitchener

Chairperson

APPENDIX B ARTEFACT DATA

SURFACE

Artefact ID	Date	Type	Raw Material	Colour	Size Class	Length mm	Width mm	Thickness	Weight	Plat surf	Plat Type	Terminatio	Shape	Reduc stag	Notes	Photo	Retouch	AS
1	2019-11-12T23:53:42.000Z	Flake	Chert	Speckled white		24	10	4		Crushed	Broad	Hinge			Crushed term	2258 to 2259		AS01
2	2019-11-12T23:56:51.000Z	Flake	Quartz	White	<30mm	26	23	6			Broad	Bipolar				2260 to 2261		AS01
3	2019-11-13T00:00:08.000Z	Retouched flake	Basalt	Grey		60	50	11			Broad					2262 to 2263		AS01
4	2019-11-13T00:02:55.000Z	Broken Flake	Volcanic	Grey		22	19	6			Broad					2264 to 2265		AS01
5	2019-11-13T00:08:56.000Z	Flake	Chert	Speckled chert		42	25	10			Broad	Feather			Split medically into 2 pieces	2226 to 2227		AS01
6	2019-11-13T00:14:15.000Z	Proximal Fragment	Chert	Whitr	<20mm	11	16	2			Broad	Feather				2268 and 2269		AS01
7	2019-11-13T00:16:45.000Z	Axe	Basalt	Grey		100	59	25							2270 to 2271 s of track beneath rock	Ground edge axe		AS01
8	2019-11-13T00:44:13.000Z	Retouched flake	Quartz	Cream white	<60mm	60	34	16		Crushed	Broad	Feather	Triangular		Retouched lateral margins	2286 to 2287		AS01
9	2019-11-13T00:47:56.000Z	Broken Flake	Chert	Grey		15	7	3								228i to 2289		AS01
10	2019-11-13T00:51:01.000Z	Core				63	50	50							8 scars unidirectional	2290 to 2291		AS01
11	2019-11-13T01:08:47.000Z	Retouched flake	Silcrete	Grey cream	<60mm	50	55	20			Focal	Hinge				2292 to 2293		AS01
12	2019-11-13T01:11:14.000Z	Proximal Fragment	Chert	White		15	6	1			Broad				No term	2294 to 2295		AS01
13	2019-11-13T01:15:12.000Z	Flake	Chert	White		20	16	5			Broad	Hinge				2297 . To 2296		AS01

14	2019-11-13T01:18:29.000Z	Flake	Silcrete	Grey		20	15	4			Broad	Feather				2298 to 2299		AS01
15	2019-11-13T00:25:43.000Z	Flake	Chert	Quartz	<20mm	10	16	1			Focal	Feather				2276 to 2277		AS01
16	2019-11-13T00:29:12.000Z	Flake	Chert	Speckled white and cream	<30mm	26	10	4		Crushed	Broad	Plunge				2378 to 2279		AS01
17	2019-11-13T00:36:47.000Z	Flake	Quartz	White	<10mm	9	8	1			Focal	Feather				2282 2283		AS01
18	2019-11-13T00:20:05.000Z	Flake	Quartz	White		10	9		2		Broad	Feather				2272 to 2273		AS01
19	2019-11-13T00:23:50.000Z	Flake	Quartz	White	<20mm	20	5	3		Crushed	Broad	Feather				2274 to 2275		AS01
20	2019-11-13T00:30:52.000Z	Flake	Chert	Brown red		29	19	9			Focal	Feather			Appears to be a flake taken from the ventral side of the flake	2280 to 2281		AS01
21	2019-11-13T00:41:13.000Z	Core	Chert	Speckled	<30mm	25	25	9								4 flakes unidirectional	2284 to 2285	AS01
22	2019-11-12T23:56:46.000Z	Flake	Silcrete	Grey		18	14	10		Faceted	Focal	Axial		Tertiary (no cortex)		0036,37,38, area 39,40		AS01
23	2019-11-12T23:58:03.000Z	Proximal Fragment	Silcrete	White		9	21	9		Flake scar	Focal			Tertiary (no cortex)		0036to38		AS01
24	2019-11-12T23:59:17.000Z	Core	Silcrete	White		16	13	6						Tertiary (no cortex)	Very reduced, exhausted. Poss vehicle damage			AS01

25	2019-11-13T00:02:05.000Z	Flake	Silcrete	White pink		21	15	8		Faceted	Focal	Feather		Tertiary (no cortex)		0039,40 area, 41,42		AS01
26	2019-11-13T00:12:33.000Z	Axe	Basalt	Dark grey		85	59	26							Ground edge, vehicle damage	0043to55, area 57to59		AS01
27	2019-11-13T00:14:26.000Z	Flake	Tin	White	<10mm					Faceted	Focal	Feather		Tertiary (no cortex)	Found near axe	56, area 57to59		AS01
28	2019-11-13T00:19:48.000Z	Flake	Silcrete	Grey		19	24	8		Flake scar	Broad	Hinge		Secondary (partial dorsal is cortex	15% cortex	0060,61		AS01
29	2019-11-13T00:24:52.000Z	Flake	Silcrete	White banded w grey		18	14	8		Crushed	Focal	Feather		Tertiary (no cortex)	Grouped with 4 other pieces with less than 1m	0062,63		AS01
30	2019-11-13T00:27:26.000Z	Flake	Silcrete	White banded w grey		17	11	5		Flake scar	Broad	Feather		Tertiary (no cortex)		0062,63		AS01
31	2019-11-13T00:28:44.000Z	Proximal Fragment	Silcrete	White w grey		14	13	4		Faceted	Broad			Tertiary (no cortex)		0062 ,63		AS01
32	2019-11-13T00:29:57.000Z	Distal Fragment	Silcrete	White banded w grey		10	8	2				Feather		Tertiary (no cortex)		0062,63		AS01
33	2019-11-13T00:31:14.000Z	Flake	Silcrete	White banded w grey		14	11	9		Crushed	Focal	Axial		Tertiary (no cortex)		0062,63		AS01

34	2019-11-13T00:36:50.000Z	Flake	Silcrete	Grey		18	12	9		Crushed	Focal	Hinge		Tertiary (no cortex)		0073to75		AS01
35	2019-11-13T00:40:03.000Z	Proximal Fragment	Silcrete	Grey		32	27	16		Flake scar	Broad			Tertiary (no cortex)	7 neg flk scars on ventral and dorsal	0076to79		AS01
36	2019-11-13T00:42:30.000Z	Flake	Quartz	White pink		25	20	7		Crushed	Broad	Hinge		Tertiary (no cortex)		0076to79		AS01
37	2019-11-13T00:44:14.000Z	Flake	Silcrete	Grey		30	15	6		Faceted	Focal	Feather		Tertiary (no cortex)		0076to79		AS01
38	2019-11-13T00:45:23.000Z	Medial Fragment	Chert	Dark grey		16	7	3								0076to79		AS01
39	2019-11-13T00:46:27.000Z	Flake	Silcrete	Pale grey		17	14	4		Crushed	Shattered	Feather		Tertiary (no cortex)		0076to79		AS01
40	2019-11-13T00:48:06.000Z	Flake	Silcrete	Grey		21	12	3		Faceted	Focal	Feather		Tertiary (no cortex)	Broken in two pieces	0080to82, 86 (Distal piece)		AS01
41	2019-11-13T00:52:32.000Z	Proximal Fragment	Silcrete	Grey		16	13	3		Ridge	Broad			Tertiary (no cortex)		0083to85		AS01
42	2019-11-13T00:55:15.000Z	Flake	Basalt	Dark grey		14	12	1		Indeterminate	Focal	Hinge		Tertiary (no cortex)	Poss removed from one axe	0087,88		AS01
43	2019-11-13T01:04:57.000Z	Geometric microlith	Silcrete	Cream		25	11	8		Faceted	Focal	Feather		Tertiary (no cortex)	Backed, w point	0089to94		AS01

44	2019-11-13T01:09:15.000Z	Flake	Silcrete	Grey		10	14	4		Faceted	Focal	Hinge		Tertiary (no cortex)		0095to97		AS01
45	2019-11-13T01:10:38.000Z	Distal Fragment	Silcrete	Cream		22	11	5				Feather		Tertiary (no cortex)		0095to97		AS01
46	2019-11-13T01:15:09.000Z	Geometric microlith	Silcrete	Cream		24	10	7		Flake scar	Focal	Feather		Tertiary (no cortex)	Backed	0098to103		AS01
47	2019-11-13T01:19:14.000Z	Flake	Silcrete	Grey		31	27	8		Flake scar	Indeterminate	Feather		Secondary (partial dorsal is cortex	3 neg flk scars on ventral ,poss cortex or patina on dorsal	0106to7		AS01
48	2019-11-13T01:23:59.000Z	Core tool	Silcrete	Brown yellow		48	46	22		Indeterminate	Indeterminate			Secondary (partial dorsal is cortex	5% cortex,scraper	0108to110		AS01
49	2019-11-13T01:16:49.000Z	Proximal Fragment	Silcrete	Cream		18	26	4		Flake scar	Focal			Tertiary (no cortex)		0104to0105		AS02
50	2019-11-14T20:45:16.000Z	Flake	Silcrete	Cream	<30mm	29	15	6			Focal	Feather				2305 to 2306		AS02
51	2019-11-14T20:48:35.000Z	Manuport	Silcrete												No diagnostics manuport	2307 to 2308		AS02
52	2019-11-11T01:07:20.000Z	Manuport	Silcrete	Grey												2085 and 2084		AS10

53	2019-11-11T01:20:02.000Z	Proximal Fragment	Silcrete	Grey	<20mm	20	16	5			Broad				Broken term	2090 and 2091		AS10
54	2019-11-11T00:47:21.000Z	Distal Fragment	Silcrete	Pink white		10	15	2							Distal flake	2070 2071		AS10
55	2019-11-11T00:50:04.000Z	Flake	Chert	Cream		8	9	2		Crushed	Focal					2072 to 2073		AS10
56	2019-11-11T00:52:58.000Z	Flake	Chert	Cream		25	6	4			Focal	Feather				Pressure 2074 and 2075	Pro retouch	AS10
57	2019-11-11T00:57:48.000Z	Proximal Fragment	Silcrete	Whit punk	<10mm	10	8	1			Focal					2076 and 2077		AS10
58	2019-11-11T01:00:15.000Z	Flake	Silcrete	White cream	<20mm	14	6	1			Focal					2078 and 2079		AS10
59	2019-11-11T01:02:41.000Z	Flake	Quartz	Clear	<20mm	11	6	2		Crushed	Focal					2080 and 2081		AS10
60	2019-11-11T01:04:54.000Z	Proximal Fragment	Volcanic	Grey	<20mm	10	14	2			Broad					2082 and 2083		AS10
61	2019-11-11T01:09:30.000Z	Manuport		Grey with white striations														AS10
62	2019-11-11T01:11:36.000Z	Manuport	Quartz	Crystal												2088 and 2089		AS10
63	2019-09-23T23:42:21.000Z	Retouched flake	Chert	IMSTC grey	<40mm							Hinge				0038to0039		AS11
64	2019-09-23T23:40:08.000Z	Retouched flake	Silcrete	Grey	<50mm								POINT		Matrix supported silcrete	0034to37		AS11

65	2019-11-10T22:56:24.000Z	Flake	Volcanic	Grey	<50mm	50	45	32		More than 1	Broad				Two flakes taken off outside broken term	2037 and 2038		AS12
66	2019-11-11T00:29:57.000Z	Flake	Silcrete	White	<30mm	20	11	2		Flake scar	Broad	Step		Tertiary (no cortex)		1129x2		AS12
67	2019-11-10T23:34:08.000Z	Broken Flake	Chert	White grey	<30mm	30		25	9	Crushed	Broad				Absent term	2059 and 2060		AS13
68	2019-11-10T23:40:48.000Z	Flake	Chert	White		24	10	4			Broad					2065 to 2066		AS13
69	2019-11-10T23:11:44.000Z	Manuport	Quartz													2043 2042		AS13
70	2019-11-10T23:14:25.000Z	Flake	Volcanic	White grey	<30mm	25	24	6		Crushed	Focal	Step				2045 and 2046		AS13
71	2019-11-10T23:17:01.000Z	Distal Fragment	Volcanic	Grey white		14	15	4				Feather				2047 and 2048		AS13
72	2019-11-10T23:19:27.000Z	Flake	Quartz	White quartz		20	16	6		Crushed	Indeterminate	Feather				2049 and 2050		AS13
73	2019-11-10T23:24:06.000Z	Proximal Fragment	Volcanic	White grey		15	16	5			Broad					2053 and 2054		AS13
74	2019-11-10T23:32:30.000Z	Manuport	Quartz	White												2056 and 2057		AS13
75	2019-11-10T23:36:43.000Z	Manuport	Silcrete	White with pink striations	<20mm											2061 and 2062		AS13
76	2019-11-10T23:38:26.000Z	Broken Flake	Silcrete	White		16	10	2			Focal				Absent term	2063and 2064		AS13
77	2019-11-10T23:01:30.000Z	Distal Fragment	Quartz	Crystal whitish		11	16	4				Feather			Distal no	2039 and 2040		AS14

78	2019-11-10T23:04:23.000Z	Proximal Fragment	Chert	Grey		15	26	5			Broad				Pros flake craked at cone	2041 and 2042		AS14
79	2019-11-10T22:58:28.000Z	Core	Chert	Black						More than 1					White patina on 70%	958 x 2		AS14
80	2019-11-10T23:01:17.000Z	Flake	Silcrete	Cream	<20mm					Crushed	Focal	Axial		Tertiary (no cortex)		1001 x 2		AS14
81	2019-11-10T23:03:41.000Z	Flake	Silcrete	White	<10mm					Indeterminate	Indeterminate	Feather		Tertiary (no cortex)		1003 x1		AS14
82	2019-11-10T23:06:27.000Z	Core	Quartz	Crystal	<30mm										1 x neg flk scar	1006 x4		AS14
83	2019-11-10T22:13:47.000Z	Proximal Fragment	Other	Pink and cream		20	19	6		Crushed	Broad					2020and 2021		AS15
84	2019-11-10T22:16:59.000Z	Flake	Silcrete	Red pink		39	11	6			Broad	Step				2022 and 2023		AS15
85	2019-11-10T21:39:41.000Z	Flake	Chert	Brown and cream banded		21	11	4		Crushed	Bipolar	Step			Banded chert full flske	2012 and 2013		AS16
86	2019-11-10T22:03:11.000Z	Proximal Fragment	Volcanic	Grey	<40mm	30	38	19			Broad				Prox flake greywacke	2018 and 2019		AS16
87	2019-11-10T21:26:41.000Z	Broken Flake	Silcrete	Grey	<10mm	8	5	2				Feather			Broken flake	2007		AS16
88	2019-11-10T21:31:48.000Z	Proximal Fragment	Silcrete	brown	<40mm	13	34	7			Broad				Broken	2008 and the 2009		AS16
89	2019-11-10T21:35:47.000Z	Broken Flake	Quartz	Crystal clear	<20mm	14	2	13		Crushed	Focal				Broken flake	210ans 2011		AS16
90	2019-11-10T21:24:43.000Z	Flake	Silcrete	White	<40mm					Ridge	Focal	Step				827 x 4		AS16

91	2019-11-10T21:31:24.000Z	Core	Silcrete	White	<30mm					More than 1	Focal			Tertiary (no cortex)		830 x 2	No	AS16
92	2019-11-10T21:32:33.000Z	Flaked Piece	Silcrete	White	<20mm					Crushed	Focal	Feather		Tertiary (no cortex)		830 x 4	No	AS16
93	2019-11-10T21:34:11.000Z	Flake	Silcrete	Brown	<60mm					Faceted	Focal	Plunge		Tertiary (no cortex)		836 x 2		AS16
94	2019-11-10T21:36:40.000Z	Flaked Piece	Silcrete	White	<10mm					Indeterminate	Indeterminate	Feather		Tertiary (no cortex)		837 x 2		AS16
95	2019-11-10T21:38:37.000Z	Flake	Basalt	Dark grey	<70mm					Crushed	Broad	Hinge		Tertiary (no cortex)		838 x 2	No	AS16
96	2019-11-10T21:41:16.000Z	Split Flake	Silcrete	White	<20mm					Faceted	Broad	Hinge		Tertiary (no cortex)		843 x 2		AS16
97	2019-11-10T21:45:49.000Z	Flake	Silcrete	White	<20mm					Indeterminate	Indeterminate	Feather		Tertiary (no cortex)	Backed	844 x 2, 845 x 1		AS16
98	2019-11-10T21:48:36.000Z	Flake	Silcrete	White/ red						Flake scar	Broad	Feather		Tertiary (no cortex)		844 x 2		AS16
99	2019-11-10T21:50:30.000Z	Flake	Silcrete	White	<40mm					Crushed	Focal	Step		Tertiary (no cortex)		851 x 2		AS16
100	2019-11-10T21:58:29.000Z	Flake	Quartz	Crystl	<10mm					Flake scar	Focal	Feather		Tertiary (no cortex)		858 x 3		AS16

101	2019-11-10T22:00:38.000Z	Flaked Piece	Quartz	Crystal	<10mm					Indeterminate	Indeterminate			Tertiary (no cortex)		901 x 1		AS16
102	2019-11-10T22:02:43.000Z	Flake	Silcrete	Light grey	<40mm					Crushed	Focal	Feather		Tertiary (no cortex)		901 x 2	No	AS16
103	2019-11-10T22:04:50.000Z	Flake	Basalt	Dark grey	<60mm					Crushed	Focal	Step		Tertiary (no cortex)		906 x 1	No	AS16
104	2019-11-10T22:07:25.000Z	Core	Silcrete	Pink	<50mm					More than 1				Tertiary (no cortex)	Blade core	909 x 3	No	AS16
105	2019-11-10T22:10:32.000Z	Proximal Fragment	Silcrete	Light grey	<30mm					Crushed	Focal			Tertiary (no cortex)		911 x 2		AS16
106	2019-11-10T22:12:32.000Z	Flake	Volcanic	Dark grey						Flake scar	Broad	Feather		Tertiary (no cortex)		913 x 2		AS16
107	2019-11-10T22:16:38.000Z	Flake	Silcrete	Pink	<10mm					Flake scar	Broad	Feather		Tertiary (no cortex)		916 x 3		AS16
108	2019-11-10T22:19:15.000Z	Flake	Silcrete	White	<20mm					Faceted	Focal	Feather		Tertiary (no cortex)		918 x 1		AS16
109	2019-11-10T22:22:09.000Z	Flake	Silcrete	Yellow	<40mm					Flake scar	Broad	Axial		Tertiary (no cortex)	Neg flakes scars x 3 on dorsal	921 x 3		AS16
110	2019-11-10T22:24:41.000Z	Flake	Silcrete	Pink	<10mm					Indeterminate	Indeterminate	Feather		Tertiary (no cortex)	Debitage	926 x 1		AS16

111	2019-11-10T22:25:50.000Z	Flake	Silcrete	White	<10mm					Indeterminate	Indeterminate			Tertiary (no cortex)	Debitage	926 x 1		AS16
112	2019-11-10T22:27:56.000Z	Medial Fragment	Quartz	Crystal	<20mm									Tertiary (no cortex)		927 x 3		AS16
113	2019-11-10T22:29:26.000Z	Flake	Silcrete	Light grey	<20mm					Cortex	Broad	Hinge		Tertiary (no cortex)		929 x 2		AS16
114	2019-11-10T22:30:57.000Z	Flake	Quartzite		<20mm					Crushed	Focal	Feather		Tertiary (no cortex)		931 x 2		AS16
115	2019-11-10T22:32:32.000Z	Distal Fragment	Quartz	Crystal	<20mm							Hinge		Tertiary (no cortex)		933 x 1		AS16
116	2019-11-10T22:34:16.000Z	Distal Fragment	Silcrete	Light grey	<20mm									Tertiary (no cortex)		934 x 2		AS16
117	2019-11-10T22:36:45.000Z	Flake	Silcrete	Pink red	<30mm					Flake scar	Focal	Hinge		Tertiary (no cortex)		936 x 2		AS16
118	2019-11-10T22:44:20.000Z	Flake	Silcrete	Cream	<20mm					Indeterminate	Focal	Hinge		Tertiary (no cortex)		944 x 2		AS16
119	2019-11-10T22:45:58.000Z	Flake	Quartz	White	<40mm					Cortex	Broad	Feather		Secondary (partial dorsal is cortex	10% cortex	945 x 2		AS16

120	2019-11-10T22:47:40.000Z	Flake	Quartz	Crystal	<20mm					Crushed	Focal	Feather		Tertiary (no cortex)		947 x 1		AS16
121	2019-09-23T23:55:37.000Z	Broken Flake	Silcrete	Pale grey	<20mm											0042to0043		AS17
122	2019-09-23T23:46:44.000Z	Retouched flake	Silcrete	Pale grey	<10mm								Geometric micrplith			0040to41		AS17
123	2019-09-24T00:01:35.000Z	Manuport	Silcrete	Pale grey	<60mm										Colin says no			AS17
124	2019-11-11T04:36:41.000Z	Scraper	Silcrete	Brown grey	<80mm	78	70	36		Crushed	Indeterminate	Hinge			Scraper	2122 to 2123		AS18
125	2019-11-11T04:49:21.000Z	Broken Flake	Silcrete	Grey		24	20	9		Crushed	Focal					2130to 2131		AS18
126	2019-11-11T04:41:23.000Z	Flake	Volcanic	Grey		25	15	4		Crushed	Focal	Hinge				2124 to2125		AS18
127	2019-11-11T04:43:52.000Z	Distal Fragment	Volcanic	Grey		15	11	3				Feather				2126 to 2127		AS18
128	2019-11-11T04:46:56.000Z	Split Flake	Silcrete	Grey		35	64	25				Feather				2128 to 2129		AS18
129	2019-11-11T04:51:11.000Z	Medial Fragment	Quartz	Milky	<20mm	10	15	2								2133to 2132		AS18
130	2019-11-11T04:43:05.000Z	Flake	Quartz	White		23	33	12		Flake scar	Focal	Hinge		Tertiary (no cortex)		0344x2		AS18
131	2019-11-11T04:47:15.000Z	Core	Silcrete	White		17	15	13		More than 1				Tertiary (no cortex)		0348x2		AS18
132	2019-11-11T04:50:57.000Z	Flake	Silcrete	Light grey		24	12	9		Crushed	Focal	Feather		Tertiary (no cortex)		0350x2		AS18

133	2019-11-11T04:52:21.000Z	Flake	Silcrete	White		11	14	4		Faceted	Focal	Axial		Tertiary (no cortex)	0350x2			AS18
134	2019-11-11T04:54:36.000Z	Distal Fragment	Silcrete	Cream pink		22	14	4				Feather		Tertiary (no cortex)		0354x2		AS18
135	2019-11-11T04:55:37.000Z	Flake	Silcrete	White		8	5	1		Indeterminate	Indeterminate	Axial		Tertiary (no cortex)		0354x2		AS18
136	2019-09-25T03:31:51.000Z	Core	Chert	Dark grey	<30mm										Prepared platform	0179to181		AS19
137	2019-09-25T03:29:36.000Z	Flake	Silcrete	Pale grey	<60mm											0175to0178		AS19
138	2019-09-25T01:51:14.000Z	Core	Quartz	White	<30mm					More than 1					Subdiscoidal	0165to171		AS20
139	2019-09-25T01:49:34.000Z	Flake	Chert	Cream									Cortical			0162to164		AS20
140	2019-09-25T05:17:40.000Z	Retouched flake	Chert	White	<30mm											0201to203		AS21
141	2019-09-25T05:16:00.000Z	Proximal Fragment	Silcrete	White						Faceted						0198to200		AS21
142	2019-09-25T05:03:28.000Z	Flake	Chert	Red	<30mm											0194to197		AS22
143	2019-09-25T05:01:22.000Z	Flake	Chert	Pink grey	<30mm							Plunge				0191to193		AS22
144	2019-09-24T05:25:09.000Z	Manuport	Quartz	White	<40mm								Manuport					AS23
145	2019-09-24T05:26:36.000Z	Flake	Silcrete	White	<10mm													AS23
146	2019-09-24T05:27:09.000Z	Flake	Silcrete	Pale grey	<30mm													AS23

147	2019-09-24T05:27:58.000Z	Core	Silcrete	Pale grey	<30mm								Reduced blade core					AS23
148	2019-09-24T05:29:10.000Z	Medial Fragment	Silcrete	Pink	<20mm													AS23
149	2019-09-25T00:17:55.000Z	Broken Flake	Other	Grey	<10mm								IMSTC			144		AS23
150	2019-09-25T00:21:13.000Z	Flake	Chert	Dark grey	<10mm										Poss recorded yesterday?	0145to146		AS23
151	2019-09-24T04:18:05.000Z	Core	Silcrete	Yellow	<90mm										Unifacial	0122to124		AS23
152	2019-09-24T04:21:29.000Z	Split Flake	Silcrete	White	<20mm								Longitudal					AS23
153	2019-09-25T00:23:57.000Z	Distal Fragment	Silcrete	Grey	<20mm											0147to0148		AS23
154	2019-09-25T00:29:10.000Z	Flake	Quartz	White	<30mm											0149to150		AS23
155	2019-09-25T00:30:38.000Z	Broken Flake	Silcrete	Grey	<50mm											0151to154		AS23
156	2019-09-24T03:32:25.000Z	Manuport	Silcrete	Pale grey	>100mm													AS23
157	2019-09-24T03:44:32.000Z	Manuport	Silcrete	Pale grey	<60mm											117to118		AS23
158	2019-09-24T03:45:23.000Z	Hammerstone	Basalt	Dark grey	<80mm										Broken	119to120		AS23
159	2019-09-24T04:26:48.000Z	Flake	Silcrete	Grey	<30mm											0127to128		AS23
160	2019-09-24T04:30:53.000Z	Core	Silcrete	Pale grey	<50mm											0129to131		AS23
161	2019-09-24T04:34:20.000Z	Core	Quartz	White	<20mm										Potentially bipolar			AS23

162	2019-09-24T04:35:59.000Z	Angular fragment	Chert	White	<30mm								Angular frag			0134to135		AS23
163	2019-09-24T04:38:06.000Z	Flake	Silcrete	Pale grey	<30mm					Crushed		Plunge			1-25% cortex	0136to137		AS23
164	2019-09-24T04:42:46.000Z	Core	Silcrete	Pale grey	>100mm								Unifacial core			0138to0140		AS23
165	2019-09-24T04:46:24.000Z	Core	Chert	Brown	<90mm											0141to0142		AS23
166	2019-09-24T04:48:21.000Z	Core	Silcrete	Pale grey	<40mm								Broken, opposed blade core, platform preparation			0143to0144		AS23
167	2019-09-24T04:54:31.000Z	Manuport	Basalt	Grey											Broken cobble	0146to0147		AS23
168	2019-09-24T04:57:27.000Z	Retouched flake	Silcrete	White	<20mm							Hinge				0148to0150		AS23
169	2019-09-24T04:59:31.000Z	Retouched flake	Silcrete	White	<30mm							Feather	Thumbnail scraper			0151to152		AS23
170	2019-09-24T05:02:46.000Z	Proximal Fragment	Basalt	Dark grey	<40mm									Primary (all coretex dorsal)	Cortical	0153to154		AS23
171	2019-09-24T05:04:22.000Z	Broken Flake	Silcrete	White	<20mm											0155to156		AS23
172	2019-09-24T05:06:51.000Z	Proximal Fragment	Silcrete	White	<20mm											0157to158		AS23
173	2019-09-24T05:08:19.000Z	Medial Fragment	Silcrete	White	<20mm													AS23

174	2019-09-24T05:08:54.000Z	Proximal Fragment	Quartz	White	<20mm													AS23
175	2019-09-24T05:10:47.000Z	Flake	Quartz	White	<20mm													AS23
176	2019-09-24T05:11:25.000Z	Distal Fragment	Chert	Dark grey											Patinated imstc			AS23
177	2019-09-24T05:13:16.000Z	Flake	Silcrete	Grey	<50mm													AS23
178	2019-09-24T05:14:49.000Z	Flake	Other	Pale grey	<30mm							Hinge	Greywacke					AS23
179	2019-09-24T05:16:21.000Z	Geometric microlith	Chert	What	<10mm								Geometric microlith					AS23
180	2019-09-24T05:17:33.000Z	Core tool	Silcrete	Pale grey	<70mm								Scraper					AS23
181	2019-09-24T05:20:58.000Z	Core	Silcrete	Pale grey	<60mm								Blade core on flake		Platform prep	0178to0182		AS23
182	2019-09-24T05:24:33.000Z	Flake	Silcrete	Pink	<30mm													AS23
183	2019-09-24T22:41:46.000Z	Retouched flake	Chert	Dark grey	<30mm										Retouched on ventral and dorsal	0037to39		AS24
184	2019-09-24T22:43:05.000Z	Flake	Silcrete	Grey	<20mm											0040to41		AS24
185	2019-09-24T23:35:00.000Z	Core	Quartz	White	<30mm								Poss core			102		AS24
186	2019-09-24T23:37:59.000Z	Flake	Silcrete	Pale grey	<40mm											0103to105		AS24
187	2019-09-24T23:38:58.000Z	Flake	Chert	Pale grey	<30mm											0106to107		AS24

188	2019-09-24T23:39:38.000Z	Flake	Silcrete	White	<30mm											0108to109		AS24
189	2019-09-24T23:40:41.000Z	Flake	Chert	White	<20mm											0110to111		AS24
190	2019-09-24T23:41:31.000Z	Distal Fragment	Silcrete	Pink	<10mm											112to113		AS24
191	2019-09-24T23:42:06.000Z	Medial Fragment	Silcrete	Grey	<20mm											114to115		AS24
192	2019-09-24T23:46:01.000Z	Broken Flake	Quartz	White	<40mm											0116to119		AS24
193	2019-09-24T23:59:22.000Z	Core	Silcrete	Grey						More than 1						0132to135		AS24
194	2019-09-25T00:03:30.000Z	Proximal Fragment	Silcrete	Grey	<40mm											0136to137		AS24
195	2019-09-25T00:04:30.000Z	Angular fragment	Silcrete	Grey	<20mm								Angular frag Poss refit			0128to0129		AS24
196	2019-09-25T00:08:19.000Z	Core	Chert	White	>100mm											0140to143		AS24
197	2019-09-24T03:13:05.000Z	Core	Chert	White	<30mm										Unifacial	0113to115		AS24
198	2019-09-24T05:37:28.000Z	Flake	Silcrete	Pale grey	<20mm											0199to0200		AS24
199	2019-09-24T05:43:37.000Z	Flake tool	Silcrete	Grey	<40mm								Scraper		Retouched scraper?	0201to0203		AS24
200	2019-09-24T22:23:58.000Z	Scraper	Silcrete	White	<80mm								Angular frag poss broken flake			0023to24		AS24
201	2019-09-24T22:28:45.000Z	Proximal Fragment	Silcrete	White	<60mm											0025to26		AS24

202	2019-09-24T22:30:17.000Z	Flake	Silcrete	Pale grey	<60mm											0027to28		AS24
203	2019-09-24T22:32:17.000Z	Flake	Chert	Grey	<40mm											0029to30		AS24
204	2019-09-24T22:33:13.000Z	Broken Flake	Quartz	White	<20mm											31		AS24
205	2019-09-24T22:36:47.000Z	Flake	Basalt	Dark grey	<20mm											0032to33		AS24
206	2019-09-24T22:38:03.000Z	Retouched flake	Chert	Dark grey	<20mm								Backed blade			0034to36		AS24
207	2019-09-24T22:47:18.000Z	Flake	Silcrete	Pink grey	<30mm											0043to44		AS24
208	2019-09-24T22:48:57.000Z	Broken Flake	Chert	Pale grey	<40mm											0045to0046		AS24
209	2019-09-24T22:49:50.000Z	Flake	Chert	Pale grey	<30mm								Core rejuvenation flake			0047to48		AS24
210	2019-09-24T22:51:25.000Z	Medial Fragment	Chert	Pale grey	<20mm											49		AS24
211	2019-09-24T22:53:06.000Z	Angular fragment	Greywacke	Grey									Angular frag		Greywacke	0050to51		AS24
212	2019-09-24T22:54:46.000Z	Flake	Silcrete	Pale grey	<20mm											0052to54		AS24
213	2019-09-24T23:16:11.000Z	Flake	Chert	White	<20mm											0083to85		AS24
214	2019-09-24T23:47:26.000Z	Proximal Fragment	Basalt	Dark grey	<40mm											0120to124		AS24
215	2019-09-24T23:02:04.000Z	Broken Flake	Quartz	Grey and white	<40mm											0062to0063		AS24
216	2019-09-24T23:02:47.000Z	Flake	Quartz	Clear white	<10mm											0064to65		AS24
217	2019-09-24T23:08:45.000Z	Core	Chert	White	<30mm					Bipolar	Bipolar					0071to0074		AS24

218	2019-09-24T23:10:47.000Z	Broken Flake	Silcrete	White	<10mm											0075to76		AS24
219	2019-09-24T23:12:07.000Z	Proximal Fragment	Silcrete	Pale grey	<30mm											0077to79		AS24
220	2019-09-24T23:13:34.000Z	Flake	Chert	Pale grey	<20mm					Faceted						0080to0082		AS24
221	2019-09-24T23:20:22.000Z	Flake	Silcrete	Pink grey	<30mm										Grain supported silcrete	0086to88		AS24
222	2019-09-24T23:23:49.000Z	Flake	Silcrete	Pink cream	<30mm											0088to91		AS24
223	2019-09-24T23:27:06.000Z	Core	Silcrete	Grey	<40mm								Broken			0092to95		AS24
224	2019-09-24T23:28:36.000Z	Broken Flake	Quartz	Crystal	<20mm											96		AS24
225	2019-09-24T23:31:04.000Z	Angular fragment	Quartz	Crystal	<10mm								Angular frag			0097to98		AS24
226	2019-09-24T22:56:29.000Z	Proximal Fragment	Chert	Pink cream	<20mm											0055to56		AS24
227	2019-09-24T22:58:23.000Z	Flake	Chert	White	<30mm											0057to61		AS24
228	2019-11-14T23:03:35.000Z	Hammerstone	Volcanic	Cream		51	54	45							Broken by plough, but likely hammerstone	0018, 19, 20		AS24
229	2019-11-15T00:04:27.000Z	Axe	Other	Greywacke grey		92	63	29							Very damaged by plough	0028,29,30		AS24
230	2019-09-24T00:29:45.000Z	Axe	Basalt	Dark grey	>100mm								Ground edge		Conjoined- prob broken by plough	0052to56		AS25

231	2019-09-24T00:37:40.000Z	Core	Silcrete	Cream	<80mm											57		AS25
232	2019-09-24T00:46:19.000Z	Angular fragment	Silcrete	Pale grey											2xangular frags	0058to59		AS25
233	2019-09-24T00:52:20.000Z	Manuport	Quartz	White	<60mm										Quartz is not local immediately	61		AS25
234	2019-09-24T00:56:19.000Z	Flake	Quartz	White	<20mm							Feather				0062to66		AS25
235	2019-09-24T01:01:27.000Z	Flake	Other	Grey	<50mm										Hornfels? Eraillure scar	67to69		AS25
236	2019-09-24T01:03:49.000Z	Broken Flake	Silcrete	Pale grey	<20mm											70to71		AS25
237	2019-09-24T01:04:59.000Z	Angular fragment	Silcrete	Pale grey	<40mm								Angular frag			0072to73		AS25
238	2019-09-24T01:09:09.000Z	Scraper	Other	Dark grey	<50mm								Side scraper, patinated hornfels					AS25
239	2019-09-24T01:12:46.000Z	Flake	Quartz	White	<50mm					Bipolar			Bipolar			0076to77		AS25
240	2019-09-24T01:15:37.000Z	Manuport	Quartz	White														AS25
241	2019-09-24T01:16:46.000Z	Flake	Silcrete	Pale grey	<50mm							Feather			Platform prep, edge damage	0079to82		AS25
242	2019-09-24T21:54:27.000Z	Flake	Silcrete	Pale grey	<40mm											0004to5		AS25
243	2019-09-24T01:20:12.000Z	Flake	Silcrete	Pink	<30mm							Feather				0084to0085		AS25
244	2019-09-24T01:22:39.000Z	Flake	Silcrete	Pale grey,pink	<30mm											0086to87		AS25

245	2019-09-24T01:23:47.000Z	Angular fragment	Silcrete	Pink, pale grey	<20mm								Angular frag			0088to0089		AS25
246	2019-09-24T01:24:43.000Z	Broken Flake	Silcrete	Pale grey	<30mm											0090to91		AS25
247	2019-09-24T01:26:21.000Z	Flake	Silcrete	Pale grey	<30mm											0092to93		AS25
248	2019-09-24T01:29:59.000Z	Broken Flake	Other	White	<30mm								Hornfels			0094to95		AS25
249	2019-09-24T01:32:58.000Z	Proximal Fragment	Quartz	White	<10mm													AS25
250	2019-09-24T01:33:54.000Z	Angular fragment	Quartz	White	<30mm								Angular					AS25
251	2019-09-24T01:34:17.000Z	Broken Flake	Quartz	White	<20mm													AS25
252	2019-09-24T01:34:37.000Z	Angular fragment	Quartz	White	<40mm								Angular frag					AS25
253	2019-09-24T01:35:11.000Z	Split Flake	Silcrete	Pale grey	<30mm								Longitudinal			0096to97		AS25
254	2019-09-24T01:42:16.000Z	Broken Flake	Quartz	White	<20mm											102		AS25
255	2019-09-24T01:44:19.000Z	Flake	Silcrete	Pale grey	<50mm											0103to106		AS25
256	2019-09-24T01:46:33.000Z	Proximal Fragment	Quartz	White	<20mm											0107to108		AS25
257	2019-09-24T01:49:09.000Z	Angular fragment	Quartz	White	<20mm								Angular frag			0109to110		AS25
258	2019-09-24T01:52:27.000Z	Retouched flake	Quartz	White grey	<50mm											0111to112		AS25
259	2019-09-24T21:52:48.000Z	Flake	Chert	Pale grey	<30mm											100-0001to3		AS25
260	2019-09-24T21:57:17.000Z	Broken Flake	Quartz	White	<20mm											0006to7		AS25

261	2019-09-24T22:03:59.000Z	Flake	Quartz	White	<10mm											0010to11		AS25
262	2019-09-24T22:04:49.000Z	Flake	Quartz	White	<10mm											0012to14		AS25
263	2019-09-24T22:06:22.000Z	Angular fragment	Chert	White	<20mm								Angular frag			0016to18		AS25
264	2019-09-24T22:07:55.000Z	Manuport	Quartz	White	<40mm											19		AS25
265	2019-11-14T23:44:36.000Z	Axe	Basalt	Grey		77	70	20							Fragment only	0021to23		AS25
266	2019-11-11T03:24:35.000Z	Flake	Quartz	White		16	18	4		Crushed	Focal	Feather		Tertiary (no cortex)		223x2		AS26
267	2019-11-11T03:27:14.000Z	Core	Quartz	White		34	41	19		More than 1				Tertiary (no cortex)		227x2		AS26
268	2019-09-23T22:20:19.000Z	Flake	Other	Pale grey	<40mm					Faceted		Hinge				0005 area; 0006 dorsal to 0007 plat; 0008 ventral		AS27
269	2019-09-23T22:18:19.000Z	Flake	Other	Pale grey	<40mm							Feather			Greywacke	0003 ventral to 0004dorsal		AS27
270	2019-09-23T23:12:29.000Z	Broken Flake	Other	Dark grey	<90mm										Greywacke	21		AS28
271	2019-09-23T23:10:42.000Z	Broken Flake	Silcrete	Yellow	<30mm											0019; 0020		AS28
272	2019-09-23T23:13:44.000Z	Broken Flake	Silcrete	Yellow	<30mm											0022 to 0023		AS28

273	2019-11-11T21:31:11.000Z	Core	Other			54	42	19							Greywacke, longest scar 60	2146 and 2147		AS3
274	2019-11-11T21:33:15.000Z	Flake	Silcrete	Pink		10	9	5			Focal	Feather				2148 and 2149		AS3
275	2019-11-11T21:37:00.000Z	Flake	Chert	Black brown	<20mm	10	15	5			Broad				2 small debitage pieces of same material in association	2150 to 2152		AS3
276	2019-11-12T00:25:29.000Z	Axe	Other	Grey		110	59	24							Greywacke, usewear on ventral and lateral	2183 to 2185		AS4
277	2019-11-12T00:32:47.000Z	Flake	Silcrete	Grey		30	40	10			Focal					2189 to 2190		AS4
278	2019-11-12T00:34:57.000Z	Flake	Silcrete	Grey	<30mm	22	28	5			Broad	Hinge				2191 to 2192		AS4
279	2019-11-12T00:39:39.000Z	Flake	Quartz	Crystal clear	<20mm	20	15	3		Crushed	Shattered				Crushed term	2196 to 2195		AS4
280	2019-11-12T00:42:55.000Z	Flake	Silcrete	Orange cream	<20mm	13	12	2		Crushed	Focal	Feather				2197 to 2198		AS4
281	2019-11-12T00:45:04.000Z	Core	Silcrete	Speckled white grey and orange											Multi directional core 11 scars longest scar is 50	2199 to 2200		AS4
282	2019-11-12T00:48:19.000Z	Scraper	Greywacke	Grey	<80mm	76	50	20							Scraper greywacke? Cutgrooveson ventral surface	2201 to 2202		AS4

283	2019-11-12T01:06:28.000Z	Flake	Silcrete	Speckled grey and white	<20mm	20	92				Broad	Feather				2213 to 2214		AS4
284	2019-11-12T01:08:42.000Z	Flake	Silcrete	Speckled whit and grey		26	14	3		More than 1	Broad	Feather				2215 to 2216		AS4
285	2019-11-12T01:10:56.000Z	Flake	Silcrete	Grey		10	6	1			Broad	Feather				2217 to 2218		AS4
286	2019-11-12T01:13:46.000Z	Broken Flake	Silcrete	Grey		15	10	4			Broad				Broken term	2219 to 220		AS4
287	2019-11-12T01:18:46.000Z	Flake	Chert	Brown		9	5	2			Broad	Feather				2223 to 2224		AS4
288	2019-11-12T01:21:24.000Z	Flake tool	Chert	Speckled white	<70mm	70	15	14							Cutting impleme nt or spear head but quite large def tool	2225 to 2226		AS4
289	2019-11-12T01:25:00.000Z	Core	Silcrete	Grey		30	22	15							3 flake scars unidirecti onal	2227 to 2228		AS4
290	2019-11-12T01:27:34.000Z	Core	Silcrete	Brown grey		36	30	30							3 scars unidirecti onal	2229 to 2230		AS4
291	2019-11-12T00:37:25.000Z	Flake	Chert	Speckled white and orange	<30mm	22	10	2			Broad	Feather				2193 to 2194		AS4
292	2019-11-12T00:53:17.000Z	Flake	Silcrete	Grey	<30mm	24	15	1			Broad	Feather				2204 to 2203		AS4
293	2019-11-12T00:55:41.000Z	Flake	Silcrete	Grey and white speckled	<10mm	10	10	1			Broad	Feather				2205 to 2206		AS4

294	2019-11-12T00:57:48.000Z	Flake	Other	Grey	<30mm	22	20	5			Broad	Feather			Greywacke potluck at term distal end	2208 to 2207 retouch around lateral margins		AS4
295	2019-11-12T01:00:47.000Z	Broken Flake	Silcrete	Speckled white	<30mm	22	20	9			Broad				Term broken off	2209 to 2210		AS4
296	2019-11-12T01:03:32.000Z	Core	Volcanic	Cream	<50mm	45	30	25							6 scars multidirectional	2211 to 2212		AS4
297	2019-11-12T01:16:21.000Z	Broken Flake	Silcrete	White pink		13	12	1			Broad				Broken term	2221 to 2222		AS4
298	2019-11-12T01:30:41.000Z	Flake	Chert	Brown	<30mm	30	22	10		Crushed	Focal	Feather				2231 to 2232		AS4
299	2019-11-12T01:56:59.000Z	Flake	Chert	Red brown	<30mm	28	20	5			Broad	Feather				2237 to 2238		AS4
300	2019-11-11T23:16:44.000Z	Scraper	Basalt	Dark grey		68	59	26		Flake scar	Broad	Hinge		Tertiary (no cortex)	Poss scraper	0034,35,36	Y	AS4
301	2019-11-12T00:38:12.000Z	Flake	Silcrete	Pink grey		52	81	24		Cortex	Broad	Hinge		Secondary (partial dorsal is cortex	15% cortex	0041,42		AS4
302	2019-11-12T00:40:25.000Z	Flake	Silcrete	Grey		96	71	31		Ridge	Broad	Feather		Tertiary (no cortex)		0041,42		AS4
303	2019-11-12T00:44:17.000Z	Core	Silcrete	Grey		45	39	33		More than 1				Tertiary (no cortex)	4 neg flk scars	0043,44		AS4

304	2019-11-12T00:49:10.000Z	Proximal Fragment	Silcrete	Pale grey		24	24	10		Ridge	Broad			Tertiary (no cortex)		0045,46		AS4
305	2019-11-12T00:53:45.000Z	Flake	Silcrete	Grey		52	41	15		Faceted	Broad	Axial		Secondary (partial dorsal is cortex	20% cortex	0047,48		AS4
306	2019-11-12T00:59:30.000Z	Flake	Other	Greywacke grey		20	30	6		Flake scar	Focal	Feather		Tertiary (no cortex)		49		AS4
307	2019-11-12T01:04:10.000Z	Flake	Quartz	Milky		24	21	5		Faceted	Broad	Feather		Tertiary (no cortex)		0050,51		AS4
308	2019-11-12T01:06:28.000Z	Flake	Silcrete	Grey		17	18	3		Faceted	Focal	Feather		Tertiary (no cortex)		52		AS4
309	2019-11-12T01:11:26.000Z	Flake	Quartz	Banded grey white		62	50	18		Flake scar	Focal	Axial		Tertiary (no cortex)		53		AS4
310	2019-11-12T01:18:02.000Z	Flake	Silcrete	Grey		62	51	23		Faceted	Broad	Feather		Tertiary (no cortex)		57		AS4
311	2019-11-12T01:21:56.000Z	Core	Silcrete	Grey		20	32	15								58		AS4
312	2019-11-12T01:27:20.000Z	Core tool	Silcrete	Red		57	63	21						Primary (all coretex dorsal)	Core scraper from pebble 60% cortex	0059,60		AS4

313	2019-11-12T01:30:44.000Z	Split Flake	Silcrete	White		28	7	5		Crushed	Focal	Feather		Tertiary (no cortex)		61		AS4
314	2019-11-12T01:33:23.000Z	Proximal Fragment	Chert	Cream brown		36	25	12		Ridge	Broad			Tertiary (no cortex)		0062,63		AS4
315	2019-11-12T02:05:54.000Z	Axe	Basalt	Grey		120	55	40								2239 to 2241 last photo poss blank		AS5
316	2019-11-12T02:08:38.000Z	Flake	Silcrete	Brown yellow		25	10	4		Crushed	Focal	Feather				2243 to 2242		AS5
317	2019-11-11T21:02:19.000Z	Flake	Chert	Speckled chert	<30mm	24	15	3		Crushed	Focal	Plunge				2136 to 2137		AS6
318	2019-11-11T21:04:58.000Z	Flake	Chert	White		20	30	9			Broad	Feather				2138 to 2139		AS6
319	2019-11-12T00:12:02.000Z	Broken Flake	Silcrete	Grey		20	10	2		Crushed	Focal					2176 to 2177		AS7
320	2019-11-12T00:16:35.000Z	Manuport	Other	White quartz like but longitudinal crystallisatikn												2180		AS7
321	2019-11-11T23:52:33.000Z	Flake	Silcrete	Grey		65	25	15			Broad	Step				2163 to 2164		AS7
322	2019-11-11T23:55:09.000Z	Core	Other	Grey	<40mm	40	36	24							Greywacke, longest scar 40	2165 to 2166		AS7
323	2019-11-11T23:58:54.000Z	Proximal Fragment	Chert	White		25	26	6		Crushed	Broad				Absent term	2167to 2168		AS7
324	2019-11-12T00:01:08.000Z	Flake	Chert	White	<20mm	20	14	3			Focal	Feather				2169 to 2170		AS7

325	2019-11-12T00:03:54.000Z	Flake	Other	Grey	<50mm	46	29	7			Broad	Hinge			Greywacke	2171 to 2172		AS7
326	2019-11-12T00:06:11.000Z	Flake	Silcrete	Grey		32	19	6			Broad	Feather				2173 to 2174		AS7
327	2019-11-12T00:14:40.000Z	Manuport	Quartz	White												2178 to 2179		AS7
328	2019-11-11T01:40:07.000Z	Flake	Chert	Cream		14	8	2			Focal					2100 to 2101		AS8
329	2019-11-11T01:27:53.000Z	Proximal Fragment	Quartz	Crystal clear	<20mm	18	16	5		Crushed					Absent term			AS8
330	2019-11-11T01:36:15.000Z	Flake	Quartz	Crystal	<30mm	30	15	6		Crushed						2096 to 2097		AS8
331	2019-11-11T01:38:13.000Z	Manuport	Quartz	Clear white												2099 to 2098		AS8
332	2019-11-11T02:57:07.000Z	Flake	Silcrete	White		22	10	2		Crushed	Focal	Axial				0156x2		AS9
333	2019-11-11T02:58:23.000Z	Medial Fragment	Chert	Cream		9	11	4						Tertiary (no cortex)		0156x2		AS9

SUBSURFACE																				
Artefact ID	Pit No.	Spit No.	Depth (cm)	Date	Type	Raw Materi	Colour	Size Class	Length mm	Width mm	Thickness	Weight	Plat surf	Plat Type	Terminatio	Reduc stag	Notes	Photo	Retouch
334	1	1	0 to 5	14/11/2019	Geometric microlith	Silcrete	Grey		19	9	4		flaked	focal	feather?	tertiary	backed	IMG_260 to 263	1
335	1	1	0 to 5	14/11/2019	Distal fragment	Chert	Cream, grey banded		27	32	16		flaked	broad	n/a	tertiary		IMG_260, 261	
336	1	1	0 to 5	14/11/2019	Medial fragment	Silcrete	Cream		24	11	9		n/a	n/a	n/a	tertiary		IMG_260, 261	
337	1	1	0 to 5	14/11/2019	Flake	Silcrete	Grey		14	18	11		flaked	focal	axial	tertiary		IMG_260, 261	
338	1	2	5 to 10	14/11/2019	Flake	Chert	Pink cream		24	16	3		flaked	focal	hinge	tertiary		IMG_264, 265	
339	1	5	20 to 30	14/11/2019	Flake	Silcrete	Grey		14	8	5		natural	focal	hinge	tertiary	backing	IMG_266, 267	1
340	1	5	20 to 30	14/11/2019	Proximal fragment	Silcrete	Pale grey		10	7	2		flaked	focal	n/a	tertiary		IMG_266, 267	
341	2	1	0 to 10	14/11/2019	Proximal fragment	Chalcedony	Dark grey		16	13	4		crushed	focal	n/a	tertiary		IMG_0271,272	
342	2	1	0 to 10	14/11/2019	Distal fragment	Quartz	Clear		9	5	2		n/a	n/a	feather	tertiary		IMG_0271,272	
343	3	1	0 to 10	14/11/2019	Flake	Chert	Cream, pink		18	23	10		crushed	focal	hinge	tertiary		IMG_258, 259	
344	3	1	0 to 10	14/11/2019	Flake	Silcrete	Red		15	15	6		natural	broad	axial	tertiary		IMG_258, 259	
345	3	1	0 to 10	14/11/2019	Flake	Chert	Dark grey		17	6	4		flaked	focal	feather	tertiary		IMG_258, 259	
346	3	1	0 to 10	14/11/2019	Proximal fragment	Silcrete	Pale grey		10	10	5		natural	broad	n/a	tertiary		IMG_258, 259	
347	3	2	10 to 20	14/11/2019	Proximal fragment	Silcrete	Pale grey		14	22	5		flaked	focal	n/a	tertiary		IMG_268, 269	
348	3	2	10 to 20	14/11/2019	Proximal fragment	Silcrete	Cream		24	8	9		flaked	focal	n/a	tertiary	2 x neg flk scars on right lateral surface	IMG_268, 269	
349	5	1	0 to 10	14/11/2019	Flake	Greywacke	Grey		26	15	2		flaked	focal	hinge	tertiary	1 x neg flake scar on dorsal	IMG_0254,0255	
350	6	1	0 to 10	14/11/2019	Flake	Chert	White		10	9	1		crushed	focal	hinge	tertiary		IMG_270	
351	6	1	0 to 10	14/11/2019	Proximal fragment	Silcrete	Grey		10	4	2		crushed	focal	n/a	tertiary	debitage	IMG_270	
352	6	4	30 to 40	14/11/2019	Split flake	Silcrete	Pink		19	8	3		crushed	focal	feather	tertiary		IMG_256, 257	
353	7	1	0 to 10	14/11/2019	Flake	Silcrete	Grey		25	10	3		flaked	broad	hinge	tertiary		IMG_250, 251	

354	7	1	0 to 10	14/11/2019	Geometric microlith	Silcrete	Grey		19	11	3		flaked	focal	feather?	secondary	5% cortex highly siliceous	IMG_250 to 253	1
355	8	1	0 to 10	15/11/2019	Proximal fragment	Silcrete	Grey		17	25	6		flaked	focal	n/a	tertiary		IMG_245, 246	
356	8	1	0 to 10	15/11/2019	Flake	Chert	Grey		26	12	3		flaked	focal	feather	tertiary		IMG_245, 246	
357	8	1	0 to 10	15/11/2019	Distal fragment	Silcrete	Pale grey		20	14	4		n/a	n/a	feather	tertiary		IMG_245, 246	
358	8	1	0 to 10	15/11/2019	Flake	Quartz	Crystal		16	11	3		flaked	broad	step	tertiary		IMG_245, 246	
359	8	1	0 to 10	15/11/2019	Medial fragment	Silcrete	Pale grey		7	5	1		n/a	n/a	n/a	tertiary	debitage	IMG_245, 246	
360	9	2	10 to 20	15/11/2019	Flake	Silcrete	Red yellow		64	44	10		natural	broad	axial	primary	50% cortex, extremely coarse material	IMG_247 to 249	
361	9	2	10 to 20	15/11/2019	Flake	Silcrete	Grey brown		22	15	3		flaked	broad	feather	tertiary		IMG_247 to 249	
362	13	1	0 to 10	15/11/2019	Flake	Chert	Cream, pink banded		18	8	5		flaked	broad	plunge	tertiary		IMG_236 to 244	
363	13	1	0 to 10	15/11/2019	Medial fragment	Greywacke	Grey		30	18	11		n/a	n/a	n/a	tertiary		IMG_236 to 244	

APPENDIX C TEST EXCAVATION DATA

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
1	1	0-5	Light brown loamy sand. Grass root inclusions. No PH or Munsell was recorded.	1 artefact from bucket.
	2	5-10	Light brown loamy sand. No PH or Munsell was recorded.	1 artefact from bucket.
	3	10-15	Light brown loamy sand. No PH or Munsell was recorded.	
	4	15-20	Light brown loamy sand. Clay nodules and rock inclusions evident. No PH or Munsell was recorded.	
	5	20-30	Light brown loamy sandy clay. Gravel inclusions evident and more clay inclusions. Excavation switched to 10cm spits owing to increased clay content and lack of material for previous two spits. No PH or Munsell was recorded.	2 artefacts, 2 possible artefacts.
	6	30-40	Yellow-grey compacted clay. Gravel inclusions. No PH or Munsell was recorded.	
 Pit 1 Spit 6			 Pit 1 Spit 6 Northern wall profile	
2	1	0-13	Grey silt. Grass root inclusions. No PH or Munsell was recorded.	2 possible artefacts.
	2	13-20	Grey silty clay. Inclusion of oranges clay nodules and pebbles. Increasing compactness. No PH or Munsell was recorded.	
	3	20-30	Compact yellow-grey orange clay with stone inclusions. No PH or Munsell was recorded.	

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
 Pit 2 Spit 3			 Pit 2 Spit 3 Eastern wall profile	
3	1	0-10	Friable grey brown silt. Grass root and stone inclusions. No PH or Munsell was recorded.	
	2	10-20	Yellow mottled clay with stone inclusions. No PH or Munsell was recorded.	2 artefacts.
	3	20-30	Compact yellow-grey orange clay with increased stone inclusions. No PH or Munsell was recorded.	1 artefact.
 Pit 3 Spit 3			 Pit 3 Spit 3 Northern wall profile	
4	1	0-10	Light brown loamy sand. Grass root and pebble inclusions. No PH or Munsell was recorded.	
	2	10-20	Light brown loamy sandy clay. Increased pebble inclusions with some rootlets protruding from the north wall. No PH or Munsell was recorded.	
	3	20-30	Yellow-grey compacted clay. Increased gravel inclusions. No PH or Munsell was recorded.	

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
 Pit 4 Spit 3			 Pit 4 Spit 3 Northern wall profile	
5	1	0-10	Light brown loamy sand. Grass root and rock inclusions. No PH or Munsell was recorded.	1 artefact.
	2	10-20	Light brown loamy sandy clay. Increased pebble inclusions with clumps of clay being extracted through bucket material. No PH or Munsell was recorded.	
	3	20-30	Yellow-grey compacted clay. Even more gravel inclusions. No PH or Munsell was recorded.	
 Pit 5 Spit 8			 Pit 5 Spit 3 Northern wall profile	
6	1	0-17	Friable grey brown silt. Grass root inclusions. No PH or Munsell was recorded.	1 artefact. 2 possible artefacts.
	2	17-20	Grey brown silty clay. No PH or Munsell was recorded.	1 artefact. 2 possible.

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
	3	20-30	Compact grey orange clay with increased stone inclusions. No PH or Munsell was recorded.	1 artefact. 2 possible.
	4	30-40	Brown clay soils with increased compaction and clay nodules. No PH or Munsell was recorded.	
 Pit 6 Spit 4			 Pit 6 Spit 4 Northern wall profile	
7	1	0-10	Light brown loamy sand. Grass root and pebble inclusions. No PH or Munsell was recorded.	1 artefact.
	2	10-20	Light brown loamy sandy clay. Increased gravel inclusions. Colour transitions to a cream as more clay content is included. No PH or Munsell was recorded.	
	3	20-30	Yellow-grey compacted clay. Increased gravel inclusions. No PH or Munsell was recorded.	
 Pit 7 Spit 3			 Pit 7 Spit 3 Northern wall profile	
8	1	0-10	Light brown loamy sand. Grass root and gravel inclusions. No PH or Munsell was recorded.	5 artefacts.

<table>
<tr><th>Pit no</th><th>Spit number</th><th>Depth (cm)</th><th>Soil Description</th><th>Artefacts</th></tr>
<tr><td></td><td>2</td><td>10-20</td><td>Light brown loamy sandy clay. Increased gravel inclusions. Clay clumps extracted.
No PH or Munsell was recorded.</td><td></td></tr>
<tr><td></td><td>3</td><td>20-30</td><td>Yellow-grey compacted clay. No PH or Munsell was recorded.</td><td></td></tr>
<tr><td colspan="3">

Pit 8 Spit 3</td><td colspan="2">

Pit 8 Spit 3 Northern wall profile</td></tr>
<tr><td>9</td><td>1</td><td>0-10</td><td>Friable grey brown silt. Gravel inclusions.
No PH or Munsell was recorded.</td><td></td></tr>
<tr><td></td><td>2</td><td>10-20</td><td>Friable grey brown silt. Gravel inclusions.
No PH or Munsell was recorded.</td><td>1 artefact. 1 possible artefact.</td></tr>
<tr><td></td><td>3</td><td>20-30</td><td>Compact grey orange clay with increased stone inclusions and clay nodules.
No PH or Munsell was recorded.</td><td></td></tr>
<tr><td colspan="3">
Pit 9 Spit 3</td><td colspan="2">
Pit 9 Spit 3 Northern wall profile</td></tr>
<tr><td>10</td><td>1</td><td>0-10</td><td>Light brown grey loamy sand. Grass root and gravel inclusions.
No PH or Munsell was recorded.</td><td></td></tr>
<tr><td></td><td>2</td><td>10-20</td><td>Light brown loamy sandy clay. Big chunky clay inclusions with large amounts of gravel content.
No PH or Munsell was recorded.</td><td></td></tr>
<tr><td></td><td>3</td><td>20-30</td><td>Orange-brown/cream compacted clay. Large amounts of gravel. No PH or Munsell was recorded.</td><td></td></tr>
</table>

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
 Pit 10 Spit 3			 Pit 10 Spit 3 Northern wall profile	
11	1	1-16	Friable grey brown silt. Gravel inclusions. No PH or Munsell was recorded.	
	2	16-23	Friable grey brown silt. Gravel and clay nodule inclusions. Increasing compactness with depth. No PH or Munsell was recorded.	
	3	23-30	Compact pale cream clay with increased stone inclusions and compactness. No PH or Munsell was recorded.	
 Pit 11 Spit 3			 Pit 11 Spit 3 Northern wall profile	
12	1	0-10	Light grey loamy sand. Grass root/insect and small amount of gravel inclusions. No PH or Munsell was recorded.	
	2	10-20	Light brown loamy sandy clay. Increased gravel and insect inclusions as well as compactness with depth. No PH or Munsell was recorded.	
	3	20-30	Orange-brown/cream compacted clay. Large amounts of gravel. No PH or Munsell was recorded.	

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
 Pit 12 Spit 3			 Pit 12 Spit 3 Northern wall profile	
13	1	0-10	Friable grey brown silt. Gravel and rootlet inclusions. No PH or Munsell was recorded.	1 artefact.
	2	10-30	Compact pale cream clay with increased stone inclusions and compactness. No PH or Munsell was recorded.	
 Pit 13 Spit 2			 Pit 13 Spit 2 Eastern wall profile	
14	1	0-10	Light brown grey loamy sand. Grass root/insect and small amount of gravel inclusions. No PH or Munsell was recorded.	
	2	10-20	Light grey-brown loamy silt, gravel inclusions.	
	3	20-30	Orange-brown/cream compacted clay. Large amounts of gravel. No PH or Munsell was recorded.	

Pit no	Spit number	Depth (cm)	Soil Description	Artefacts
 Pit 14 Spit 3			 Pit 14 Spit 3 Northern wall profile	
15	1	0-10	Friable grey brown silt. Gravel and root inclusions. No PH or Munsell was recorded.	
	2	10-20	Compact orange-yellow clay with increased stone inclusions and compactness. No PH or Munsell was recorded.	
 Pit 15 Spit 2			 Pit 15 Spit 2 Western wall profile	
16	1	0-10	Light brown grey loamy sand. Grass root/insect and small amount of gravel inclusions. No PH or Munsell was recorded.	
	2	10-20	Light brown loamy sandy clay. Increased gravel inclusions. No PH or Munsell was recorded.	
	3	20-30	Orange-brown/cream compacted clay. Large amounts of gravel. No PH or Munsell was recorded.	

<table>
<tr><th>Pit no</th><th>Spit number</th><th>Depth (cm)</th><th>Soil Description</th><th>Artefacts</th></tr>
<tr><td colspan="3">

Pit 16 Spit 3</td><td colspan="2">

Pit 16 Spit 3 Northern wall profile</td></tr>
</table>

APPENDIX D SITE CARDS

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0273

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF7

Easting: 369808

Northing: 6637805

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

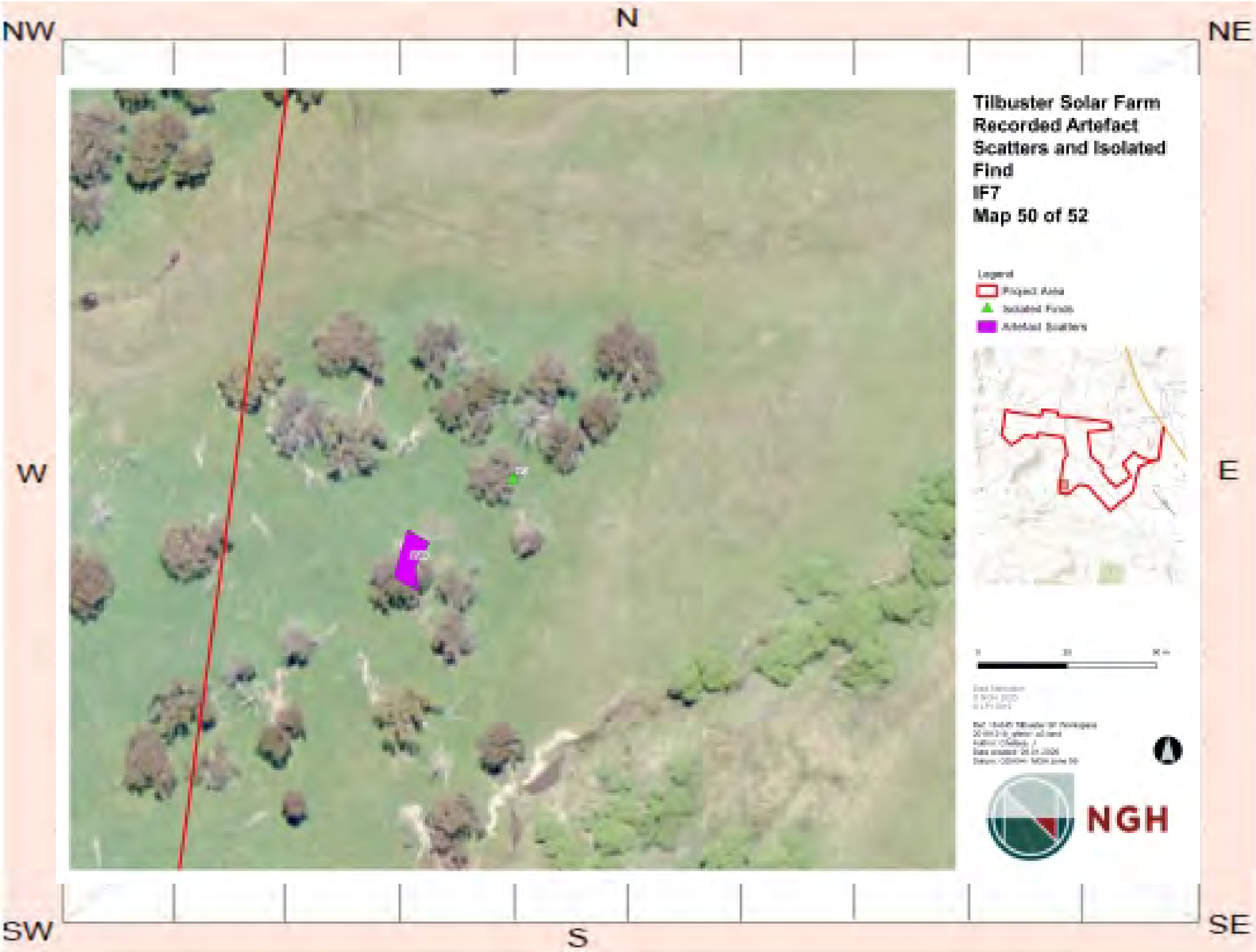
Distance to Water (m): 1570

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a small cluster of trees. The artefact was a silcrete flake located between two unnamed tributaries of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

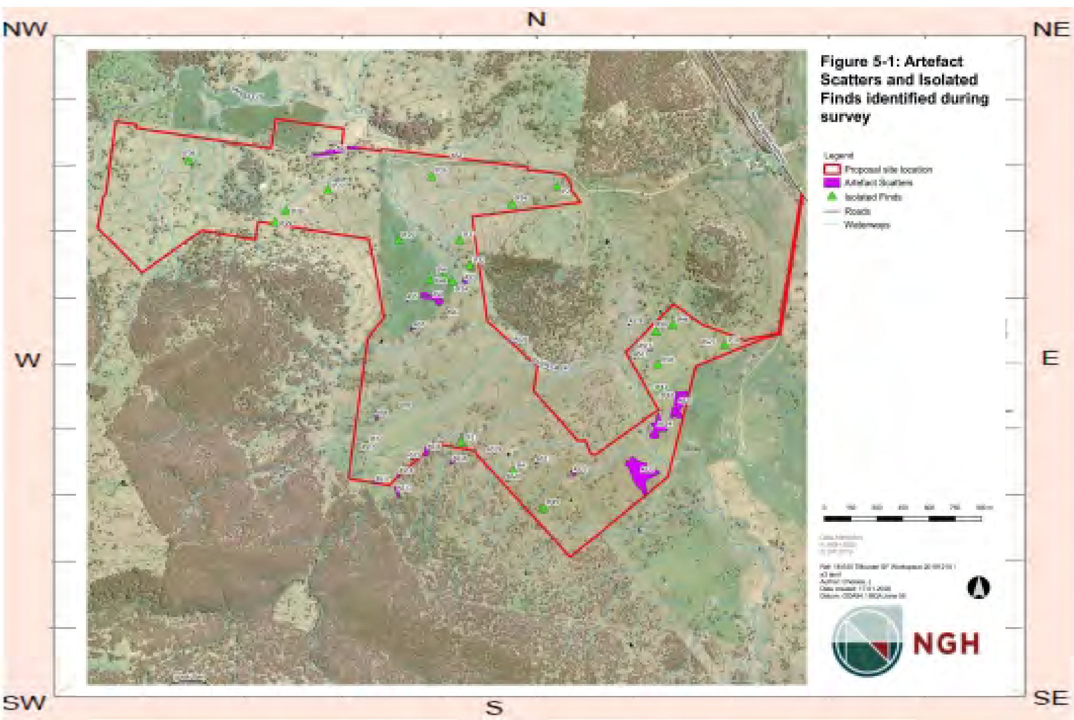
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF7.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF7.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone:

E-mail:

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0274

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF8

Easting: 369936

Northing: 6638110

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

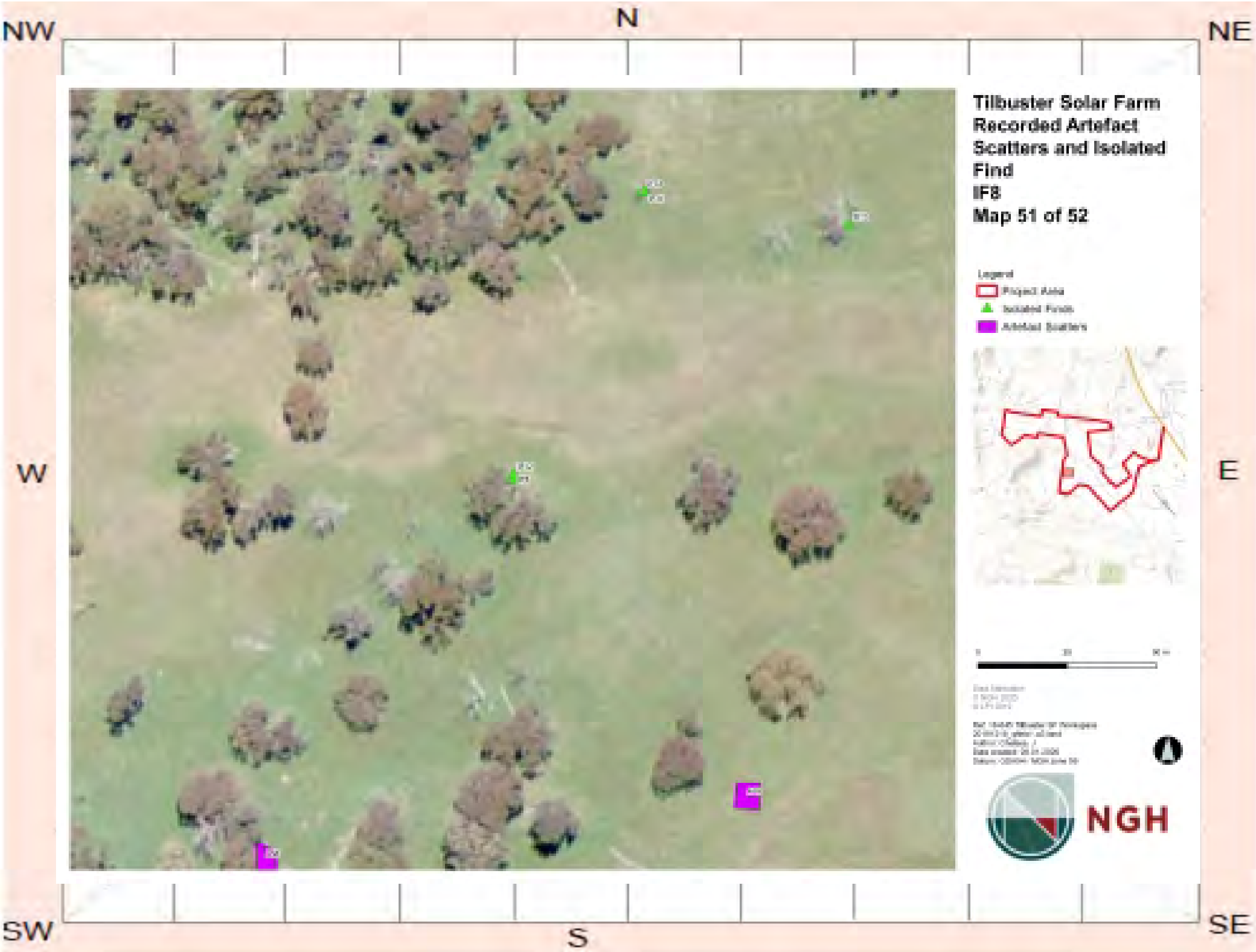
Distance to Water (m): 17

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NW of house.

Other site information: The soils consisted of a shallow yellow-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a small cluster of trees. The artefact was a basalt distal fragment located approximately 17 metres south of an unnamed tributary of Duval Creek and 155 metres north of a third order tributary.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

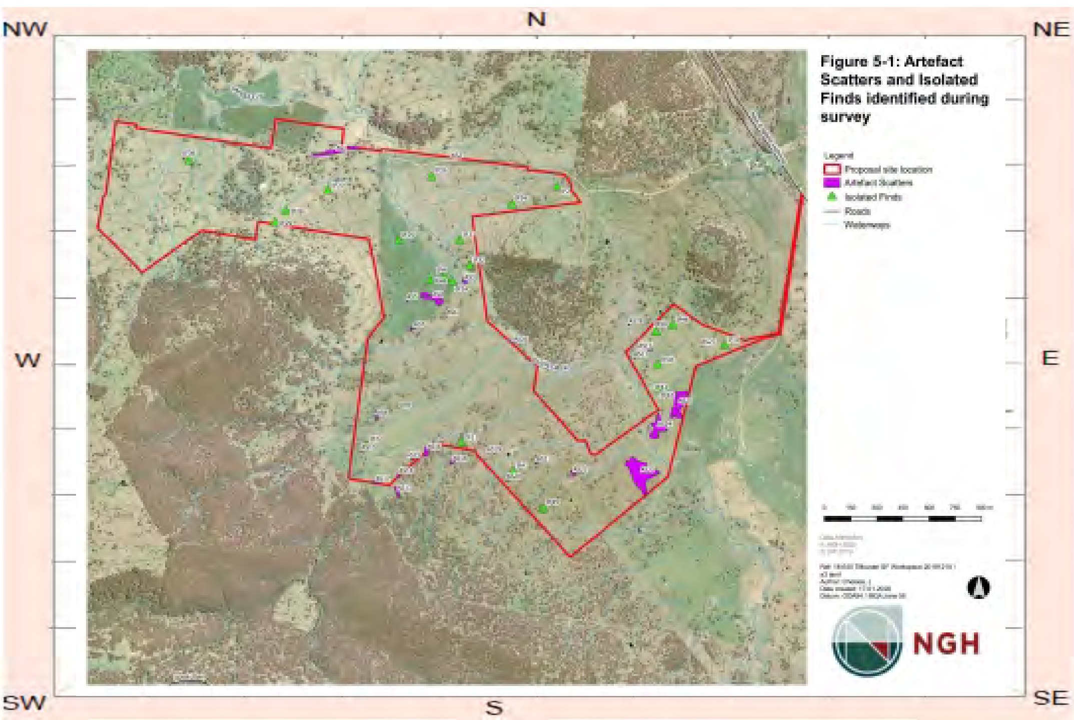
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow yellow-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of basalt distal fragment, Tilbuster Solar Farm IF8.

Description: Close up of basalt fragment, Tilbuster Solar Farm IF8.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0275

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF9

Easting: 369788 **Northing:** 6637649 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

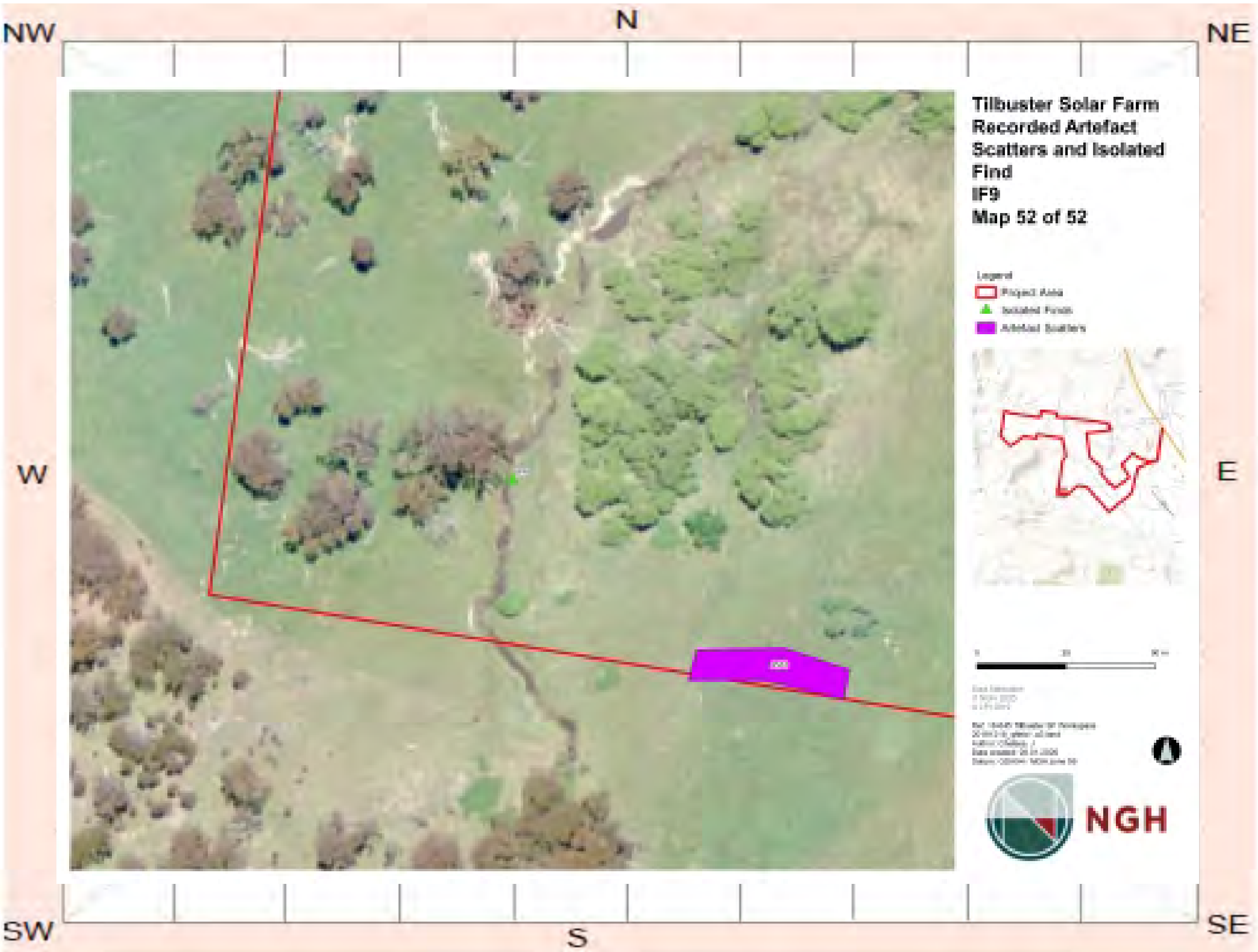
Distance to Water (m): 1650

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.2km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	1	1				

Description:

This site consisted of a single silcrete flake located at the confluence of a first order and third order tributary of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

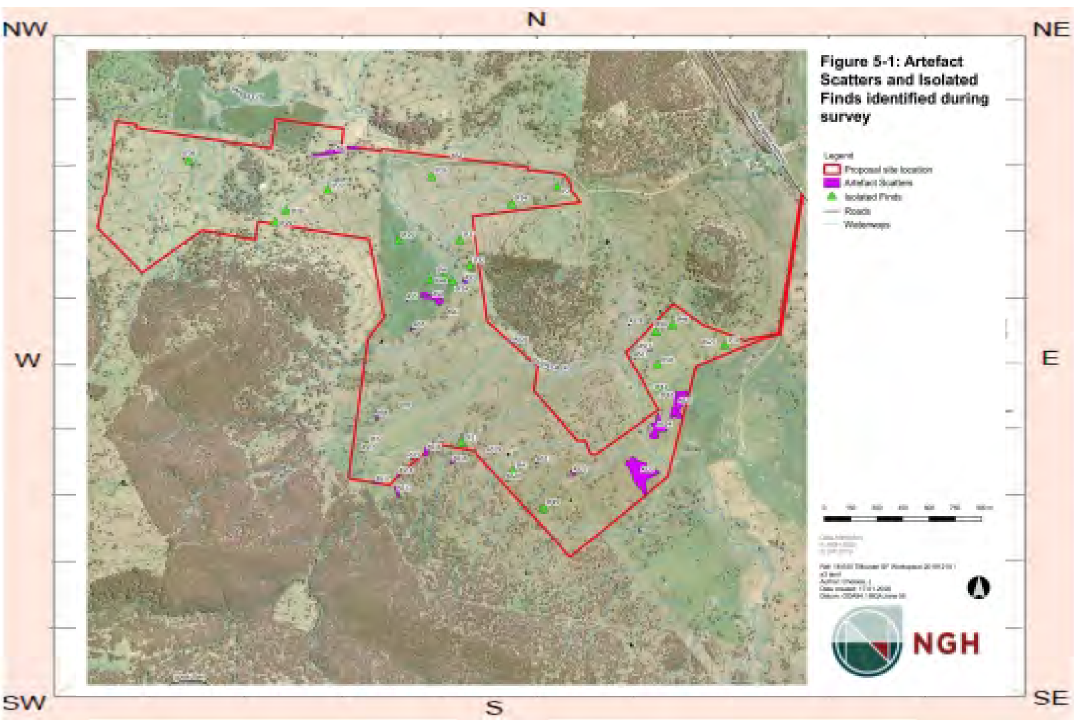
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF9.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF9.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0276

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF10

Easting: 371860

Northing: 6638377

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

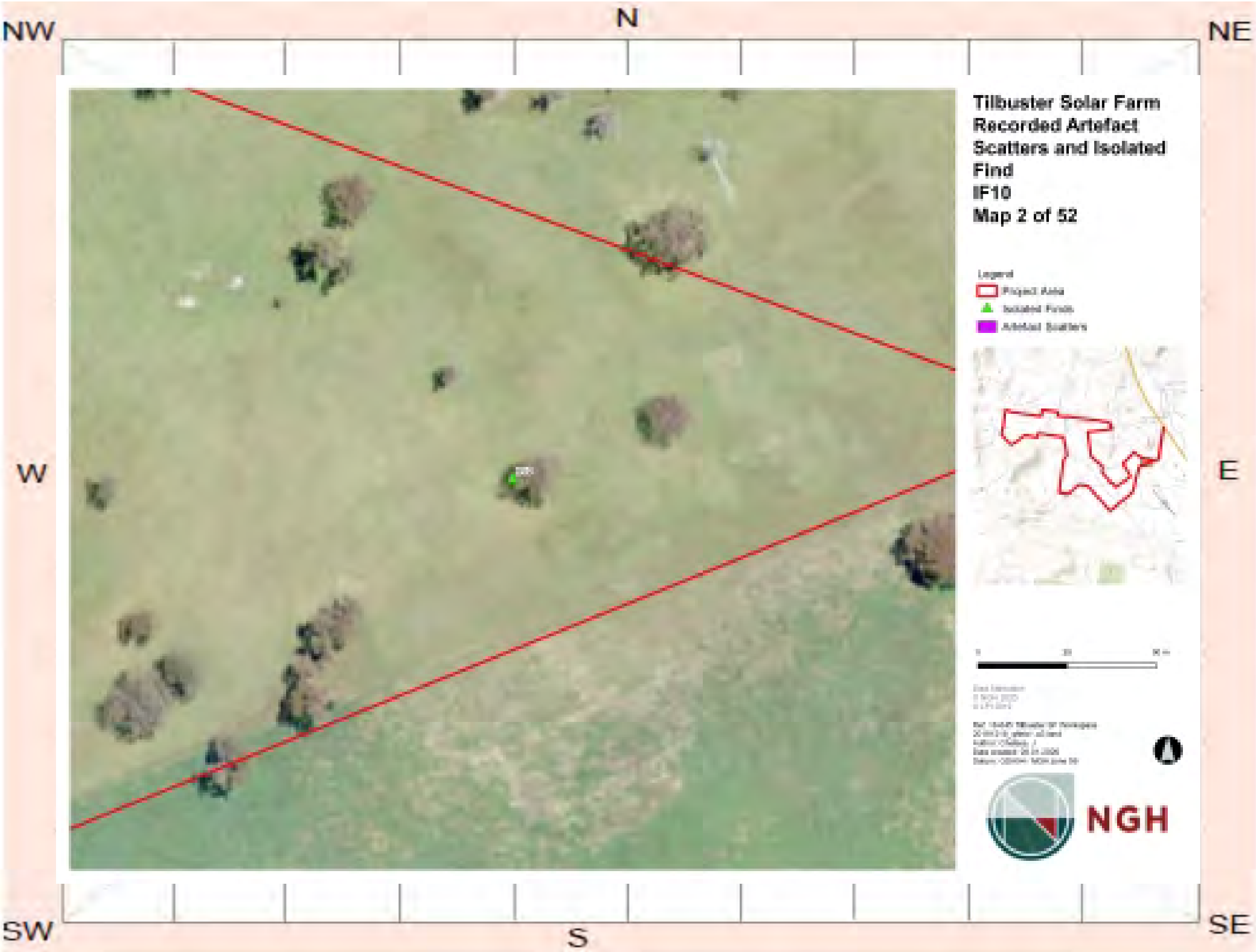
Distance to Water (m): 225

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 640m N of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on within a predominantly cleared paddock. The artefact was a basalt broken flake located approximately 225 metres east of an unnamed first order drainage line associated with Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

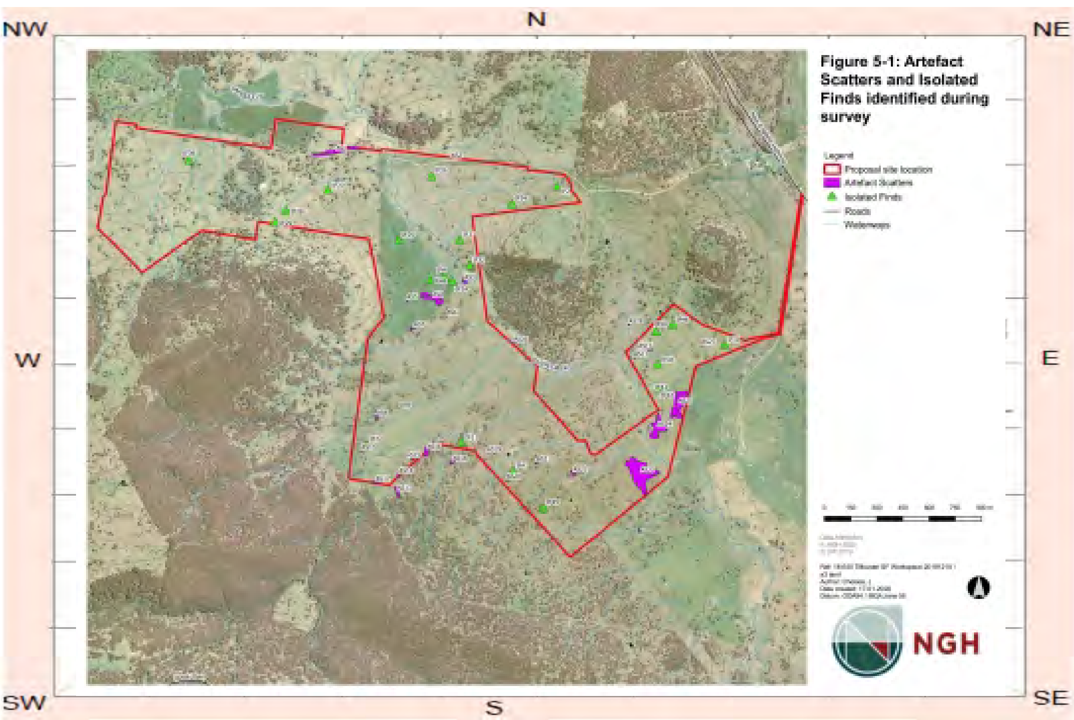
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of basalt broken flake, Tilbuster Solar Farm IF10.

Description: General location of basalt broken flake Tilbuster Solar Farm IF10.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender | General | Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone:

E-mail:

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0277 **Date recorded:** 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF11

Easting: 370352 **Northing:** 6637822 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain **Land Use:** Pastoral/Grazing

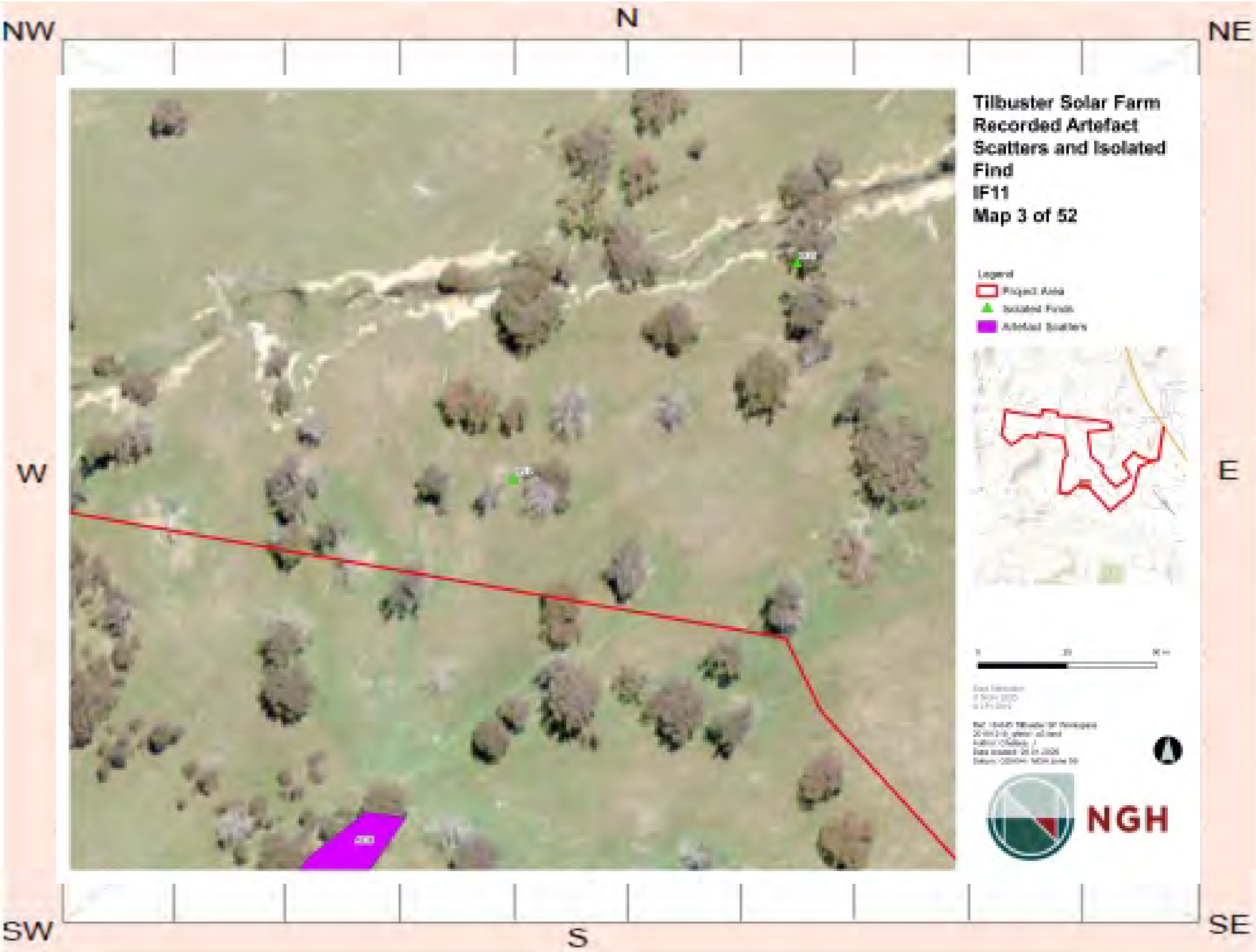
Land Form Unit: Slope **Vegetation:** Isolated clumps of trees

Distance to Water (m): 54 **Primary Report:** Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.6 W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a cluster of trees south of a third order unnamed tributary of Duval Creek. The artefact was a silcrete flake located approximately 54 metres south of the stream.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

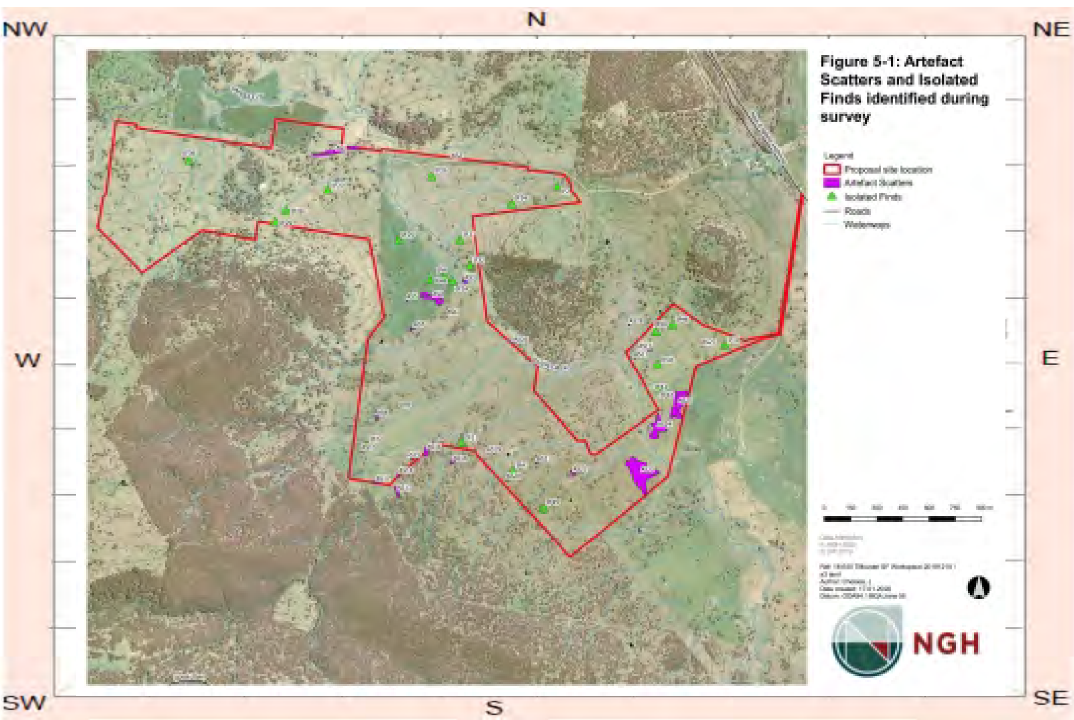
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF11.

Description: Close up of silcrete, Tilbuster Solar Farm IF11.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0278

Date recorded: 21-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF13

Easting: 370030 **Northing:** 6638181 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

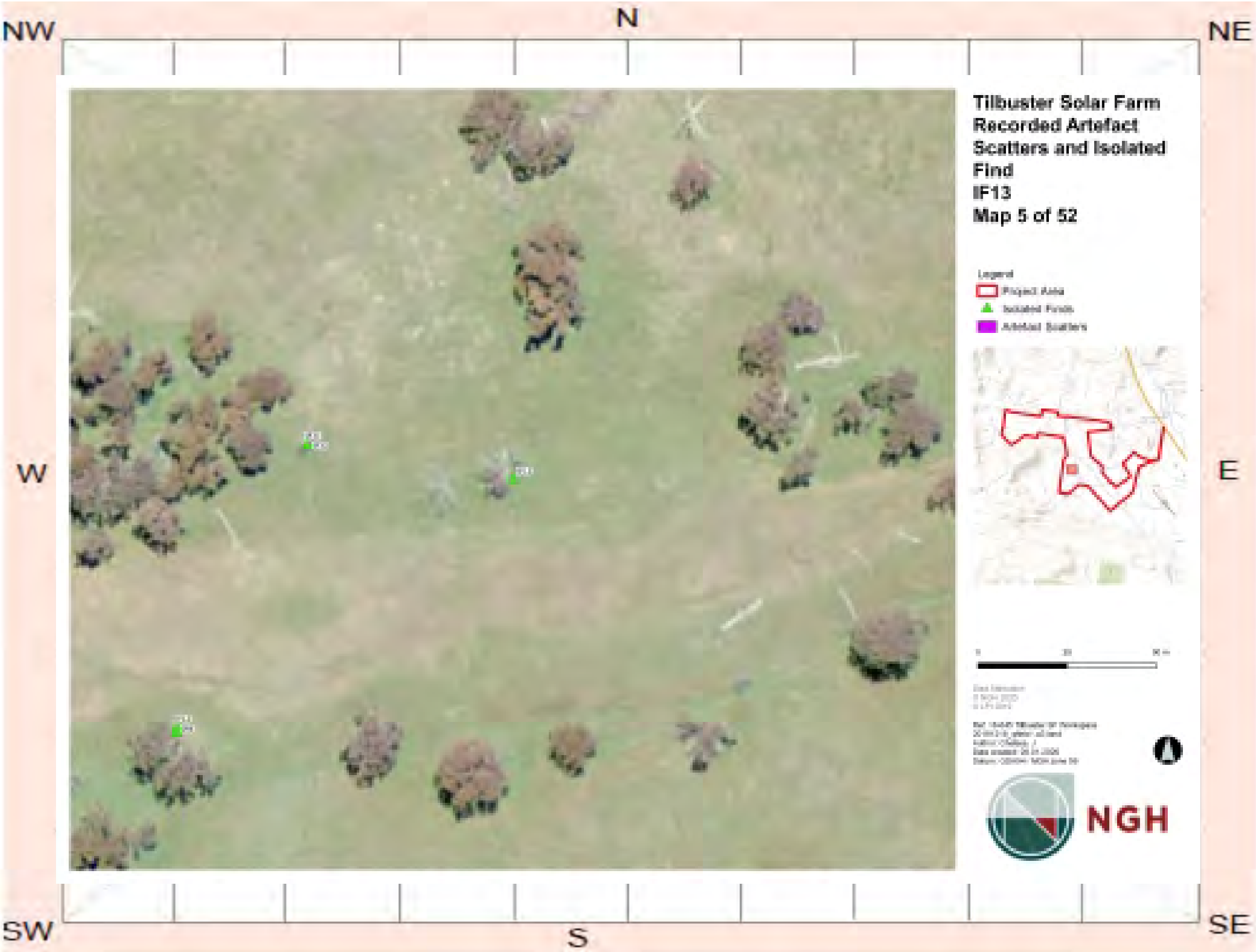
Distance to Water (m): 39

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Good

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a tree. The artefact was a volcanic distal fragment located approximately 39 metres north of an unnamed first order tributary of Duval Creek.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

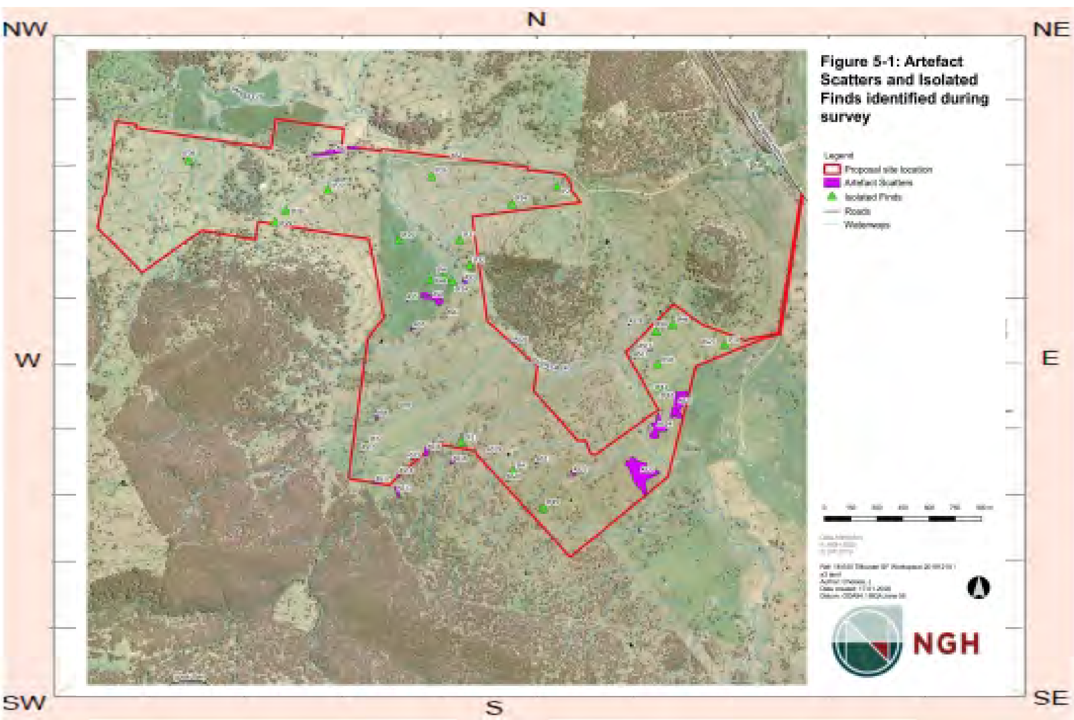
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of volcanic distal fragment, Tilbuster Solar Farm IF13.

Description: Close up of volcanic distal fragment, Tilbuster Solar Farm IF13.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0279 **Date recorded:** 21-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF3

Easting: 370127 **Northing:** 6638540 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Dune

Vegetation: Isolated clumps of trees

Distance to Water (m): 100

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam A horizon deposit with B horizon clay visible through the shallow topsoils. Visibility within the area was 70%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact broken in two, beneath the existing transmission line within a previously cropped field. The artefact was a greywacke flaked piece located approximately 98 metres north of an unnamed tributary of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

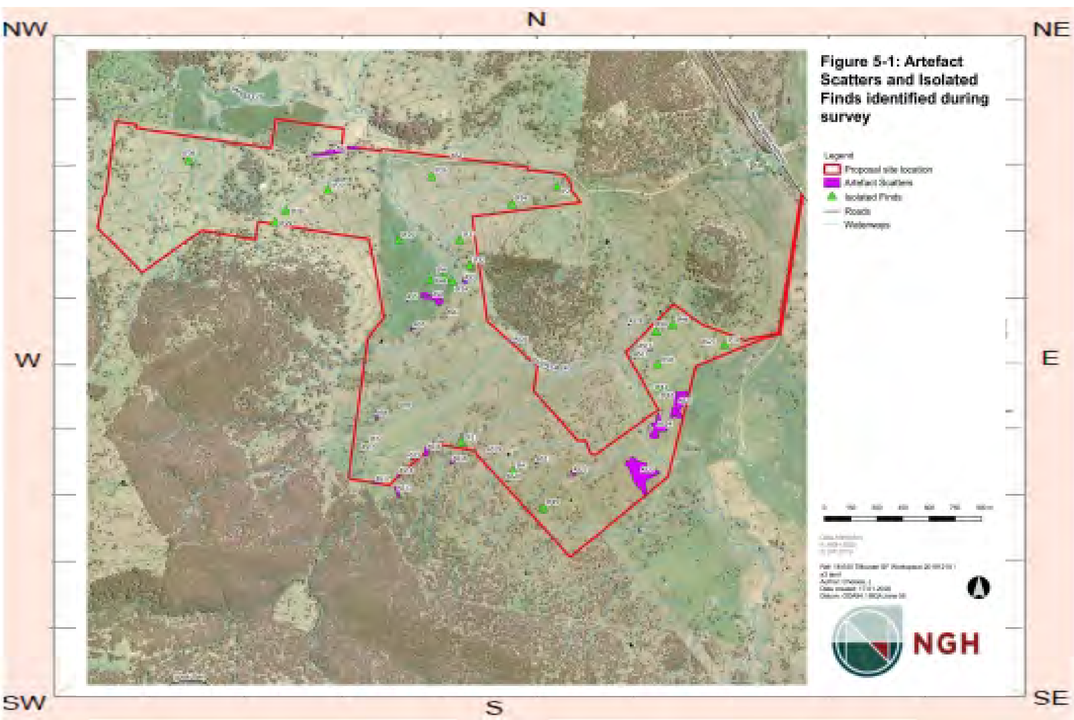
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam A horizon deposit with B horizon clay visible through the shallow topsoils. Visibility within the area was 70%.

Site plan



Site photographs

Description: Greywacke flaked piece, Tilbuster Solar Farm IF3.

Description: General location of greywacke flaked piece, Tilbuster Solar Farm IF3.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender | General | Location

Why is this site restricted?:

Further information contact

Title | **Surname** | **First name**

Organisation:

Address:

Phone: | **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0280

Date recorded: 21-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF1

Easting: 370167

Northing: 6638474

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

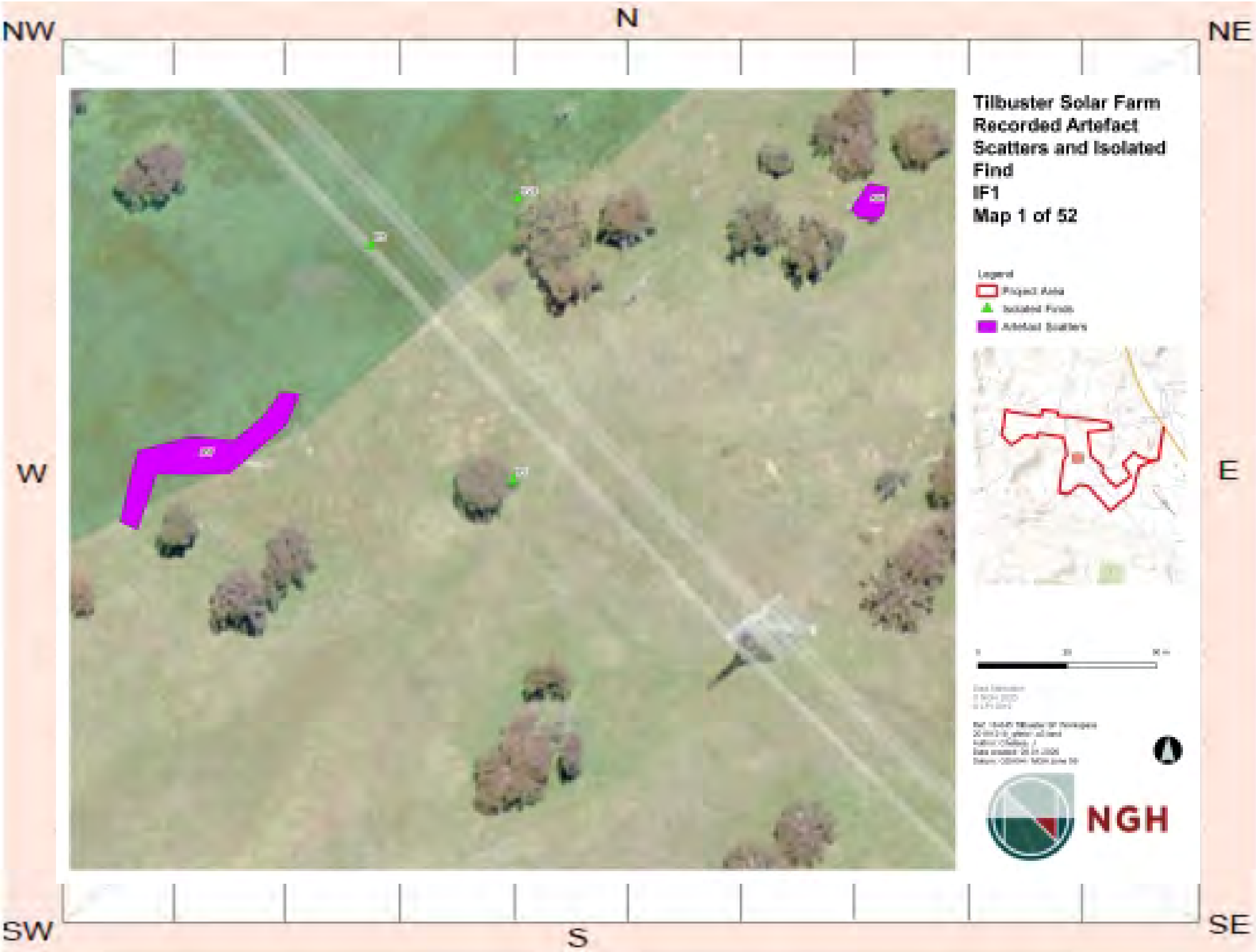
Distance to Water (m): 24

Primary Report: NGH 2020 Tilbuster Solar Farm ACHAR

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km NW of house.

Other site information: The soils consisted of a redeposited A horizon grey-brown sandy silt deposit atop visible eroded B horizon silt clay. Visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Good

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an alluvial plain in a predominantly cleared paddock. The artefact was a quartzite flake located approximately 24 metres north of an unnamed tributary of Duval Creek and immediately west of the existing transmission line.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

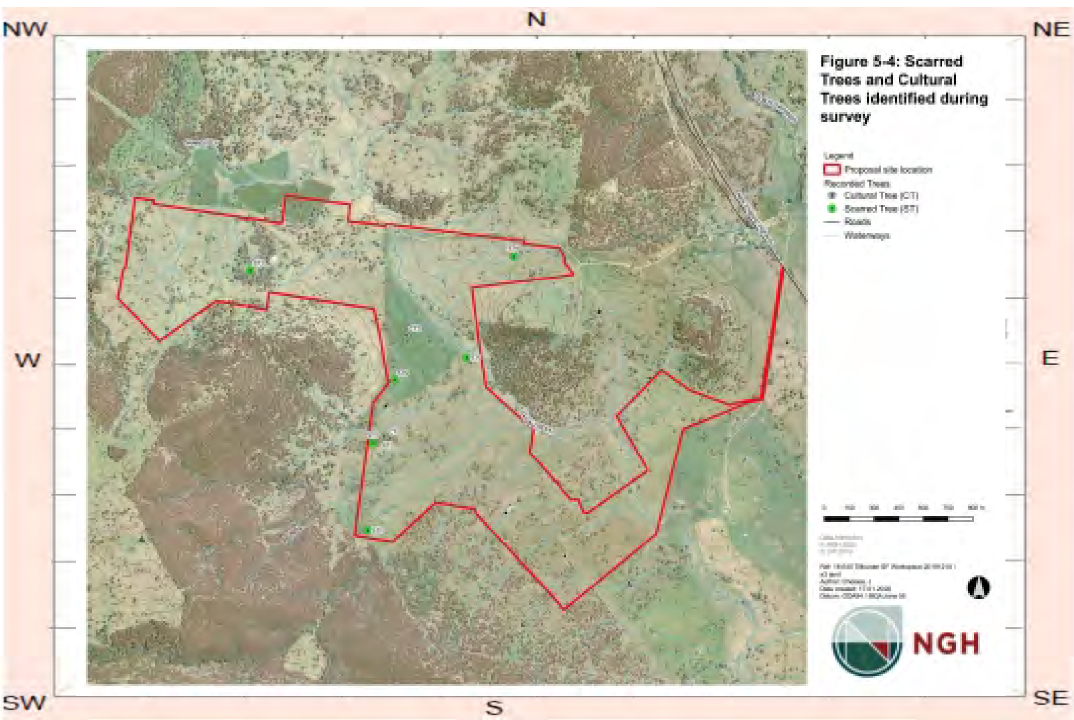
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a redeposited A horizon grey-brown sandy silt deposit atop visible eroded B horizon silt clay.
Visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of greywacke flake, part of Tilbuster Solar Farm IF1.

Description: Close up of greywacke flake, part of Tilbuster Solar Farm IF1.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0281

Date recorded: 03-05-2020

Site Location Information

Site name: Tilbuster Solar IF18

Easting: 370265

Northing: 6638144

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

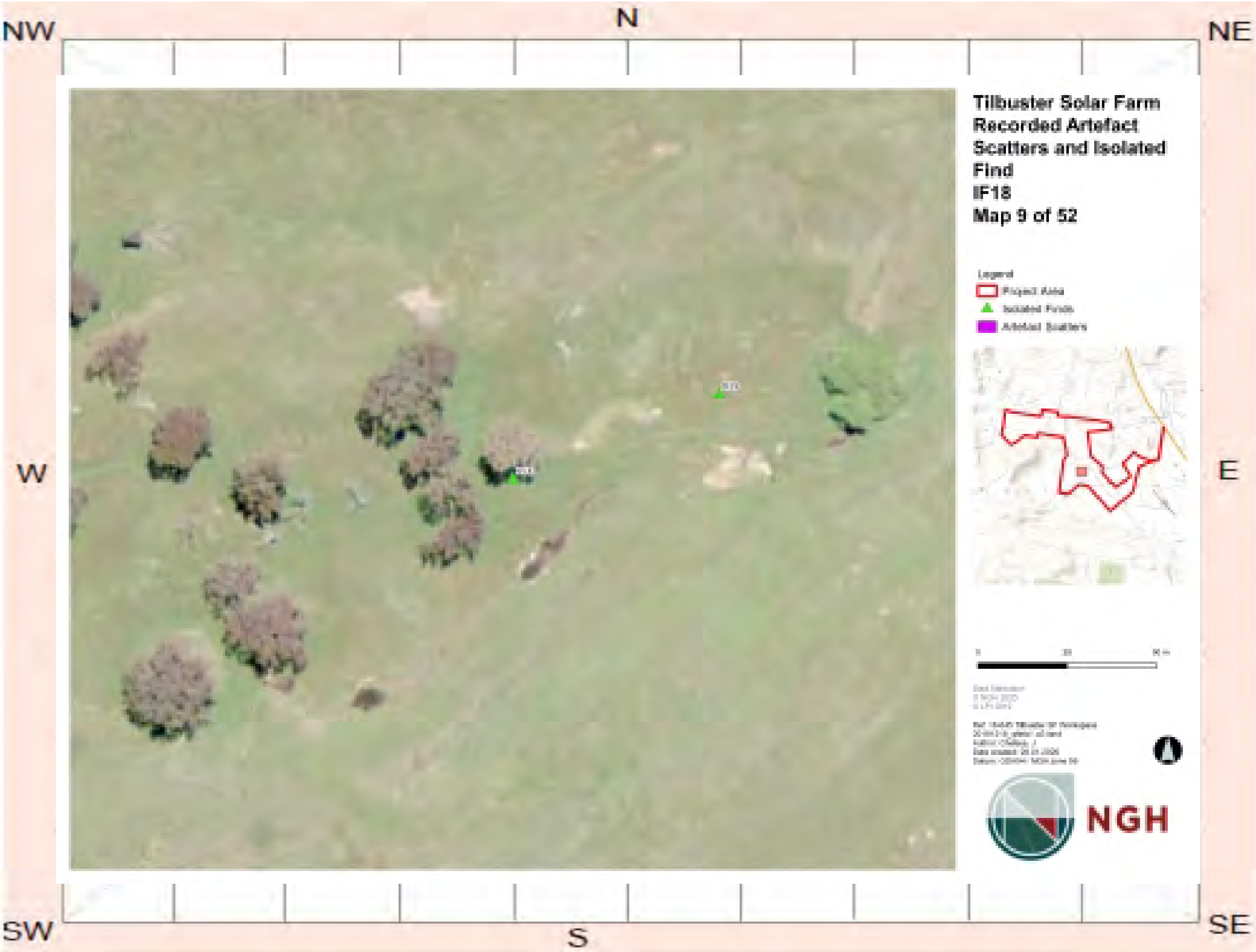
Distance to Water (m): 600

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.75km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact west of the existing transmission line. The artefact was a greywacke flake located near the confluence of a first order and third order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

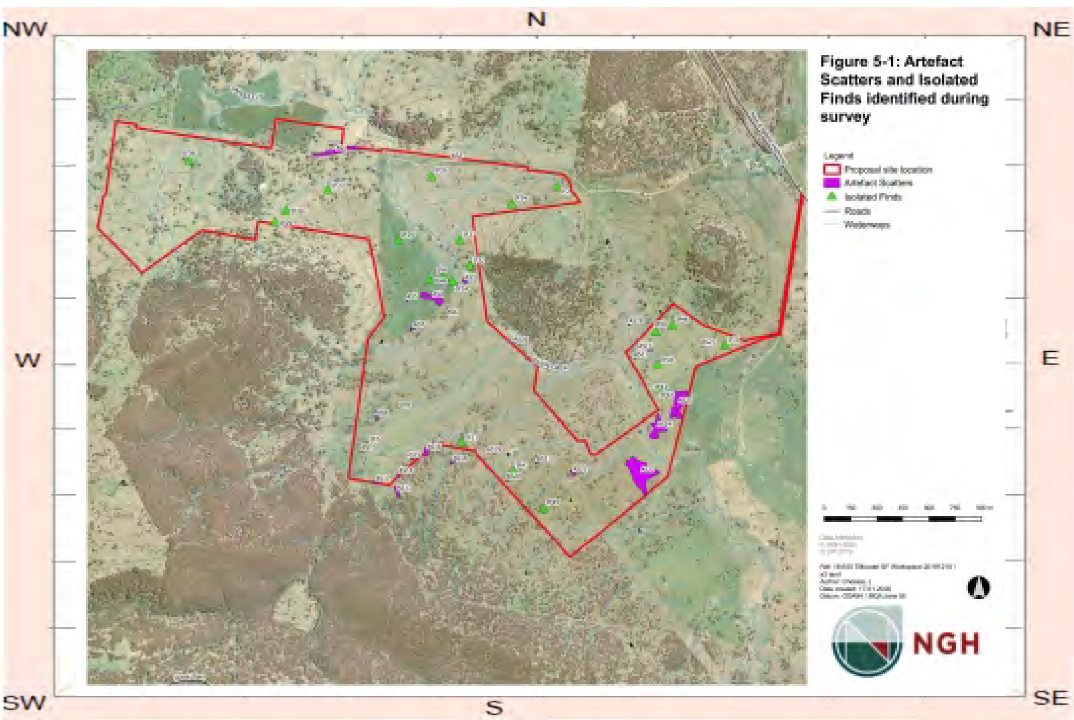
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

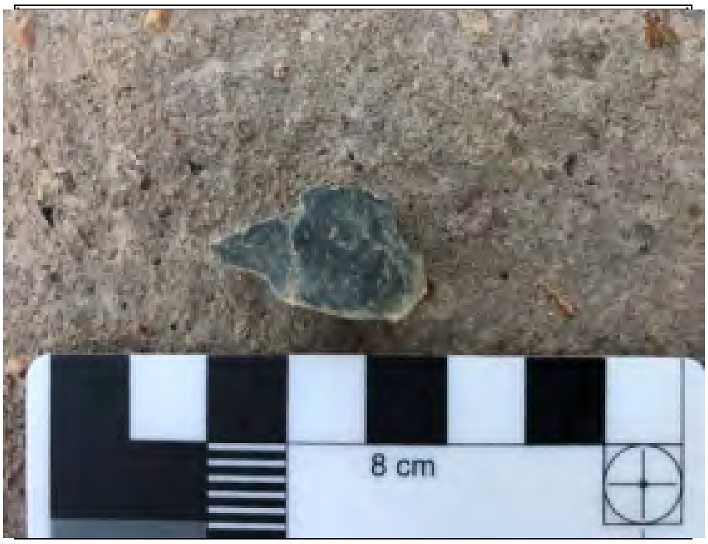
Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of greywacke flake, part of Tilbuster Solar Farm IF18.



Description: Close up of greywacke flake, part of Tilbuster Solar Farm IF18.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0282

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF19

Easting: 370323 **Northing:** 6638168 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

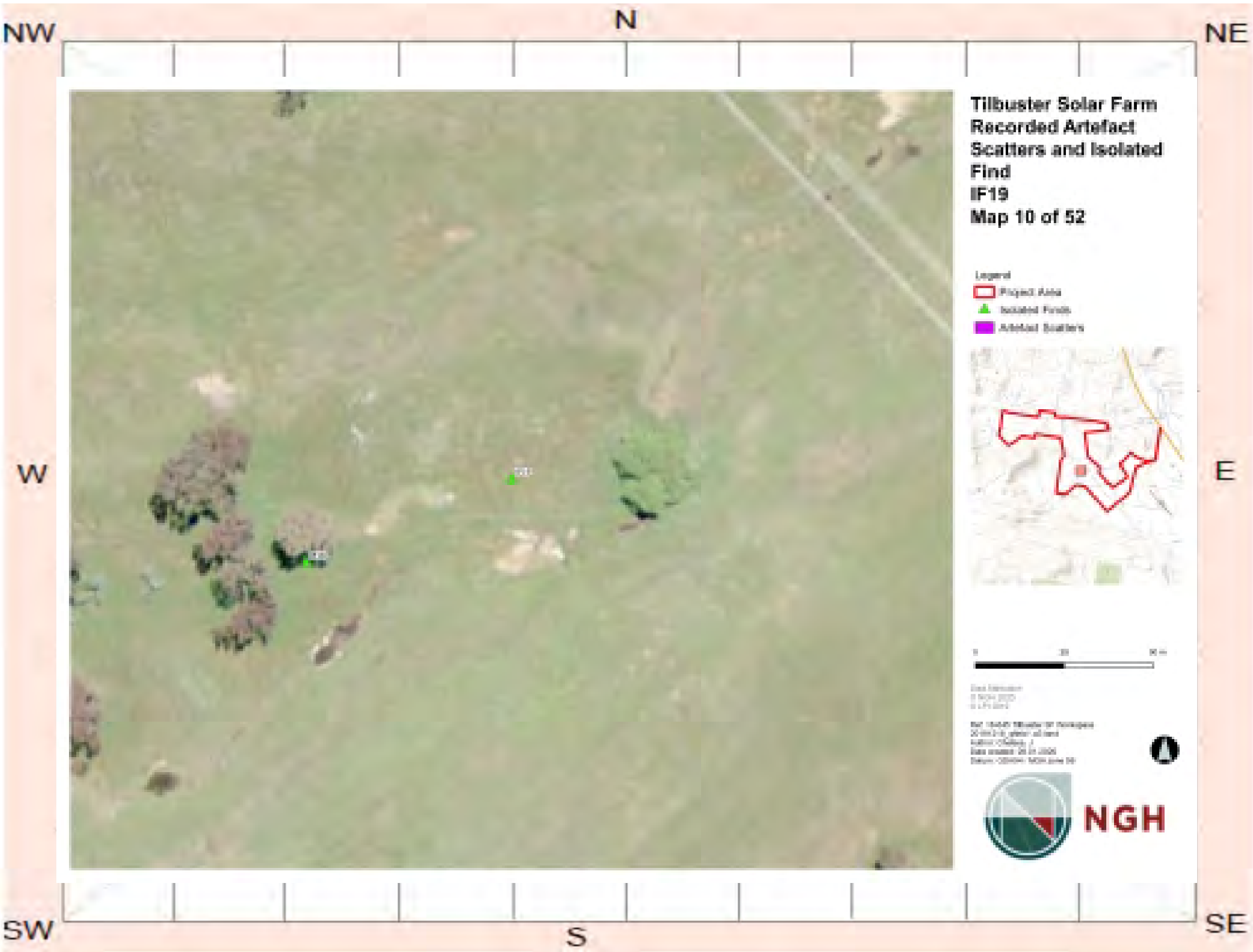
Distance to Water (m): 20

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.7km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single greywacke flake located at the confluence of a first order and third order tributary of Duval Creek, west of the transmission line.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

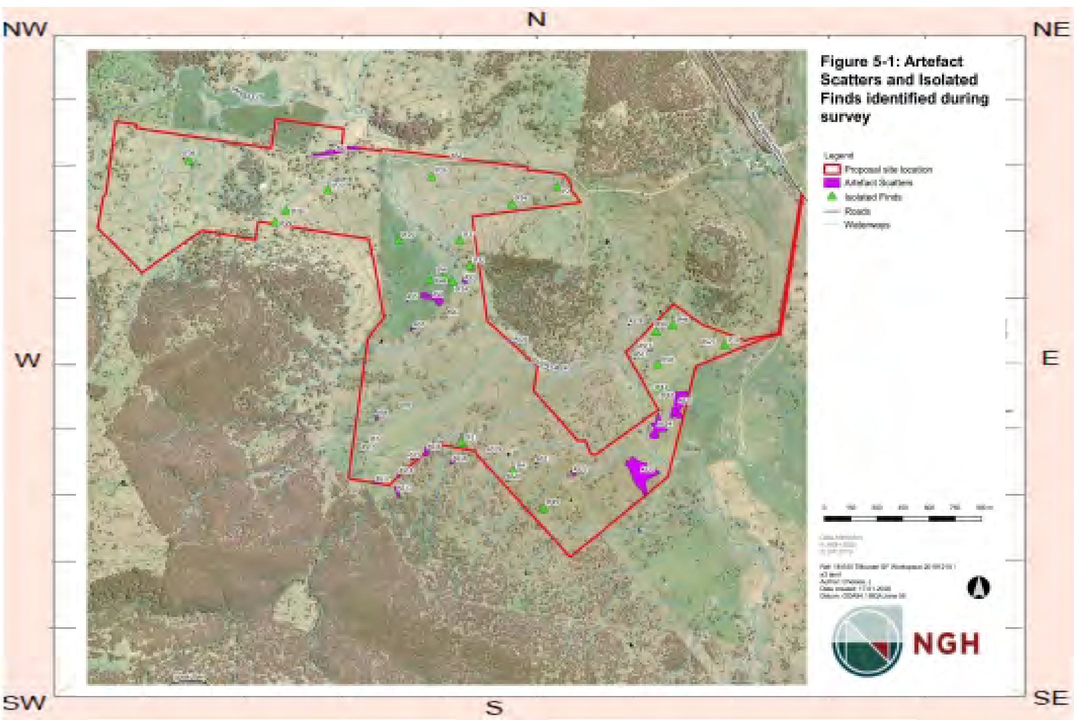
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of greywacke flake, Tilbuster Solar Farm IF19.

Description: Close up of greywacke flake, Tilbuster Solar Farm IF19.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0283

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF21

Easting: 370264 **Northing:** 6637652 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 30

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.7km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a large cluster of trees. The artefact was a quartz flake located approximately 30 metres east of an unnamed drainage line.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

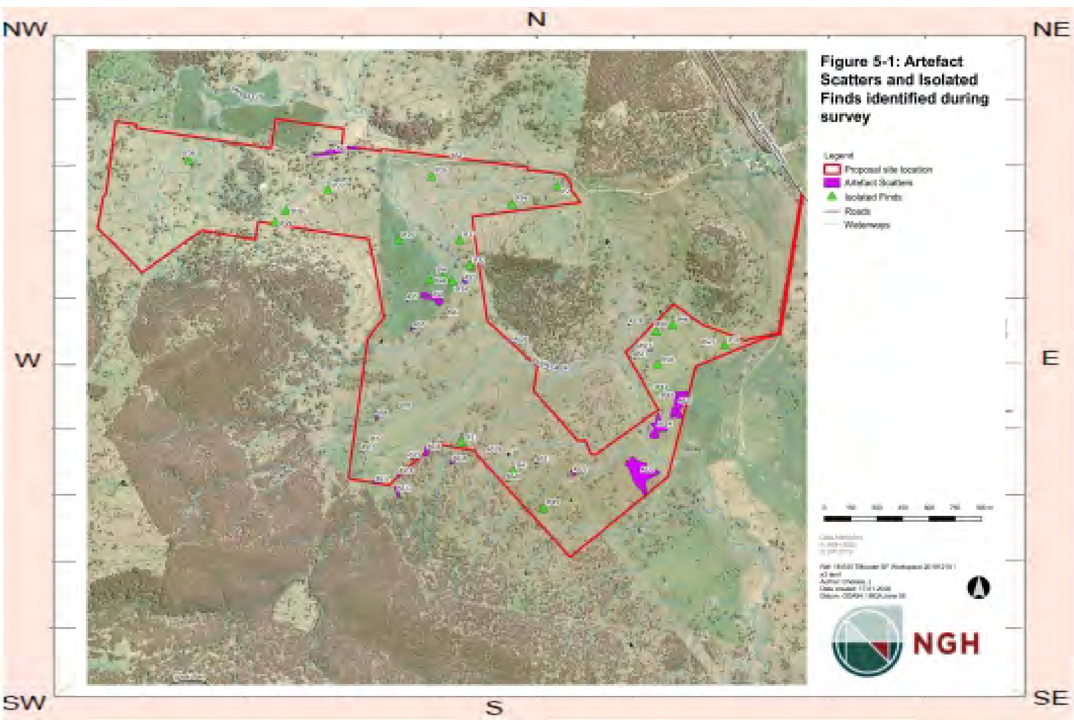
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of quartz flake, part of Tilbuster Solar Farm IF21.

Description: Close up of quartz flake, part of Tilbuster Solar Farm IF21.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

NSW Government — Office of Environment & Heritage

AHIMS site ID: 21-1-0284

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF22

Easting: 369919

Northing: 6637541

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

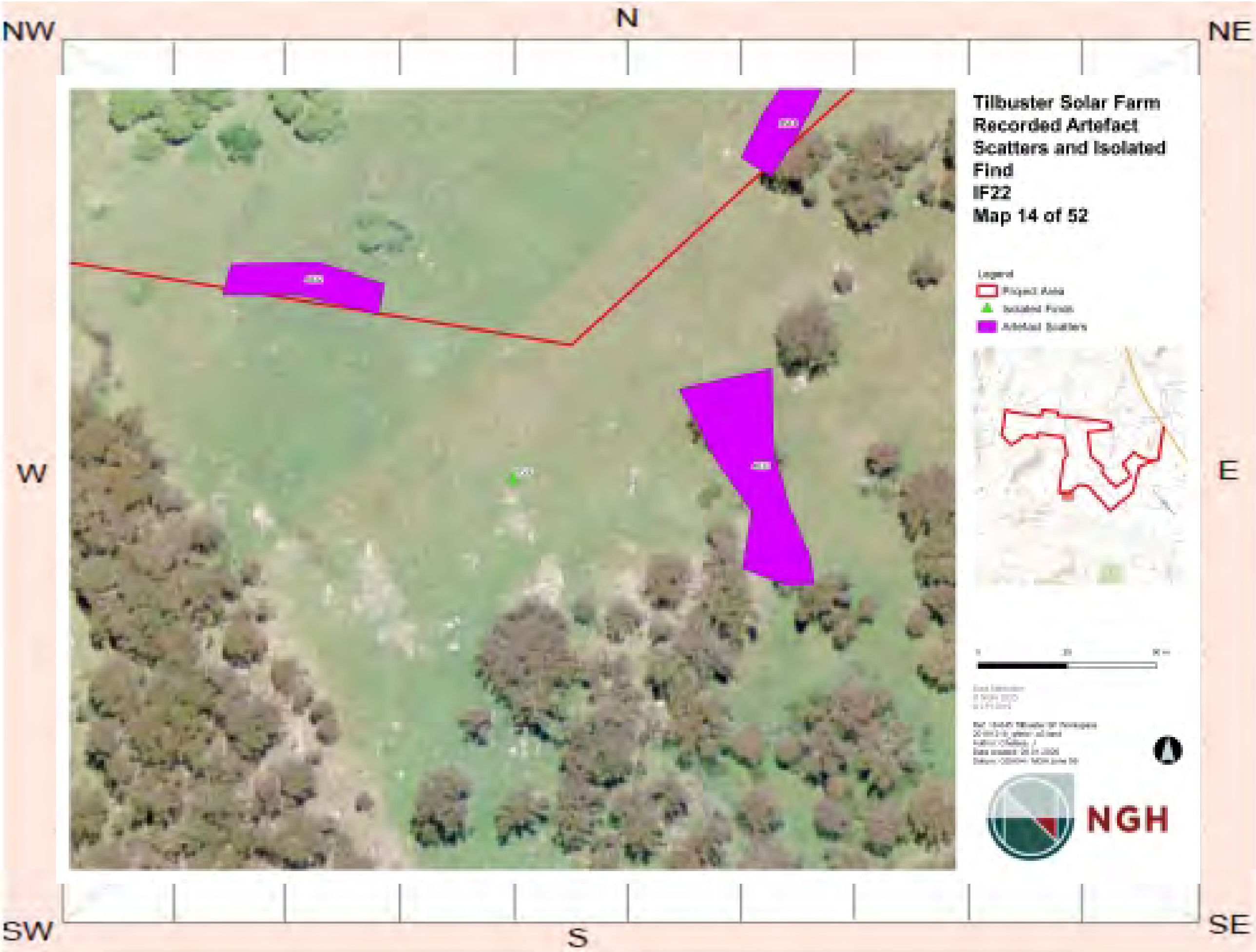
Distance to Water (m): 108

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along the lower slope of a hill. The artefact was a silcrete distal fragment located approximately 108 metres east of an unnamed third order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

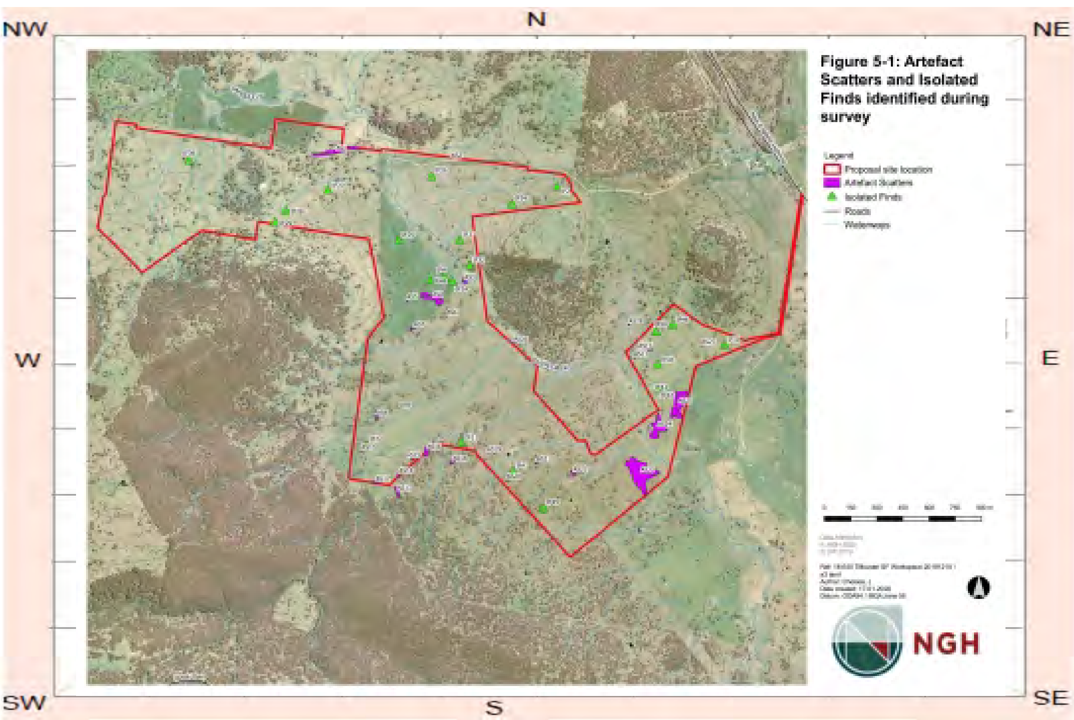
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete distal fragment, Tilbuster Solar Farm IF22.

Description: Close up of silcrete distal fragment, Tilbuster Solar Farm IF22.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0285

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF23

Easting: 370168 **Northing:** 6638553 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

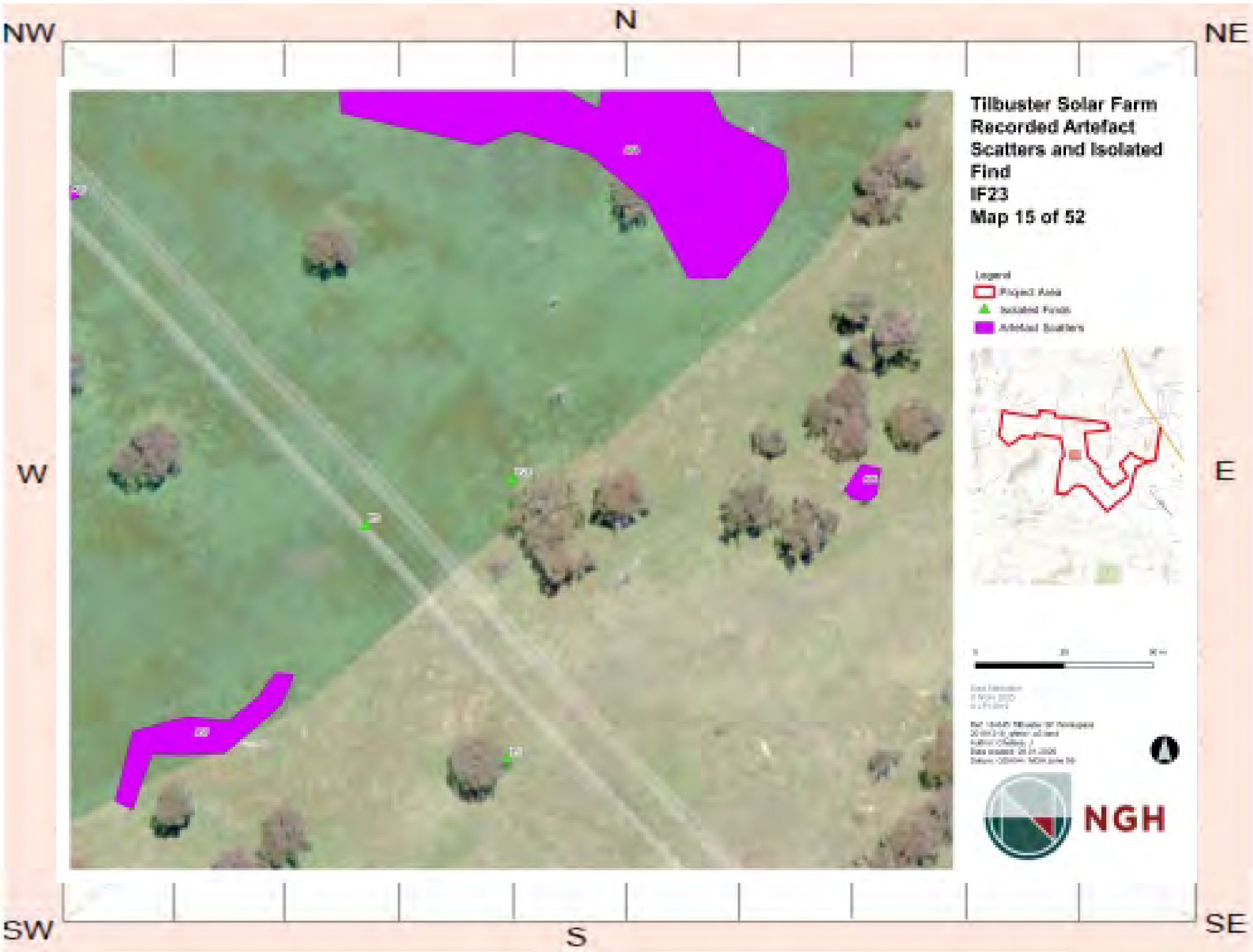
Distance to Water (m): 96

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact 30 metres east of the existing transmission line within a previously cropped field. The artefact was a chert proximal fragment located approximately 96 metres north west of an unnamed second order tributary of Duval Creek.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

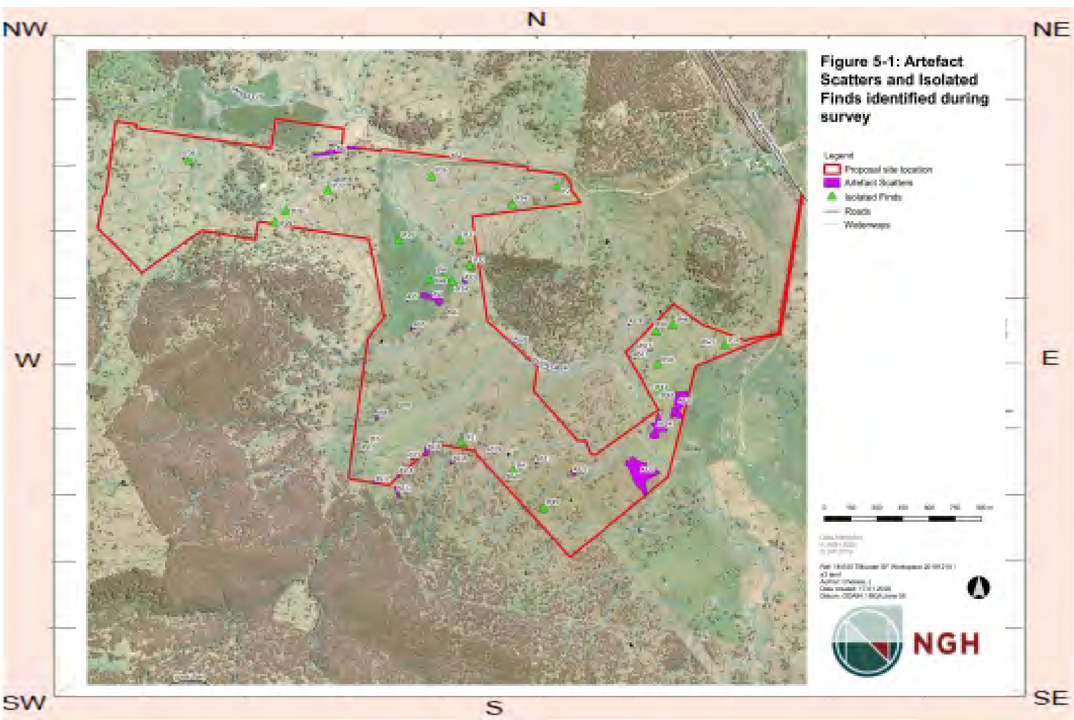
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

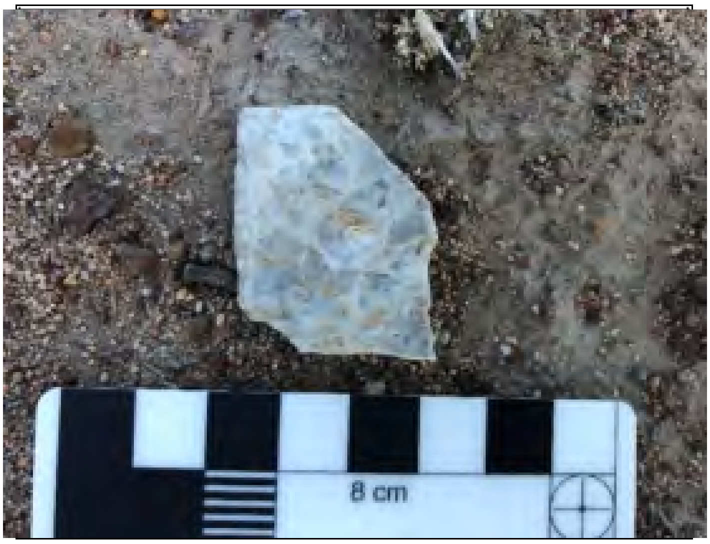
Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of chert proximal fragment, Tilbuster Solar Farm IF23.



Description: Close up of chert proximal fragment, Tilbuster Solar Farm IF23.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0286

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF24

Easting: 370299

Northing: 6638743

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

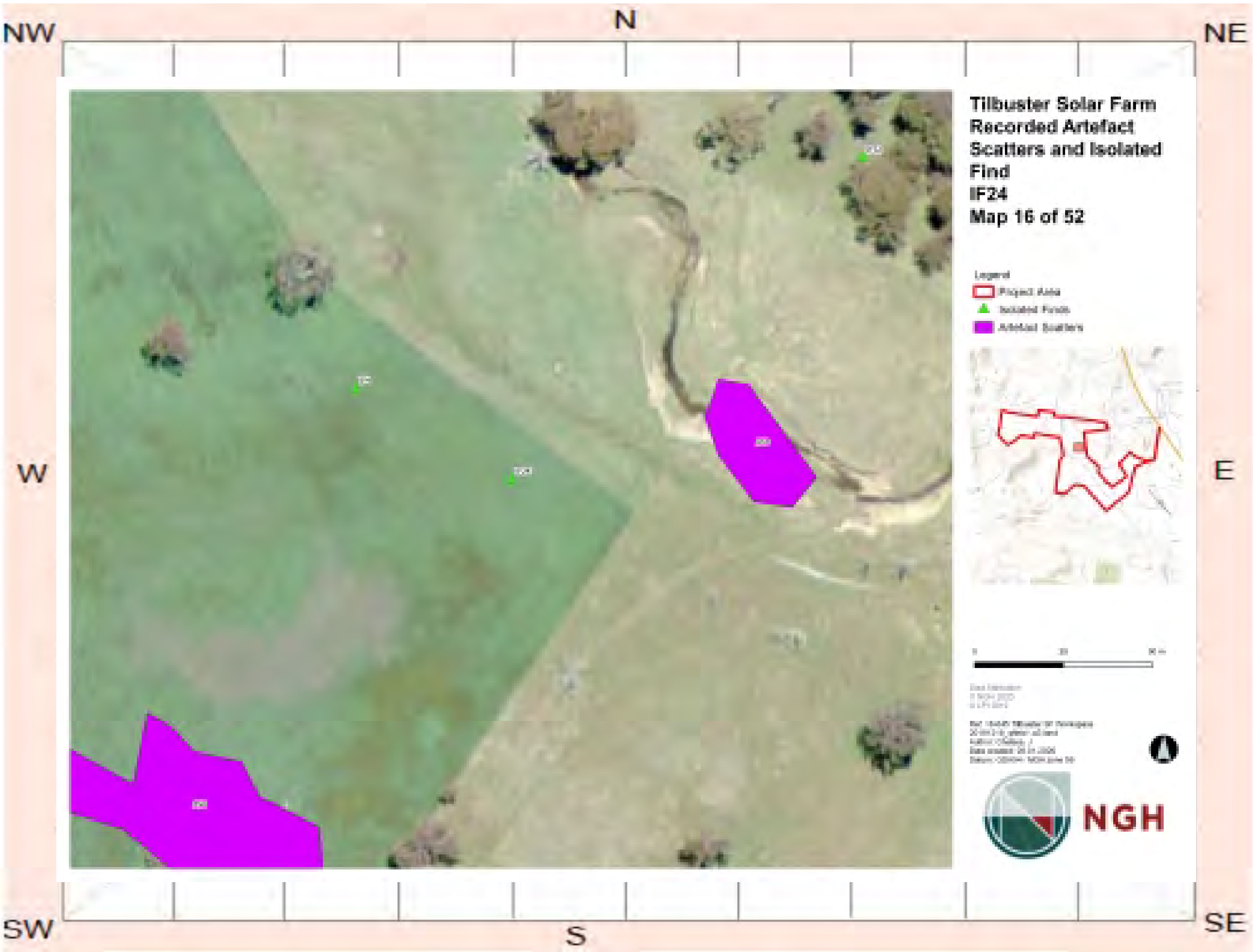
Distance to Water (m): 60

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km NNW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a previously cropped paddock. The artefact was a silcrete flake located approximately 30 metres south west of an unnamed drainage line and approximately 60 metres from Duval Creek itself.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

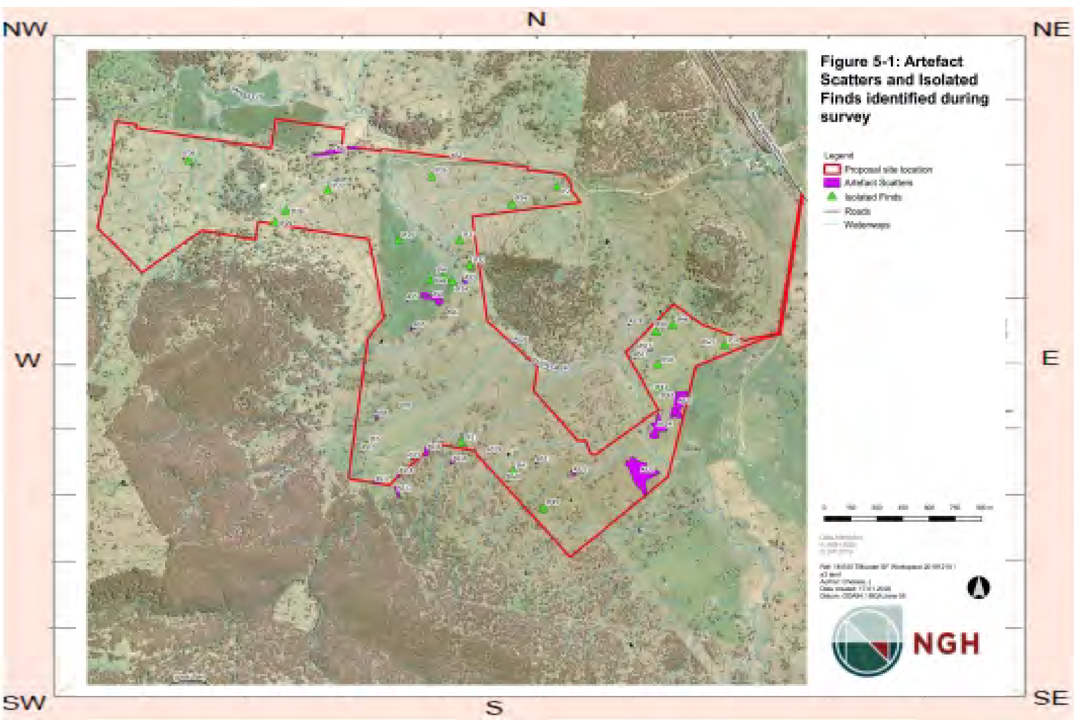
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of tertiary silcrete flake, Tilbuster Solar Farm IF24.

Description: Close up of tertiary silcrete flake, Tilbuster Solar Farm IF24.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0287

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF25

Easting: 369993 **Northing:** 6638978 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

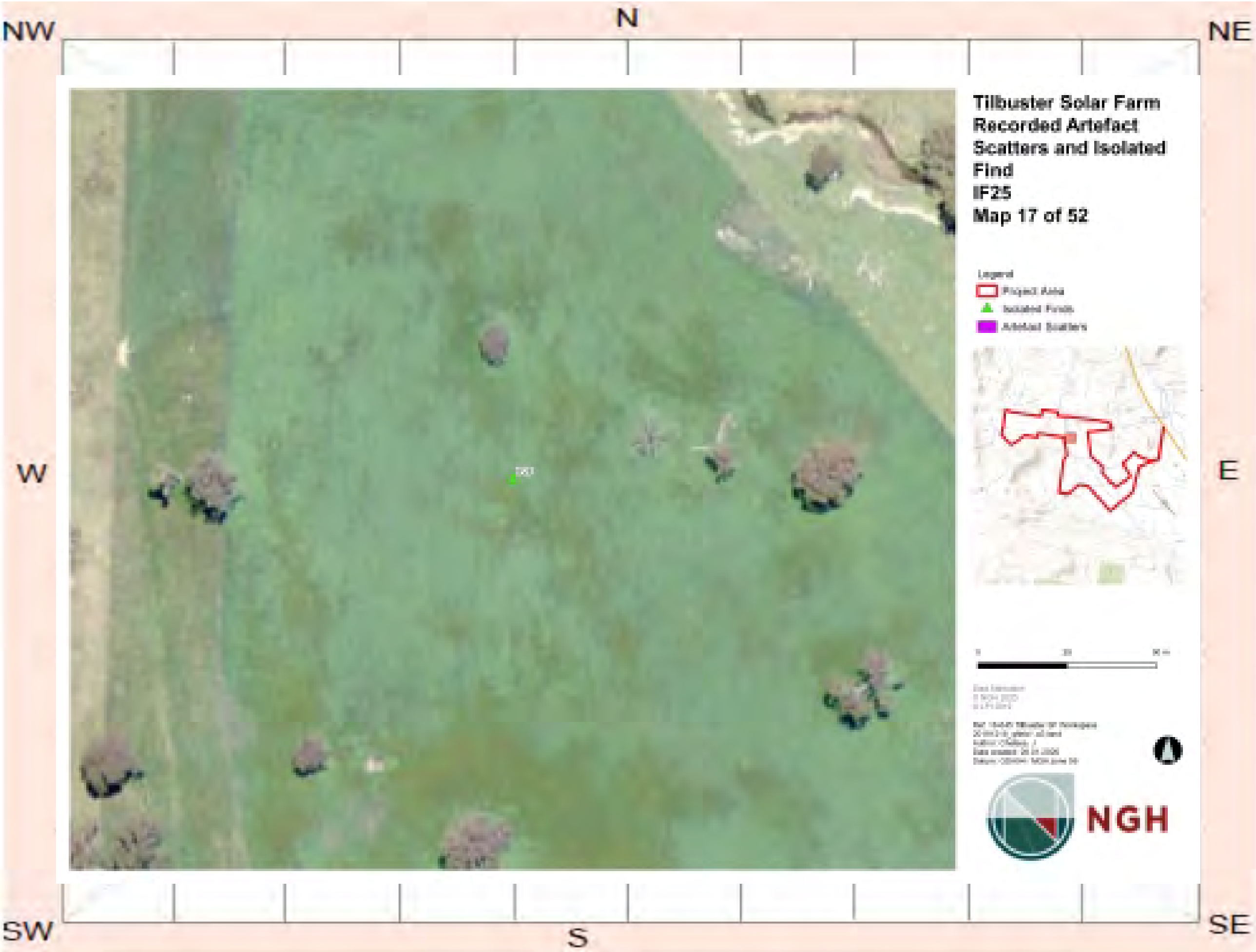
Distance to Water (m): 158

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.3km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 90%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a previously cropped paddock. The artefact was a chert split located approximately 158 metres west of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

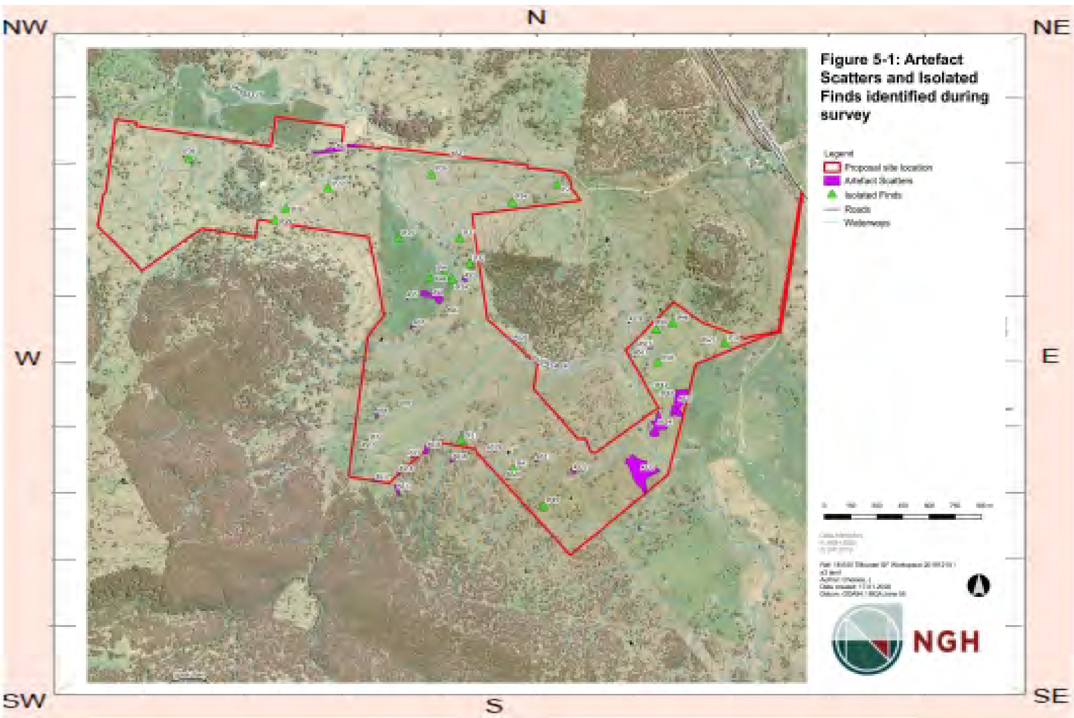
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 90%.

Site plan



Site photographs

Description: Close up of chert split flake, Tilbuster Solar Farm IF25.

Description: Location of Tilbuster Solar Farm IF25.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0288

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF26

Easting: 370181

Northing: 6639347

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

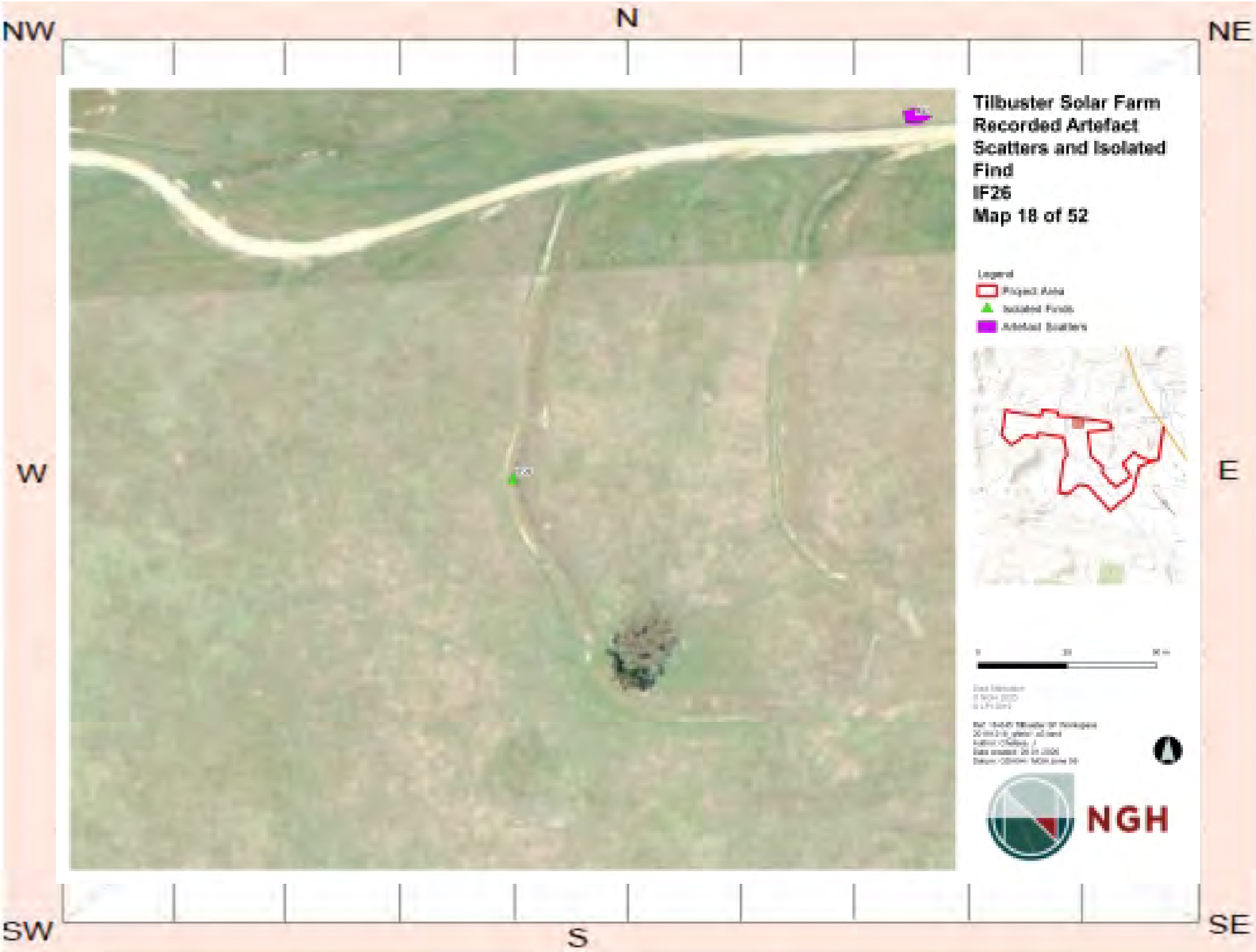
Distance to Water (m): 56

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.4km NNW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact 80 metres south of a vehicle track with a predominantly cleared paddock. The artefact was a silcrete distal fragment located approximately 102 metres south east of an unnamed first order tributary of Duval Creek, and less than 200 metres east of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

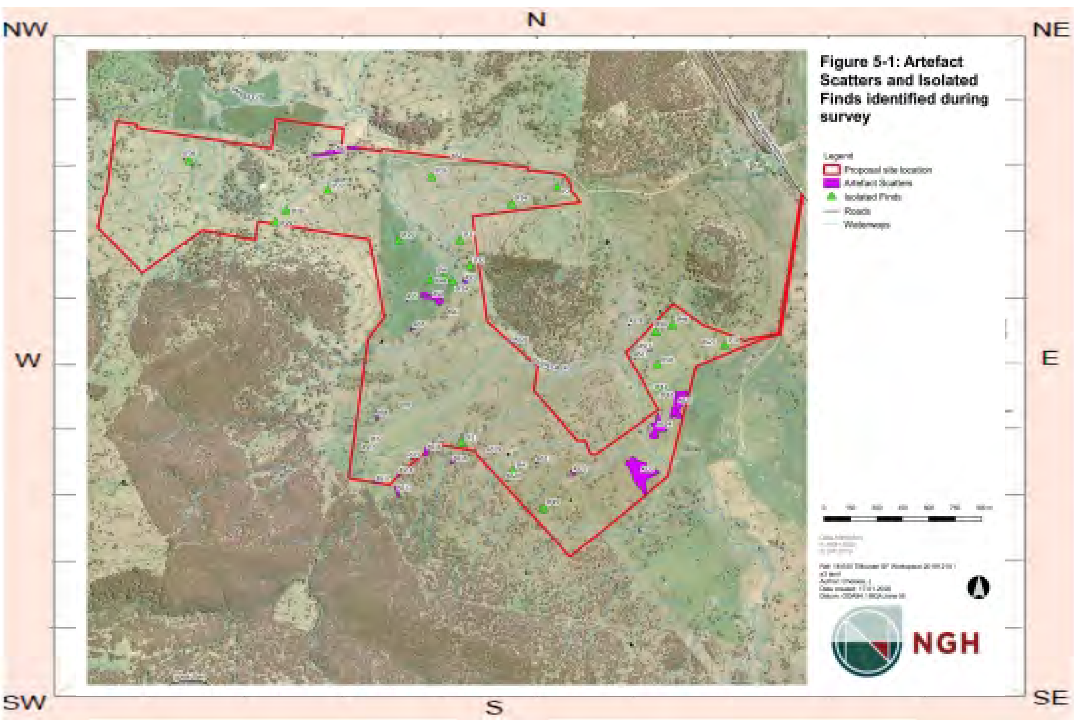
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete distal fragment Tilbuster Solar Farm IF26.

Description: Location of Tilbuster Solar Farm IF26.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0289

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF27

Easting: 369585 **Northing:** 6639267 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

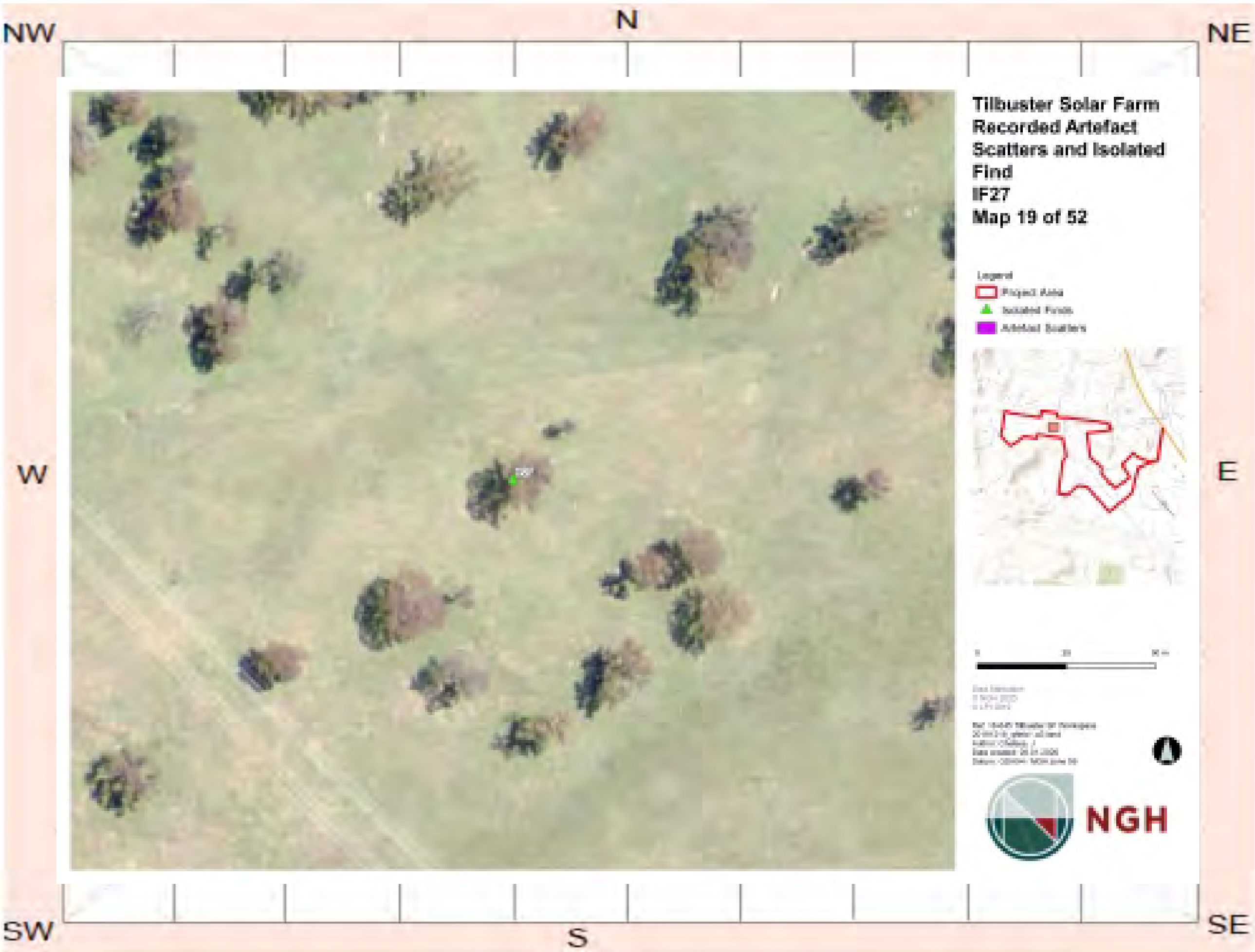
Distance to Water (m): 56

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.8km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a small cluster of trees. The artefact was a cream silcrete core of a highly

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

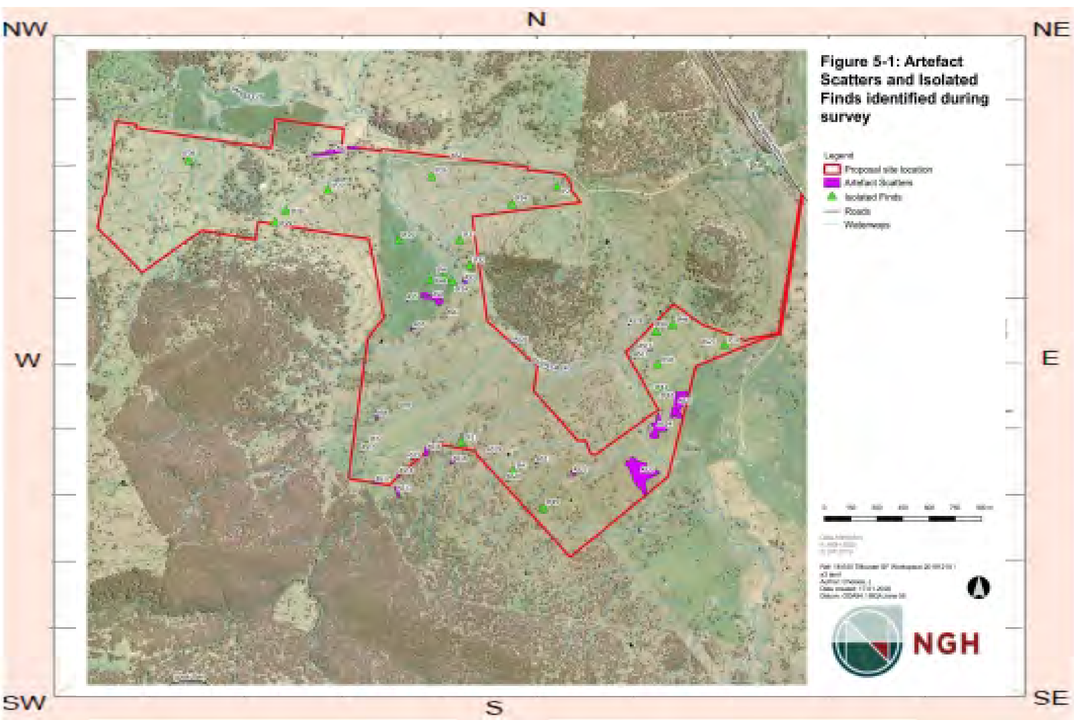
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete core, Tilbuster Solar Farm IF27.

Description: Close up of silcrete core, Tilbuster Solar Farm IF27.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0290

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF28

Easting: 369345

Northing: 6639149

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

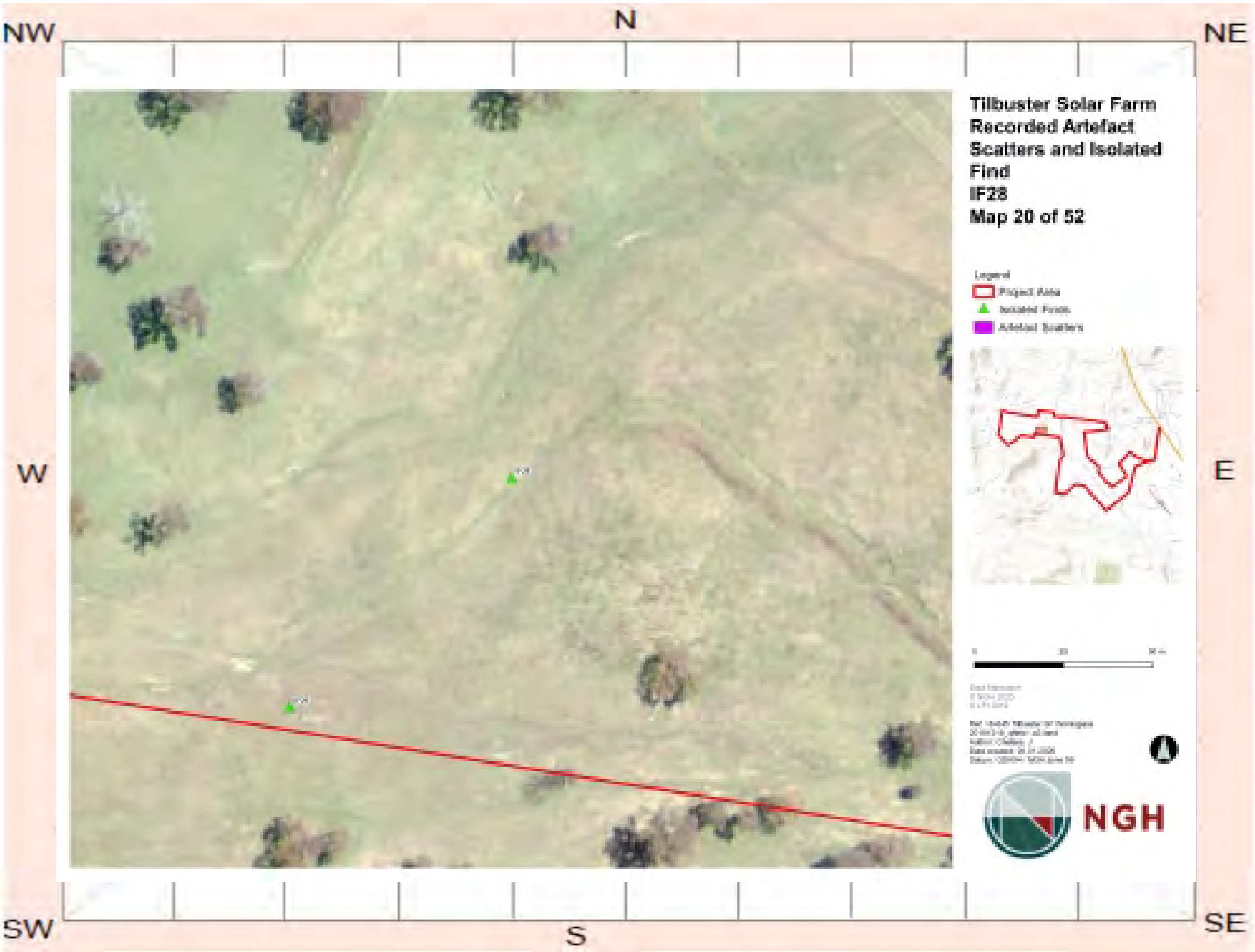
Distance to Water (m): 28

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on the base of a slope. The artefact was a silcrete flake with 20% cortex present indicating secondary production phase, located approximately 28 metres south east of an unnamed drainage line.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

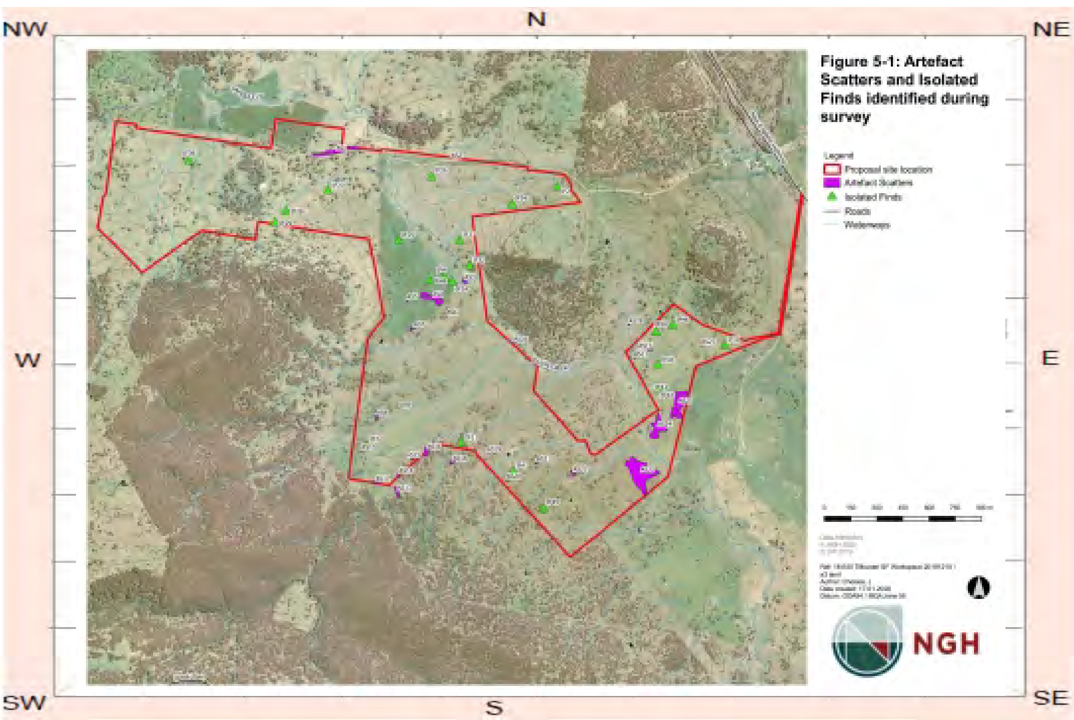
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF28.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF28.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0291

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF29

Easting: 369283 **Northing:** 6639084 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

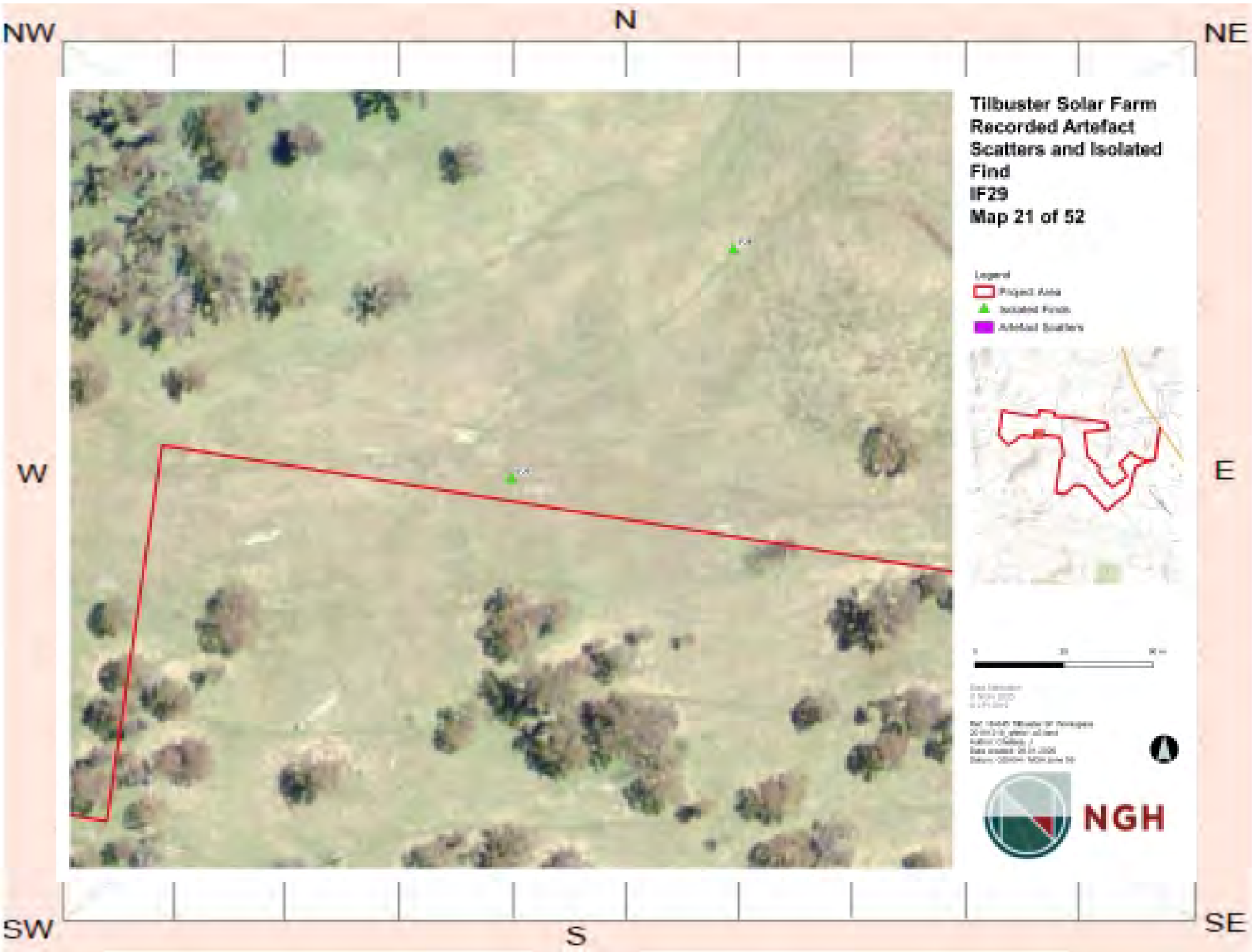
Distance to Water (m): 66

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.1km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along the base of a slope. The artefact was a silcrete flake located approximately 66 metres south of an unnamed drainage line.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

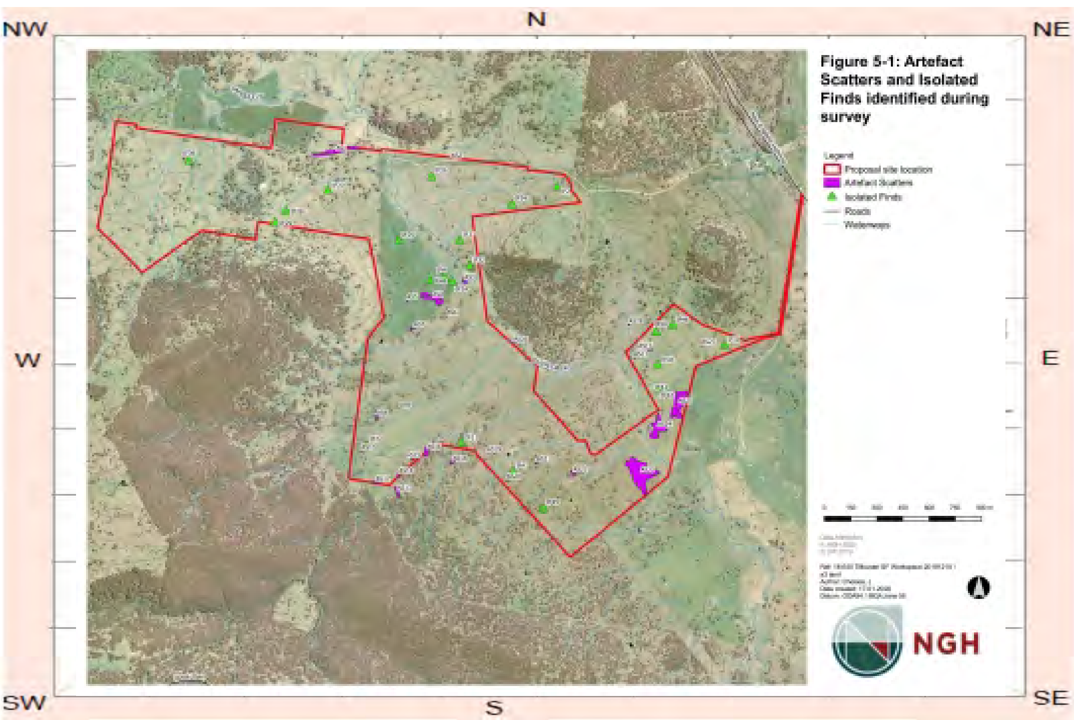
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF29.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF29.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0292

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF30

Easting: 369162 **Northing:** 6639527 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

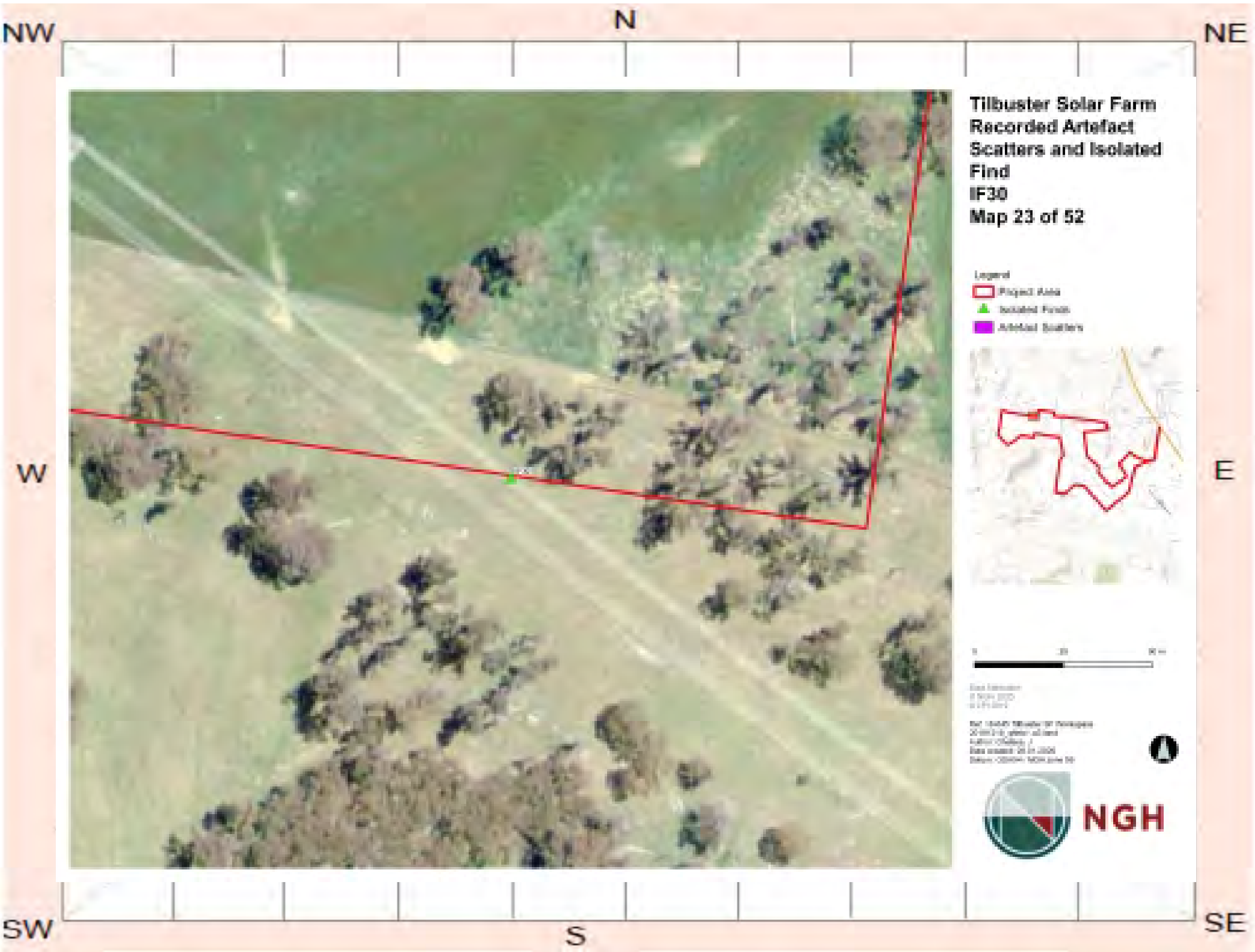
Distance to Water (m): 57

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.3km NW of house.

Other site information: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along an existing transmission line easement. The artefact was a silcrete flake located approximately 57 metres east of an unnamed drainage line; the left and right lateral margins exhibited some evidence of retouch.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

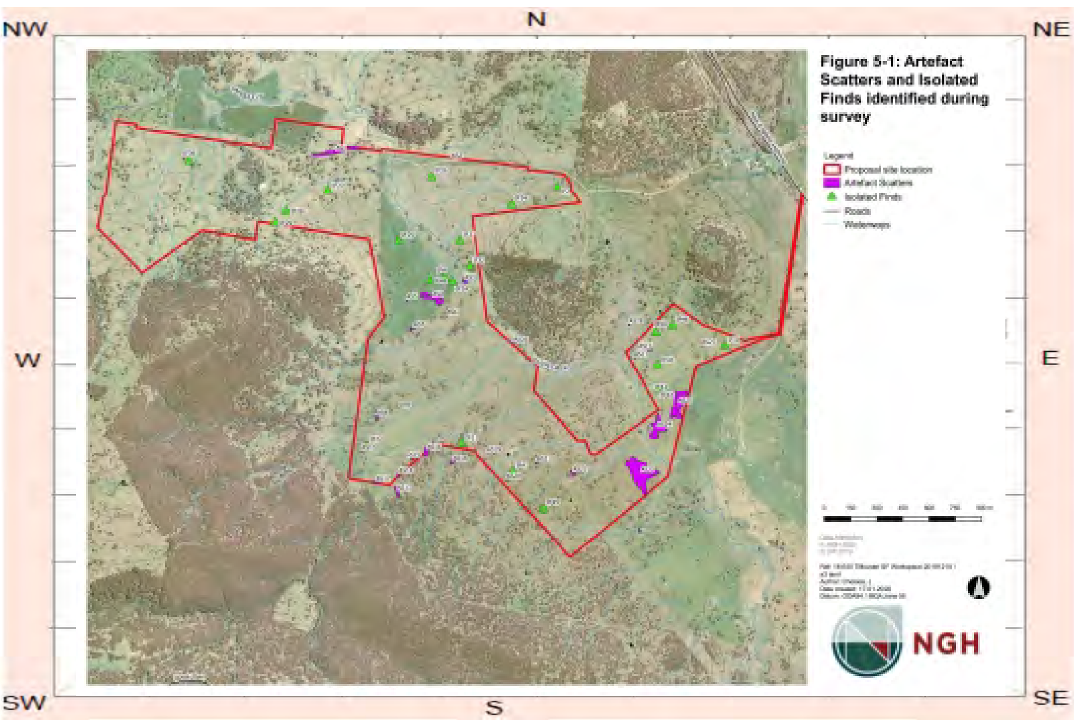
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF30.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF30.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0293

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF31

Easting: 369972 **Northing:** 6638190 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

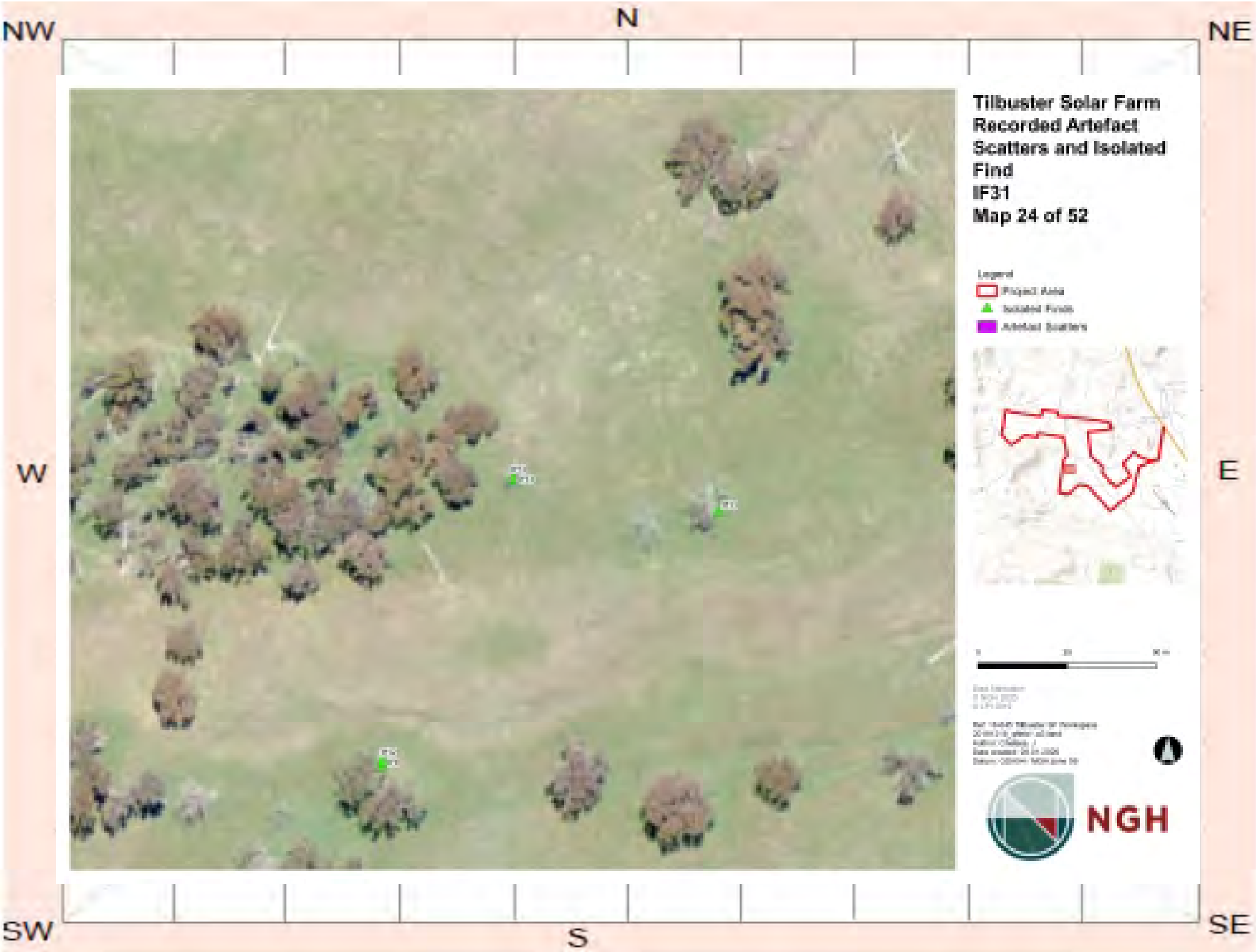
Distance to Water (m): 102

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2km NW of house.

Other site information: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a small cluster of trees a west of the existing transmission line easement. The artefact was a silcrete core located approximately 102 metres south of an unnamed drainage line associated with a major tributary of Duval Creek known as Sams Gully.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

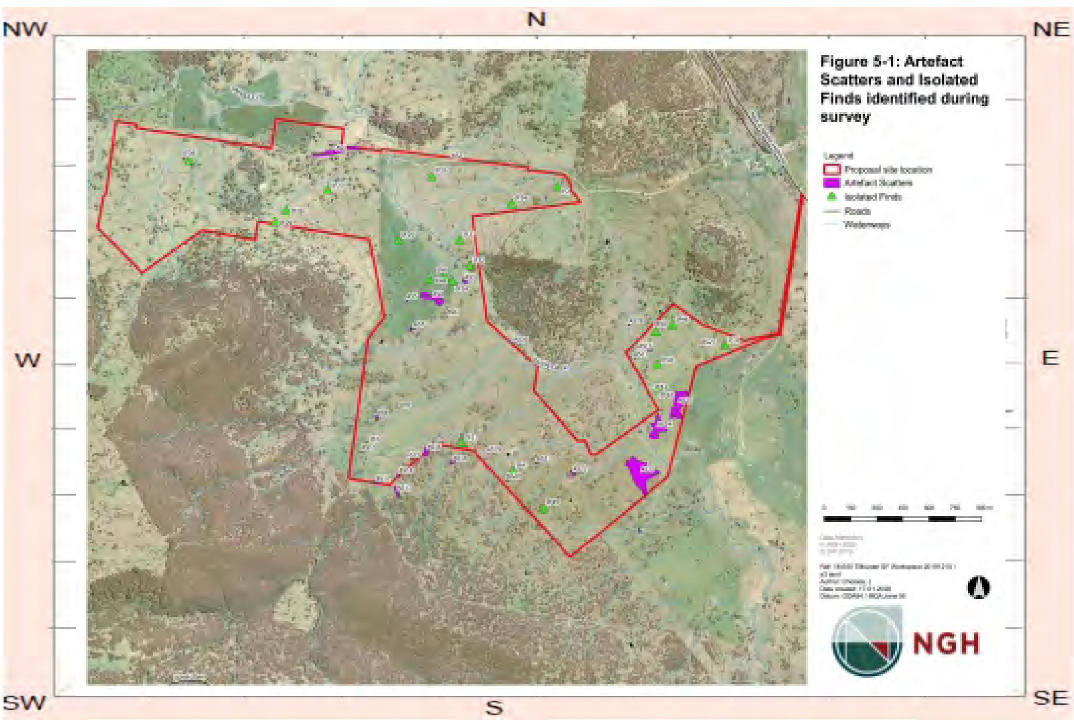
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake core, Tilbuster Solar Farm IF31.

Description: Close up of silcrete flake core, Tilbuster Solar Farm IF31.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0294

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF32

Easting: 370398 **Northing:** 6638834 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

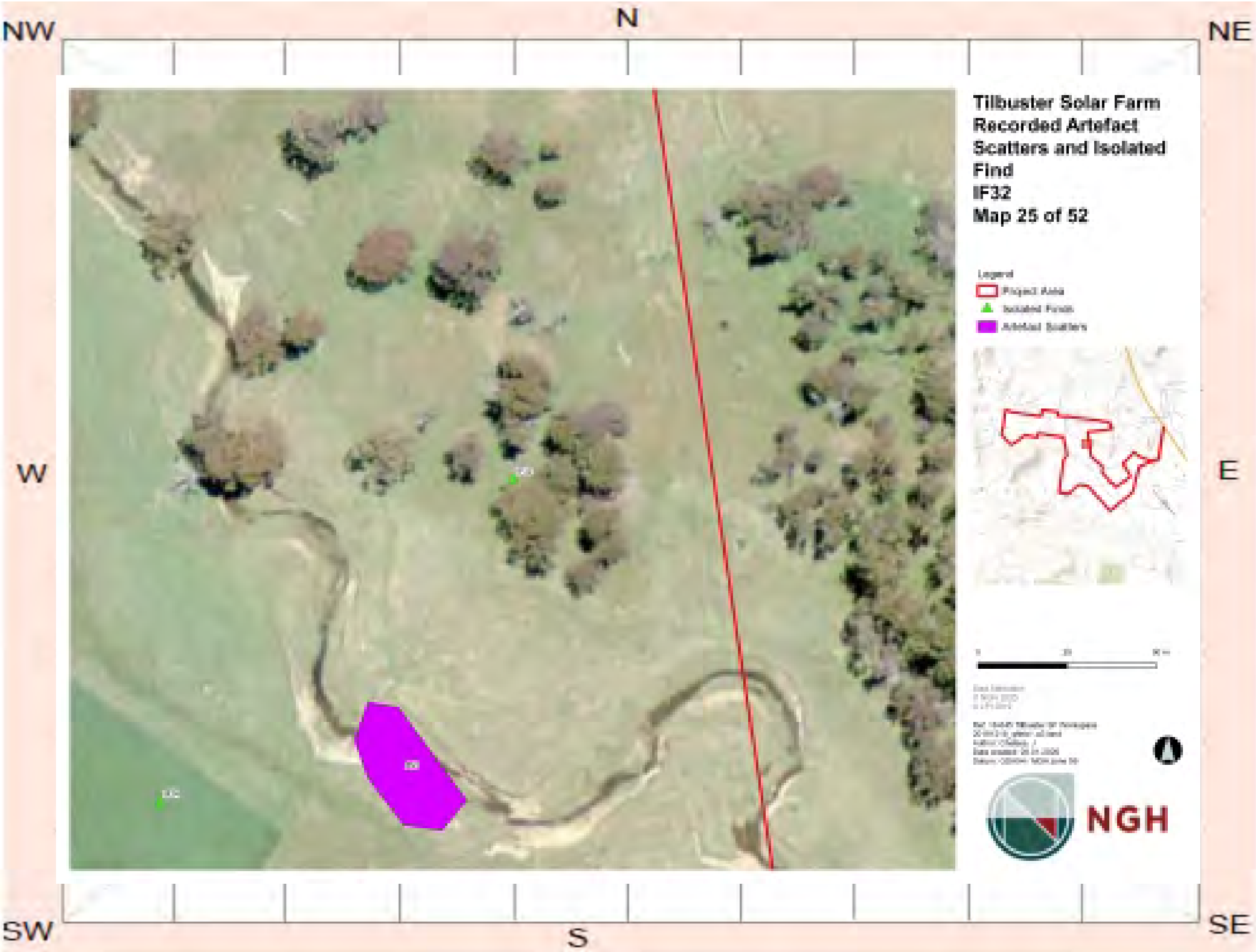
Distance to Water (m): 54

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km NNW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact located with a small group of trees. The artefact was a silcrete scraper located approximately 54 metres east of Duval Creek. The scraper contained 50% cortex and was therefore likely the result of primary production.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

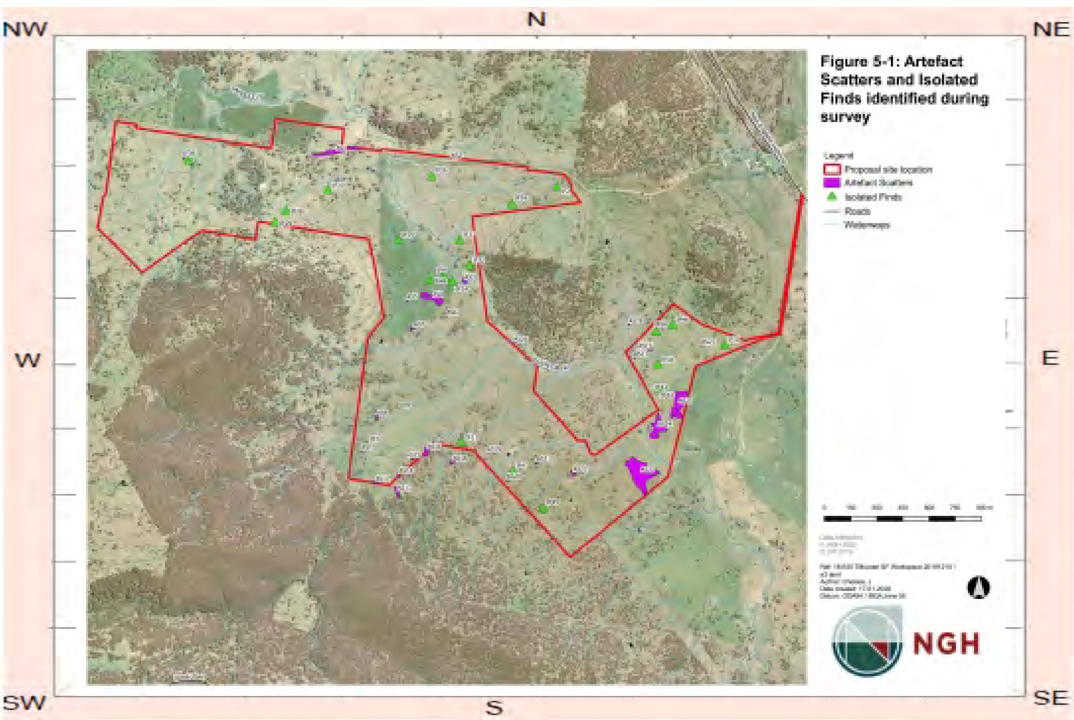
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete scraper, Tilbuster Solar Farm IF32.

Description: Location of Tilbuster Solar Farm IF32, looking west towards Duval Creek (mid-ground).

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0295

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF33

Easting: 369972

Northing: 6638190

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

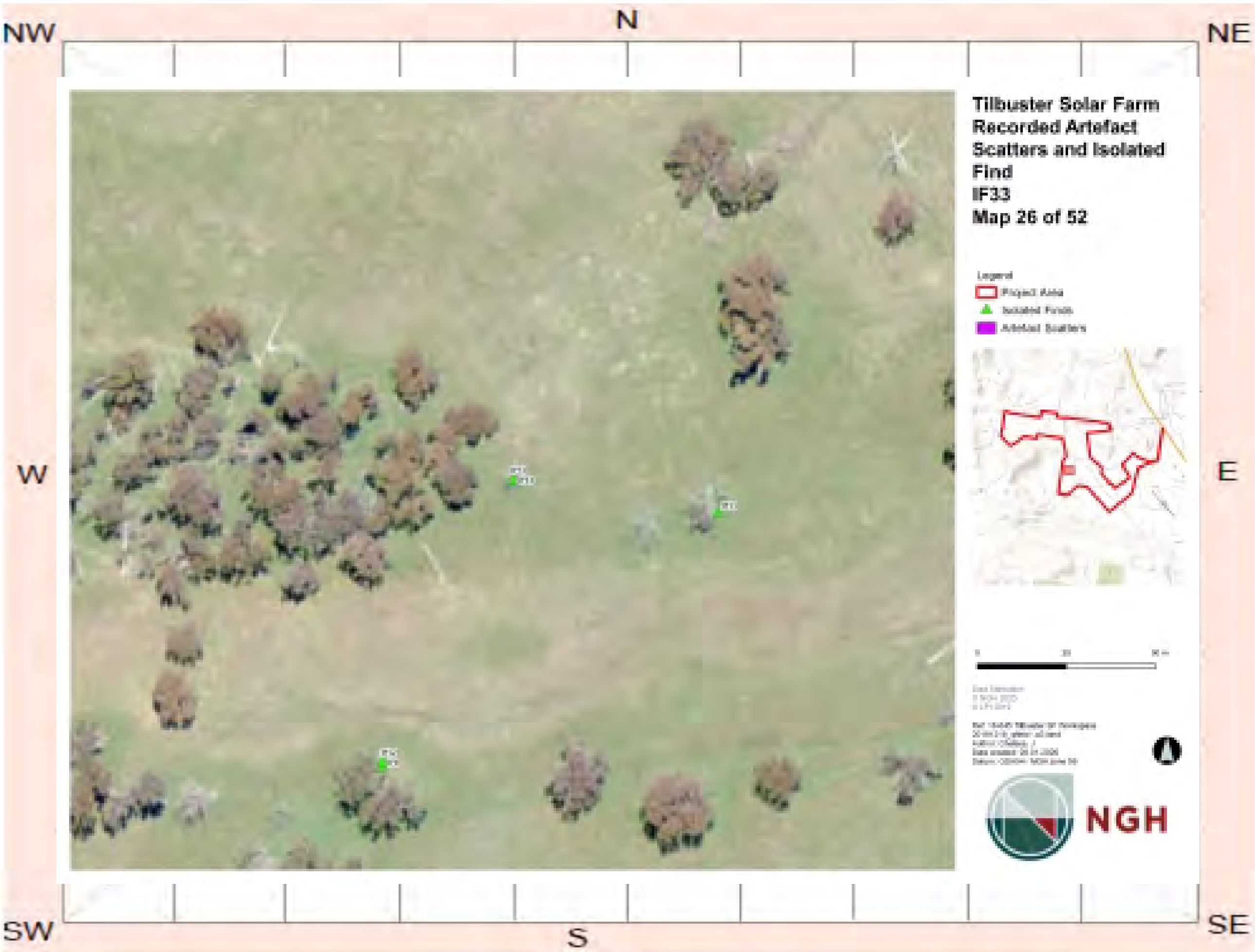
Distance to Water (m): 74

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a small cluster of trees between two unnamed tributaries of Duval Creek. The artefact was a silcrete proximal fragment located 104 metres south of one unnamed drainage line and 74 metres north of another.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

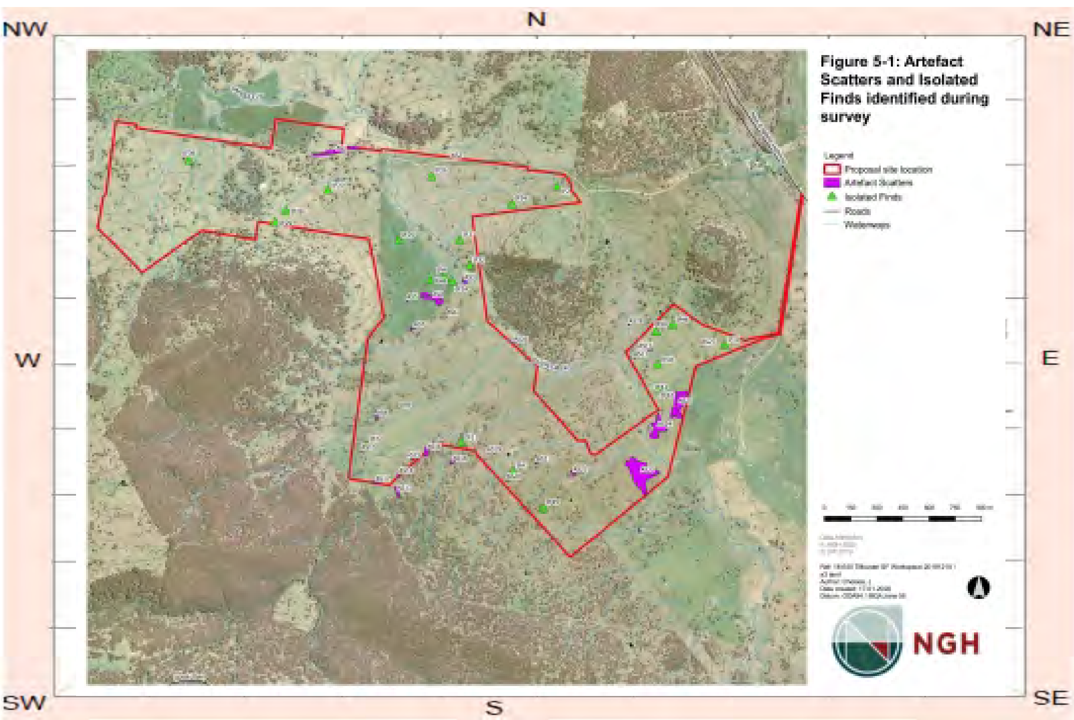
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF33.

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF33.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0296

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF34

Easting: 370640

Northing: 6639187

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

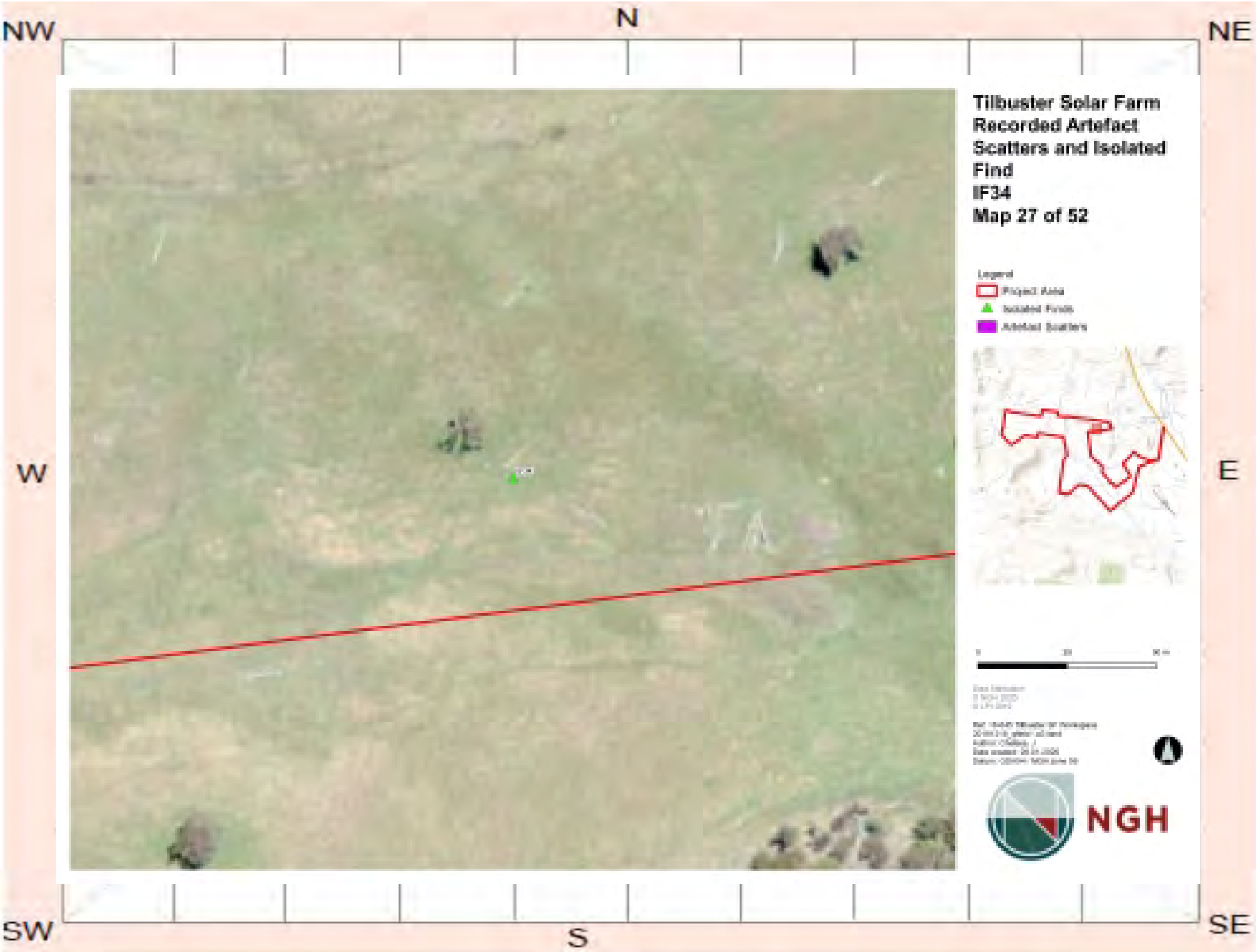
Distance to Water (m): 10

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km N of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a predominantly cleared paddock. The artefact was a silcrete flake located approximately 10 metres north of an unnamed drainage line.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

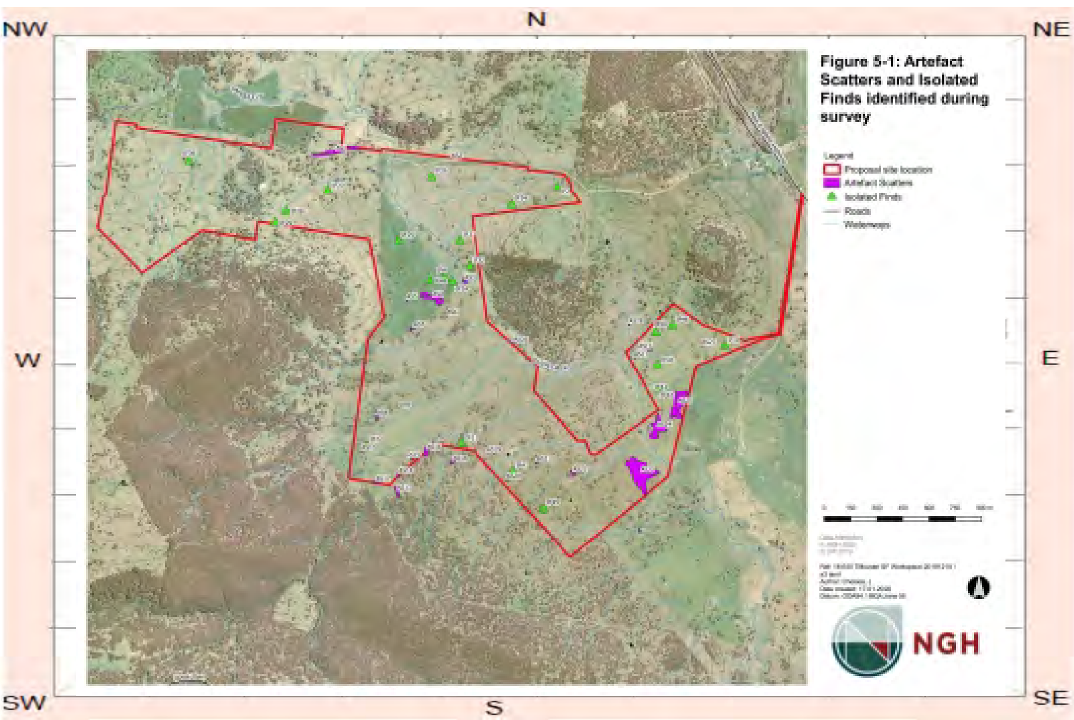
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF34.

Description: General location of silcrete flake, Tilbuster Solar Farm IF34.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0297

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF35

Easting: 370509

Northing: 6637923

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

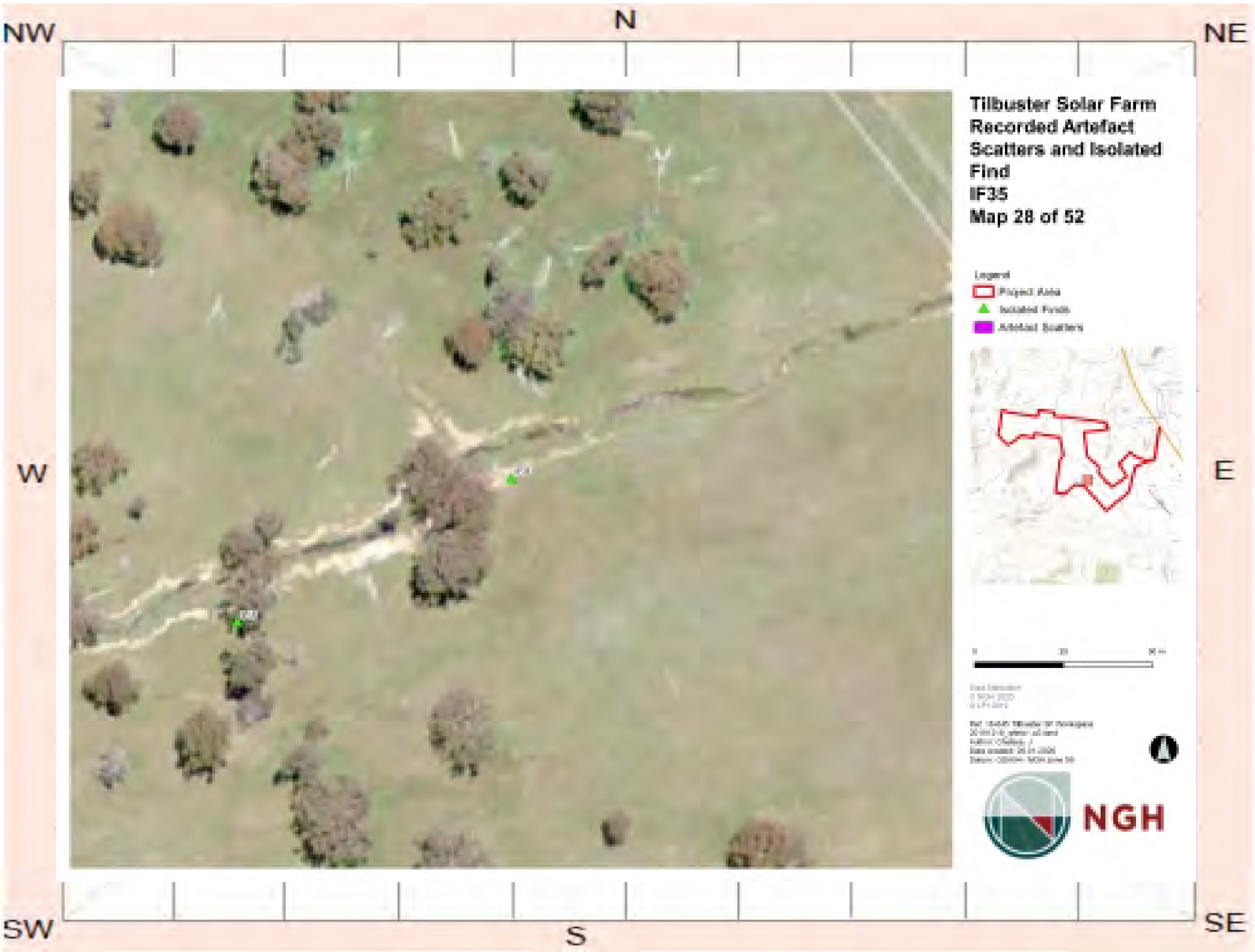
Distance to Water (m): 4

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.5km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact located immediately adjacent to an alluvial depression and small group of trees. The artefact was a quartz flake located approximately four metres south of a third order tributary of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

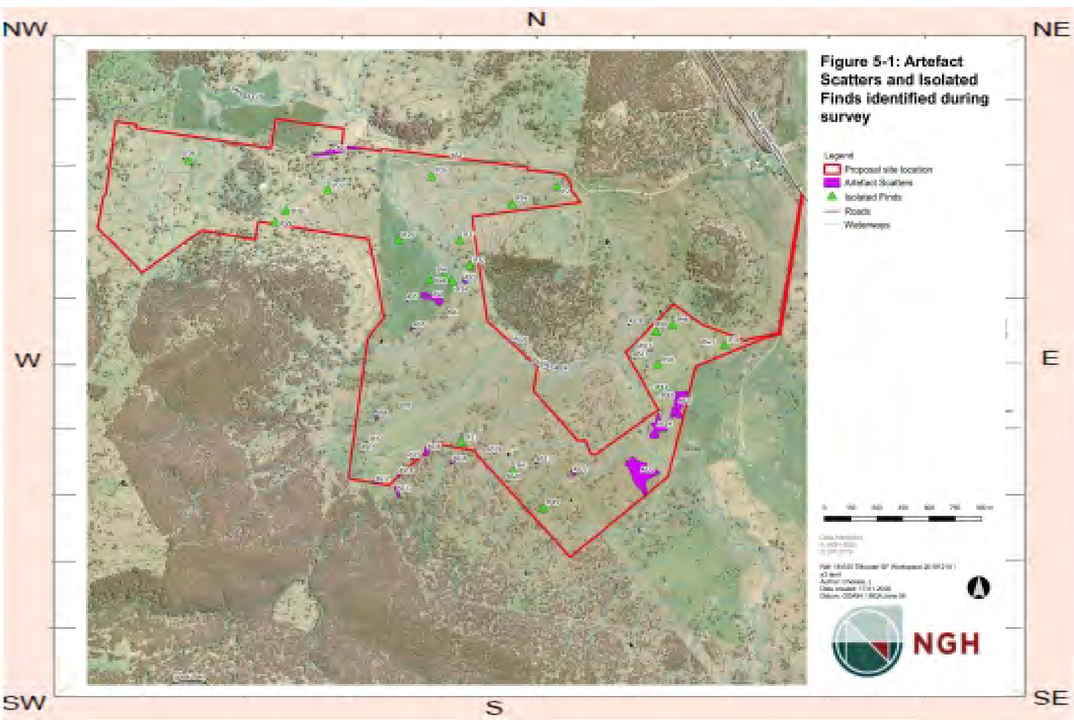
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of quartz flake, Tilbuster Solar Farm IF35.

Description: Close up of quartz flake, Tilbuster Solar Farm IF35.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0298 **Date recorded:** 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF36

Easting: 368789 **Northing:** 6639439 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain **Land Use:** Pastoral/Grazing

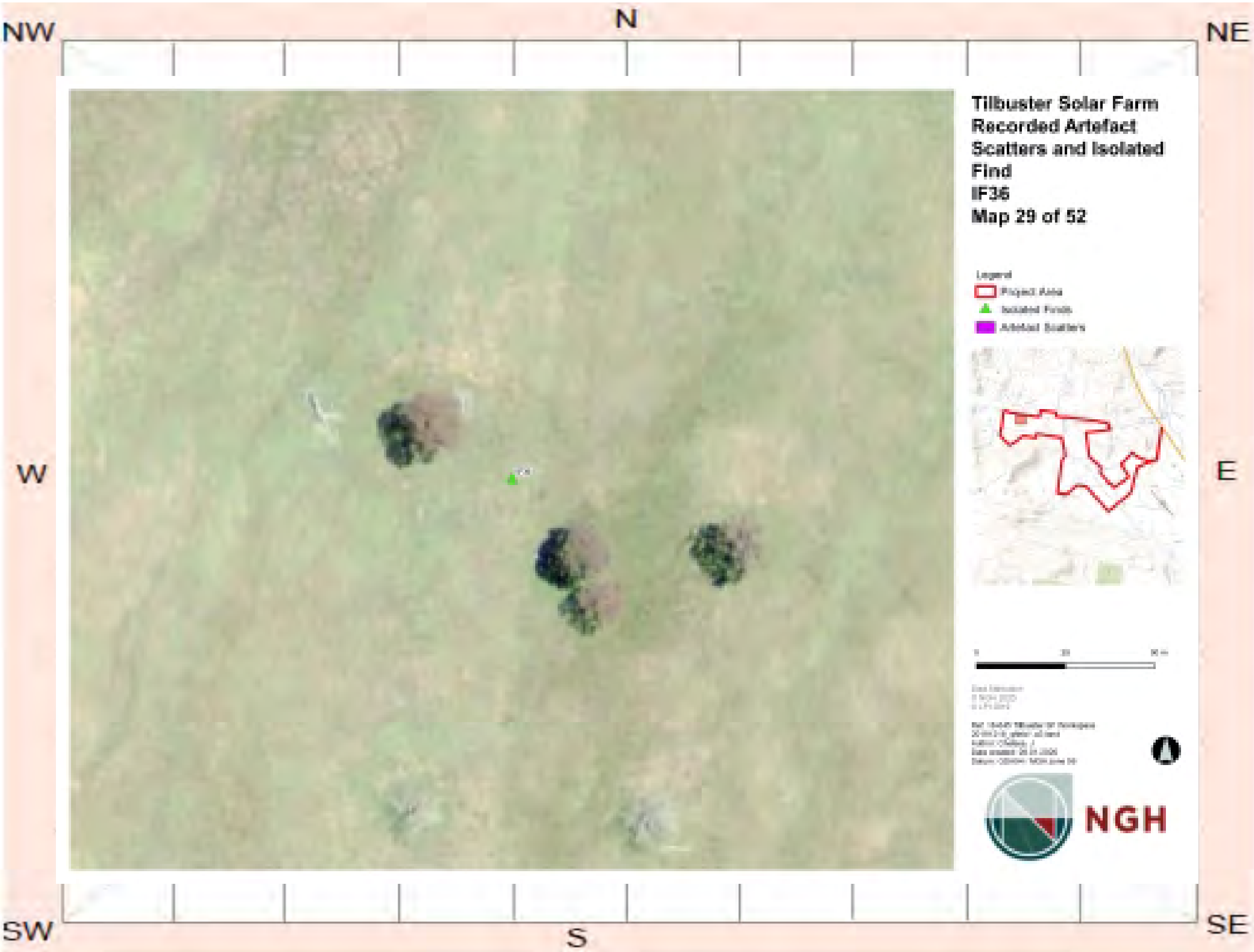
Land Form Unit: Slope **Vegetation:** Isolated clumps of trees

Distance to Water (m): 36 **Primary Report:** Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.6km NW of house.

Other site information: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1. Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a predominantly cleared field approximately 86 metres east of a third order and 36 metres west of a first order tributary of Sams Gully, which is itself a major tributary of Duval Creek. The artefact was a silcrete proximal fragment.

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

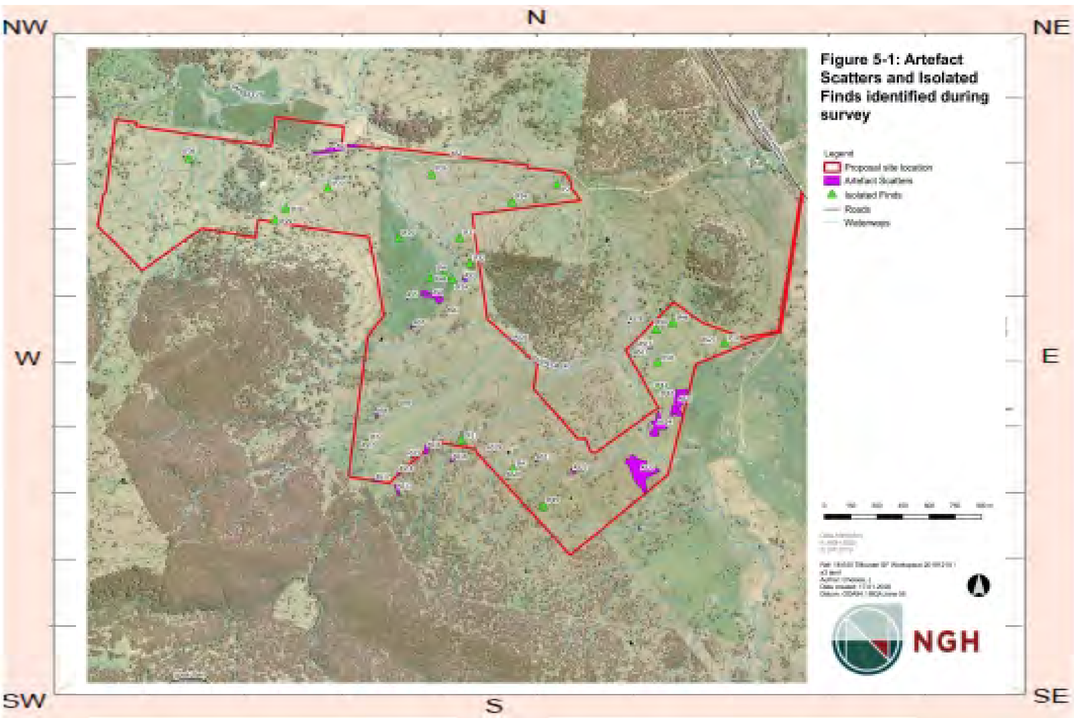
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF36.

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF36.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0299

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF37

Easting: 370341 **Northing:** 6638981 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

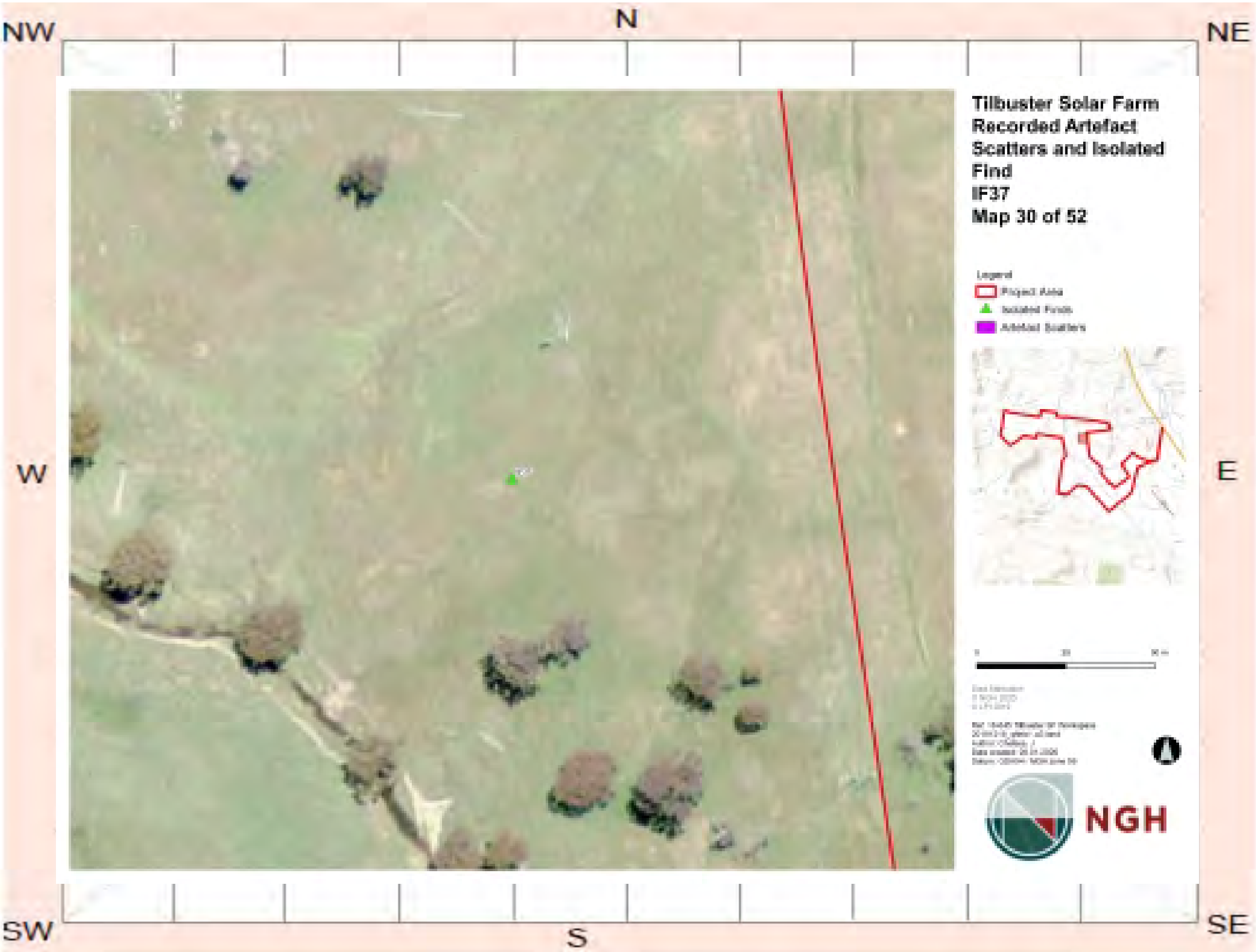
Distance to Water (m): 43

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NNW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an alluvial plain within a cleared paddock. The artefact was a volcanic flake located approximately 43 metres south east of an unnamed drainage line and 70 metres north east of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

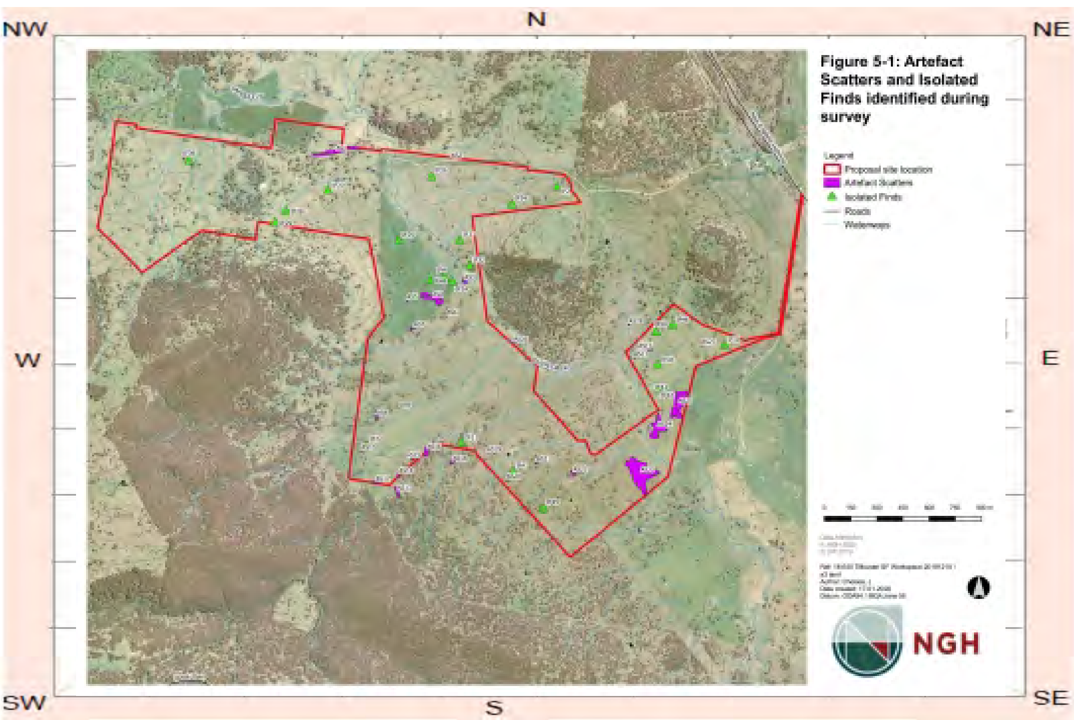
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of volcanic flake, Tilbuster Solar Farm IF37.

Description: Close up of volcanic flake, Tilbuster Solar Farm IF37.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW GOVERNMENT

AHIMS site ID: 21-1-0300

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF38

Easting: 371020

Northing: 6639129

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

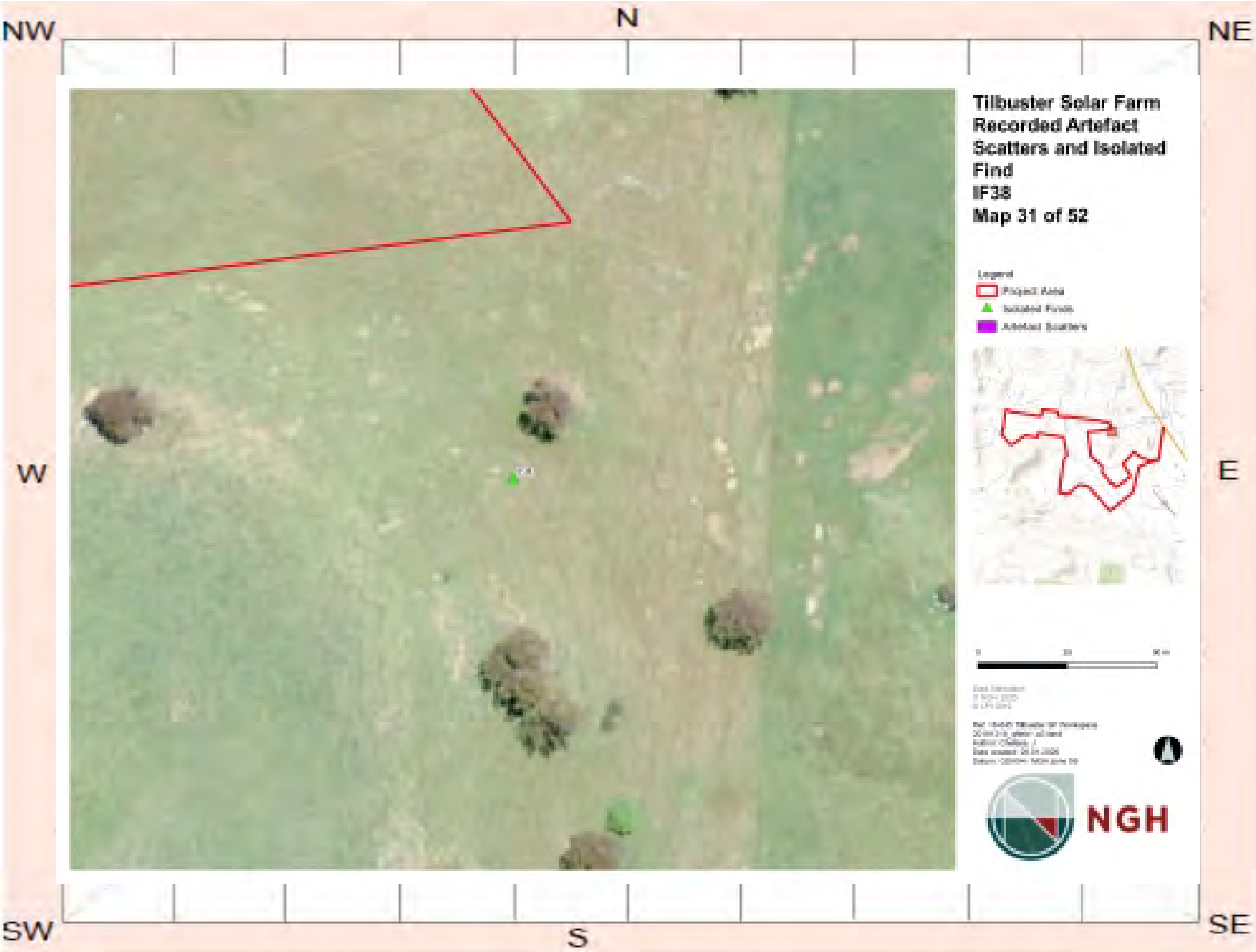
Distance to Water (m): 80

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.6km N of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on the crest of an upper slope in a cleared paddock. The artefact was a chert core located approximately 80 metres north east of an unnamed tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

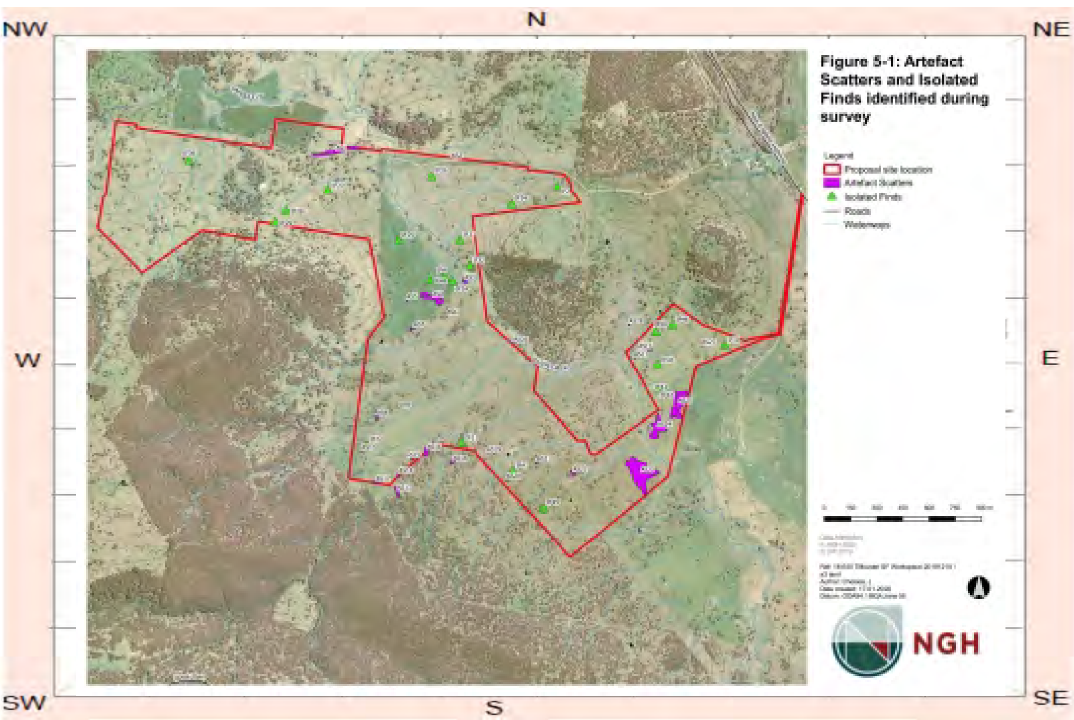
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of chert core, Tilbuster Solar Farm IF38.

Description: Close up of chert core, Tilbuster Solar Farm IF38.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0301

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF39

Easting: 370205

Northing: 6637779

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

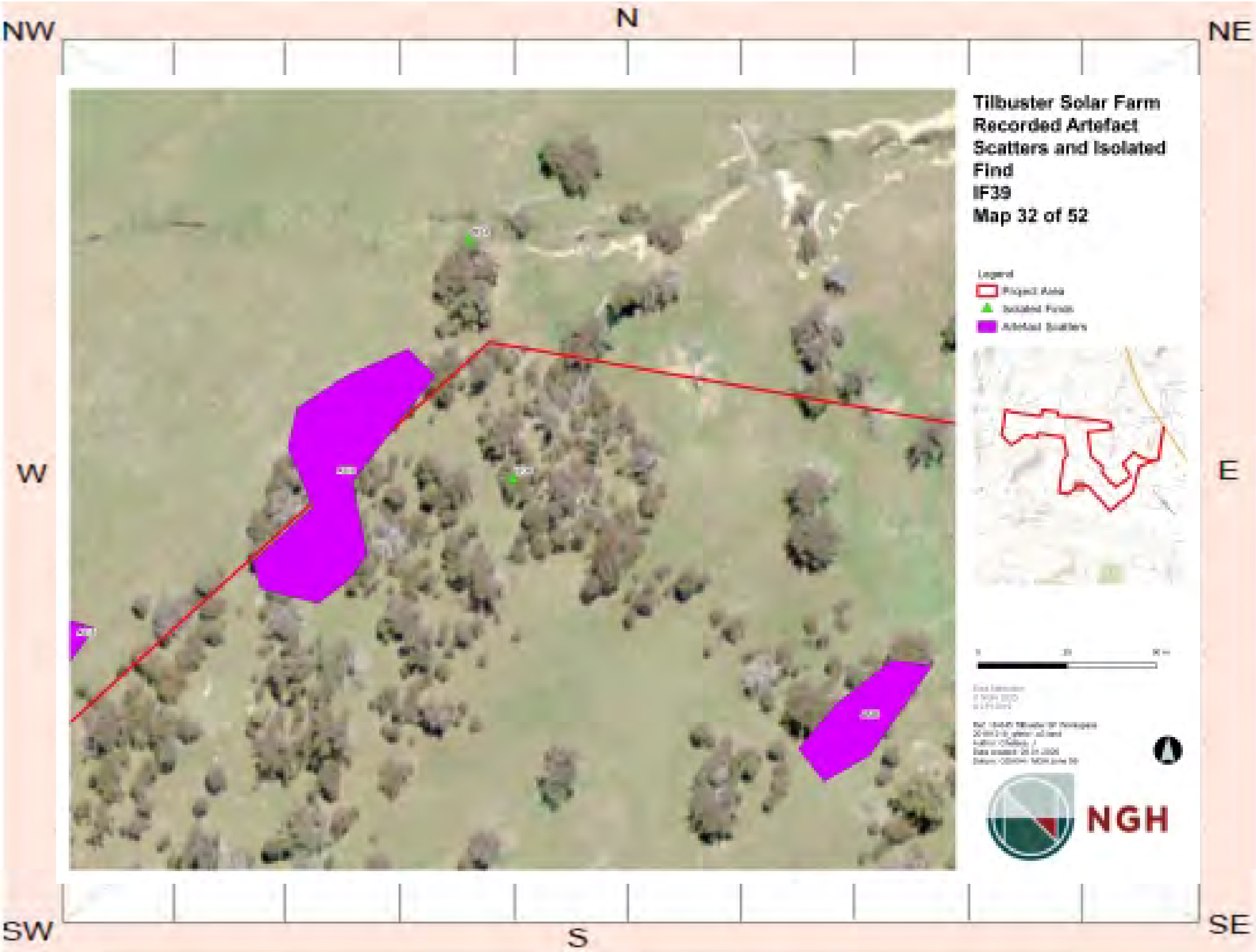
Distance to Water (m): 760

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.8km W of house.

Other site information: The soils consisted of a redeposited grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a large cluster of trees. The artefact was a jasper located within a third order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

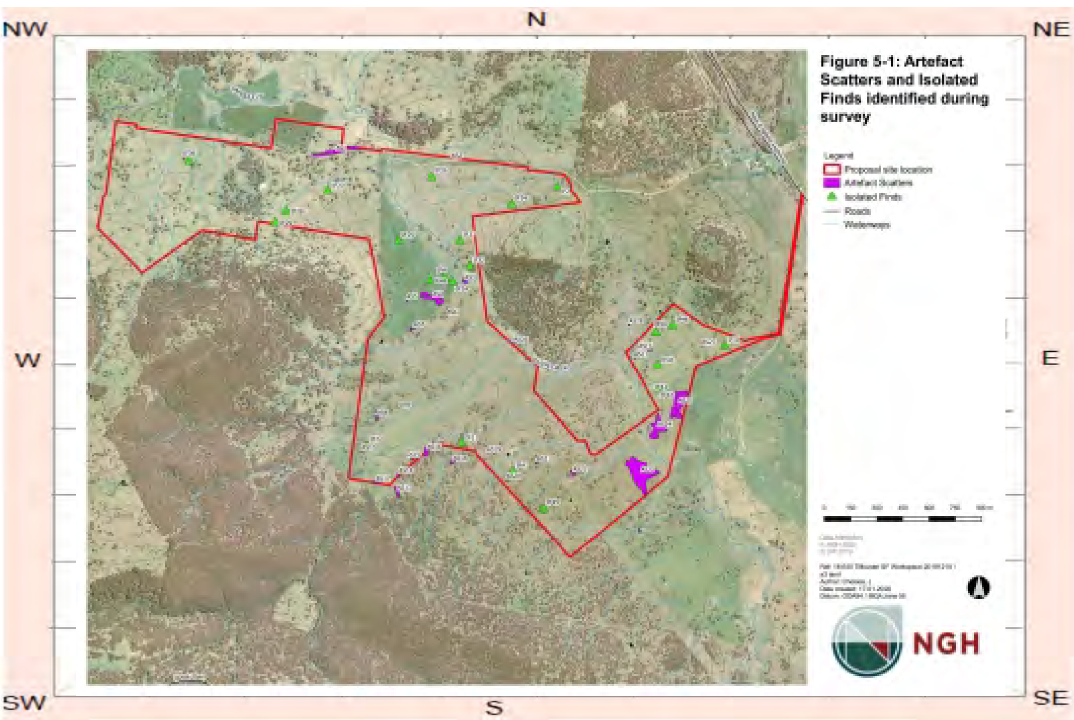
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a redeposited grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of jasper flake, Tilbuster Solar Farm IF39.

Description: Close up of jasper flake, Tilbuster Solar Farm IF39.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0302 **Date recorded:** 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF40

Easting: 371471 **Northing:** 6638316 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 100

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 780m N of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1. Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek. The artefact was a chert debitage flake located approximately 100 metres south of the confluence of two unnamed tributaries of Duval Creek.

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

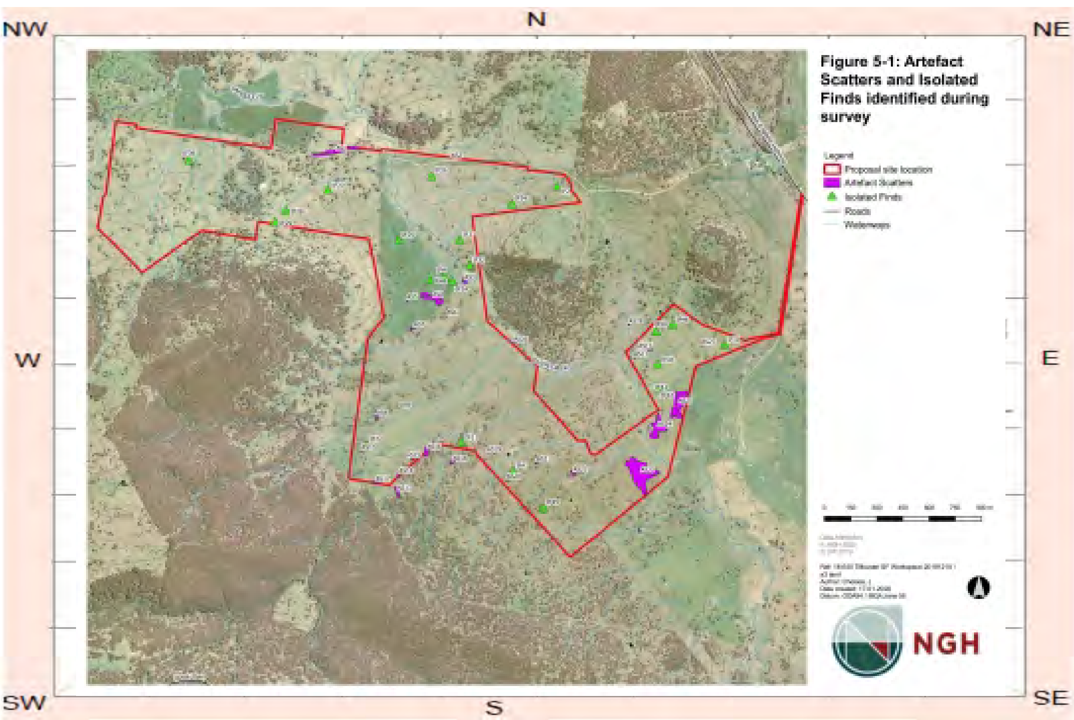
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of chert debitage flake, Tilbuster Solar Farm IF40.

Description: Close up of chert debitage flake, Tilbuster Solar Farm IF40.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage (NSW Government)

AHIMS site ID: 21-1-0303

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF41

Easting: 371479

Northing: 6638267

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

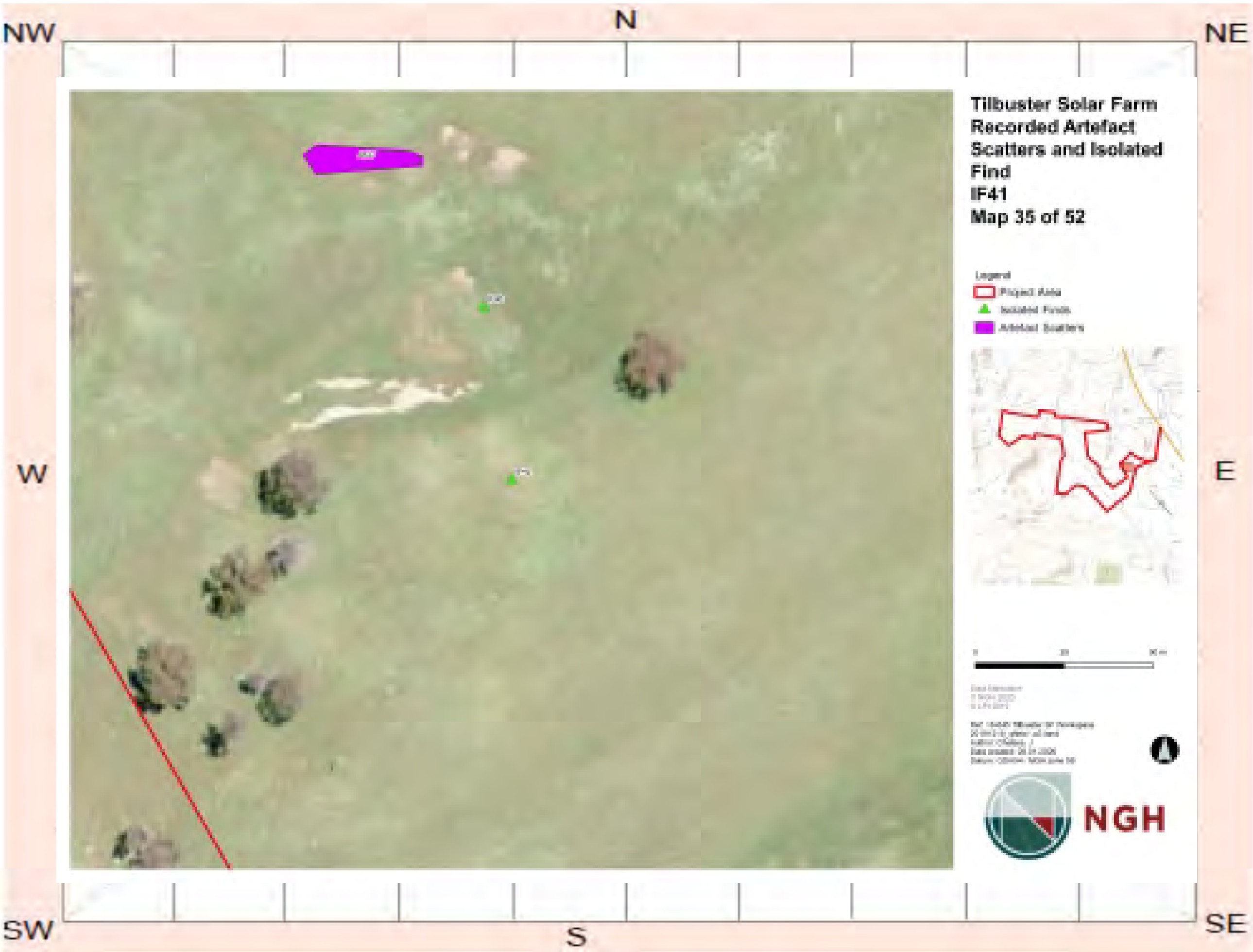
Distance to Water (m): 58

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 685m N of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek. The artefact was a retouched silcrete flake located approximately 58 metres south of an unnamed drainage line associated with Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

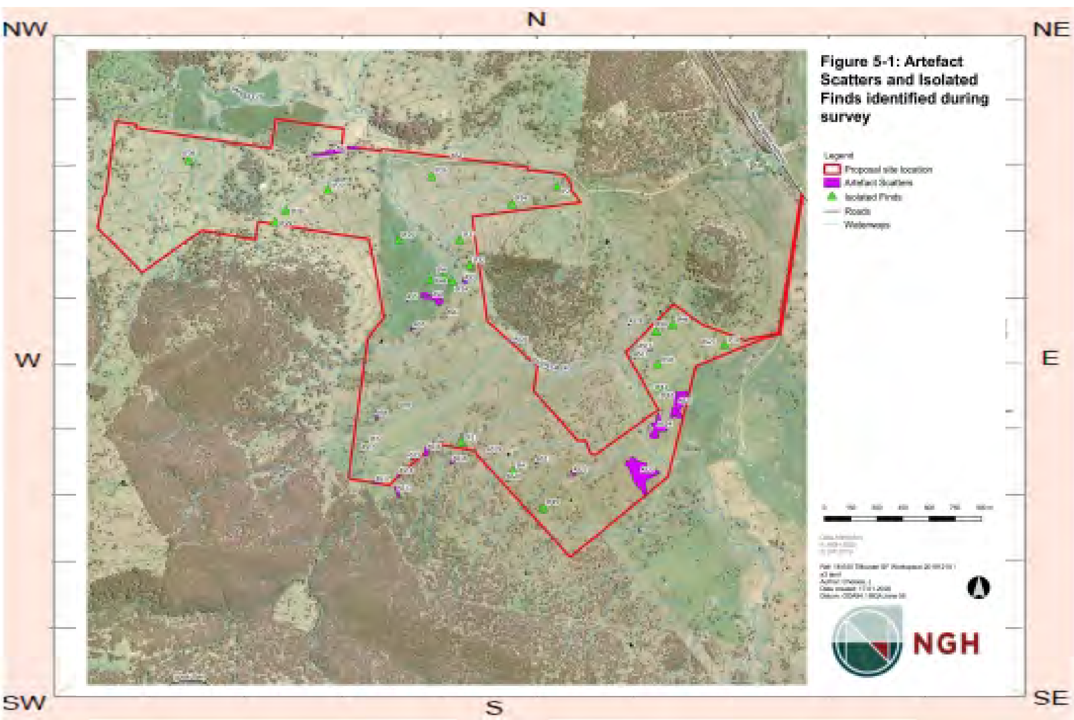
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees			
				Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of retouched silcrete flake, Tilbuster Solar Farm IF41.

Description: Close up of retouched silcrete flake, Tilbuster Solar Farm IF41.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0304

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF42

Easting: 371480

Northing: 6638134

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

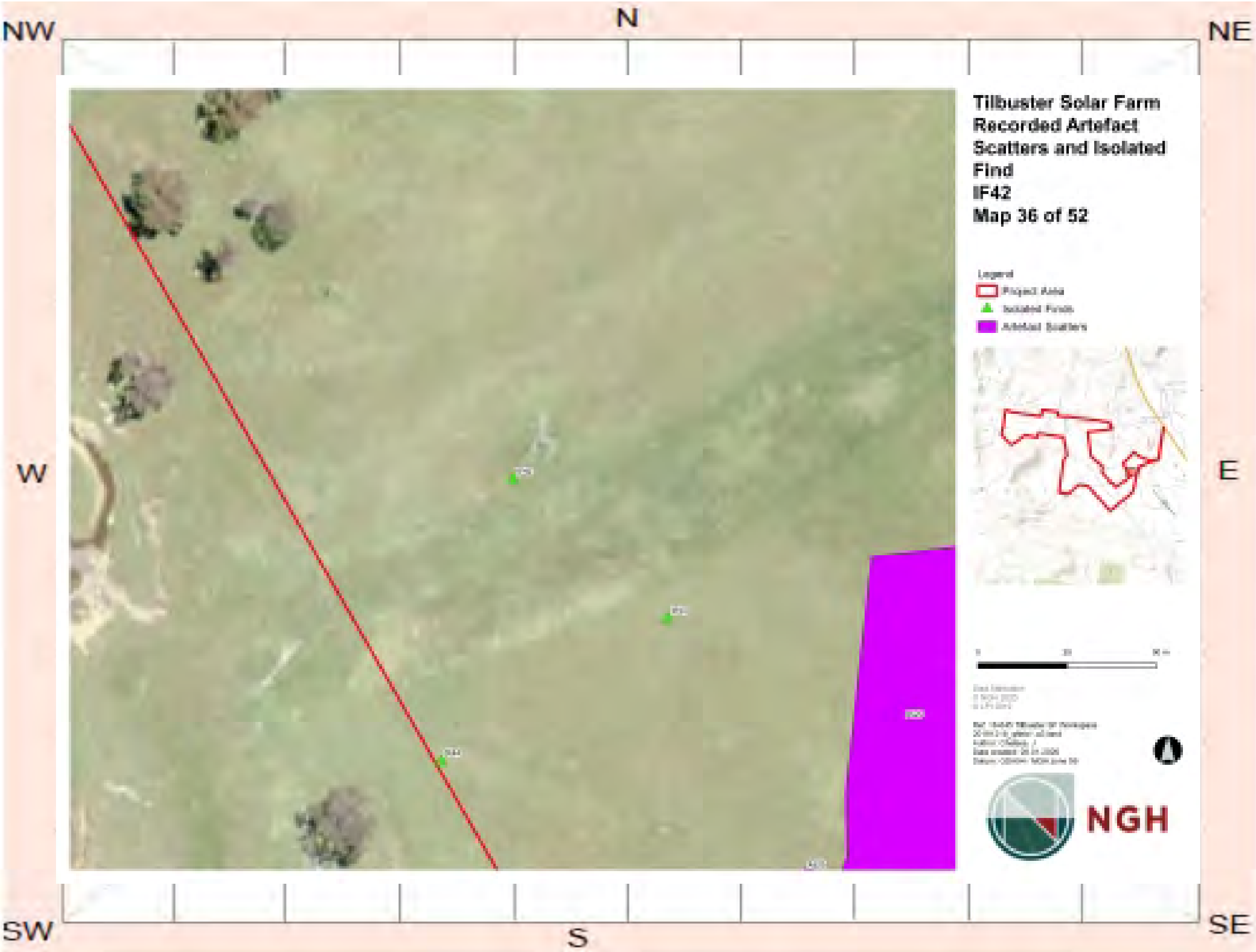
Distance to Water (m): 23

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 610m NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1. Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on a lower slope overlooking Duval Creek, with a westerly aspect.
The artefact was a retouched silcrete notched scraper located approximately 39 metres south of an unnamed drainage line and 23 metres north of another unnamed drainage line

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

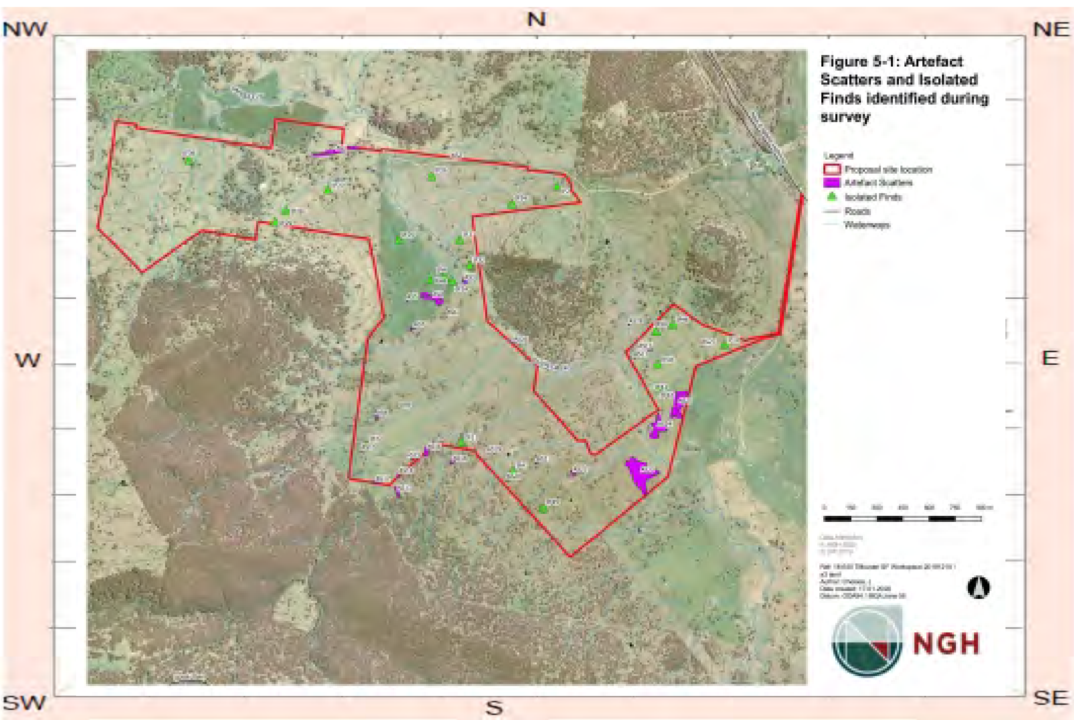
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of retouched silcrete notched scraper, Tilbuster Solar Farm IF42.

Description: Close up of retouched silcrete notched scraper, Tilbuster Solar Farm IF42.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender | General | Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone:

E-mail:

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0305

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF43

Easting: 371524

Northing: 6638095

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

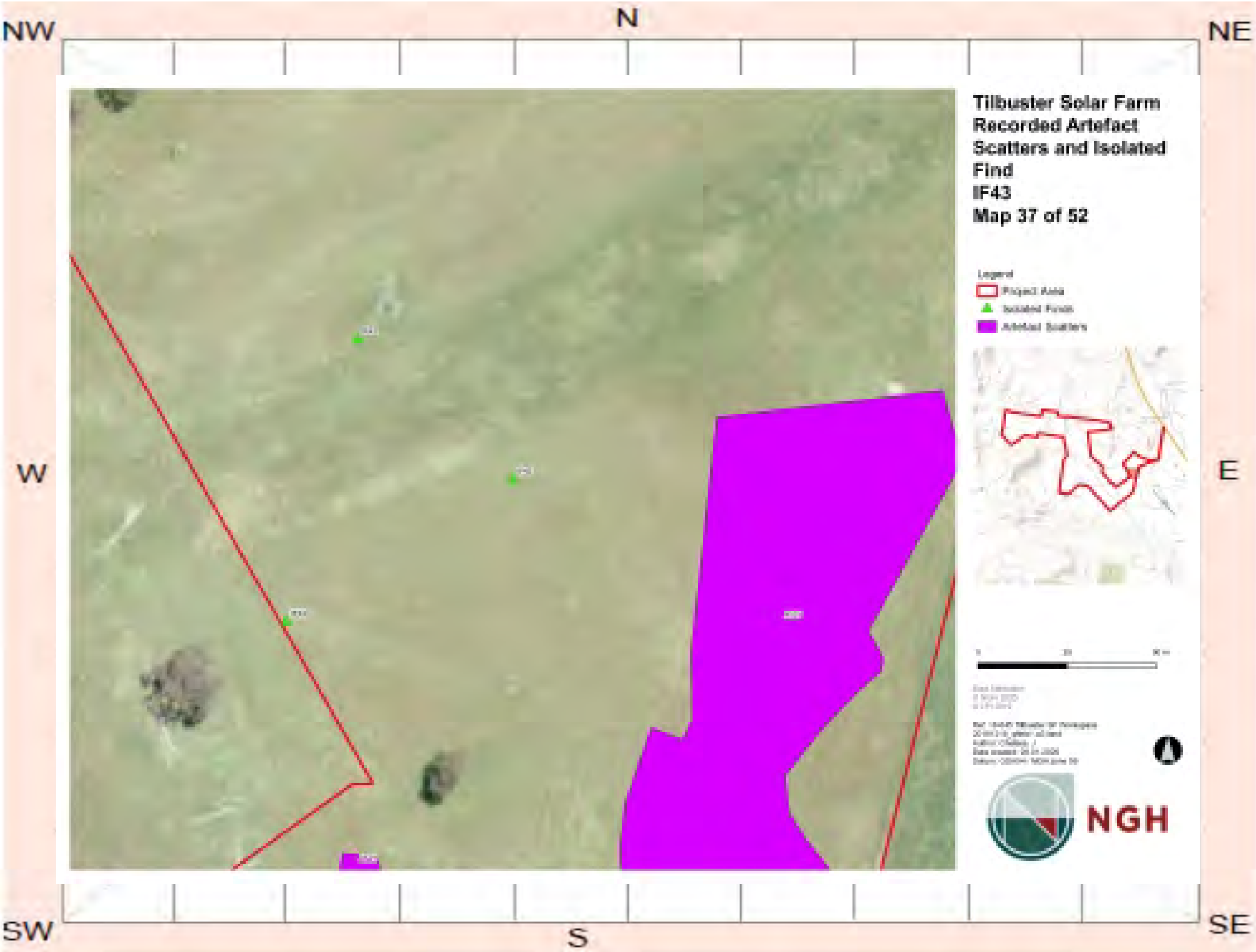
Distance to Water (m): 19

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 537m NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on a lower slope. The artefact was a quartz flake, possible scraper, located approximately 19 metres south of an unnamed tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

3.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

4.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

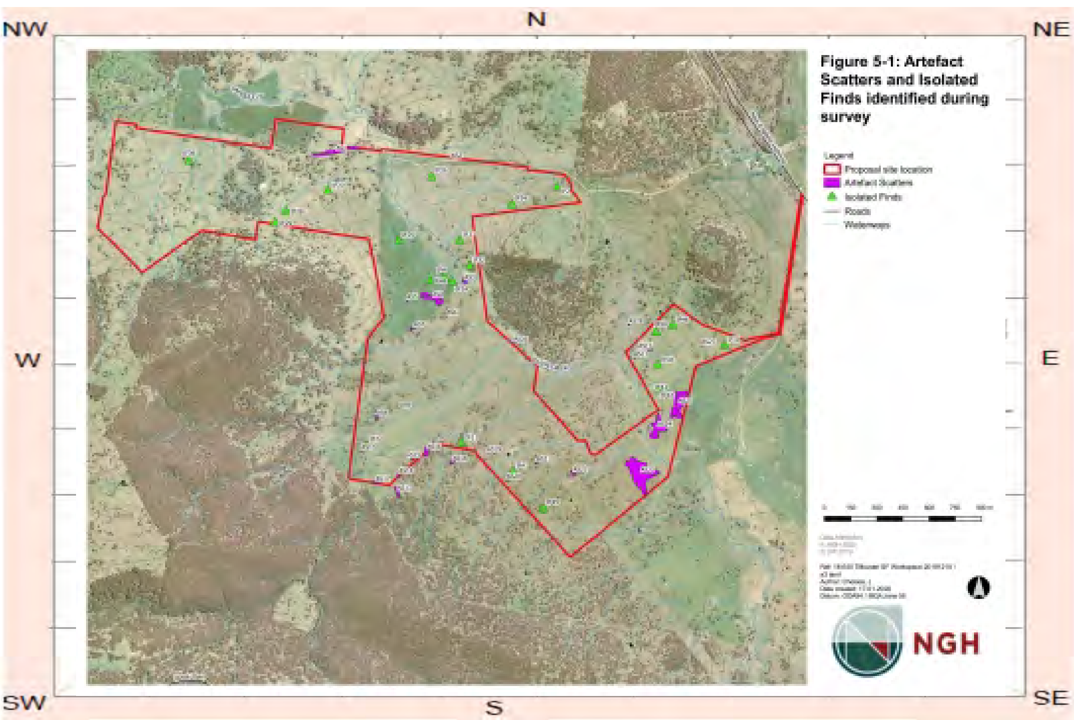
Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

5.

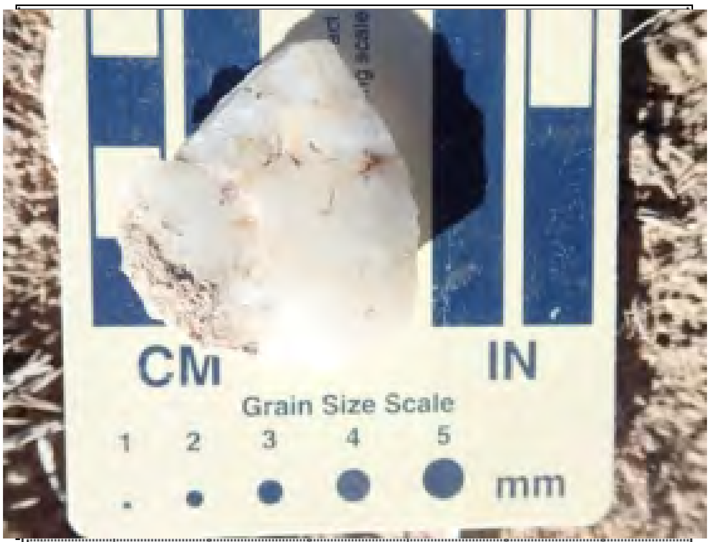
Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

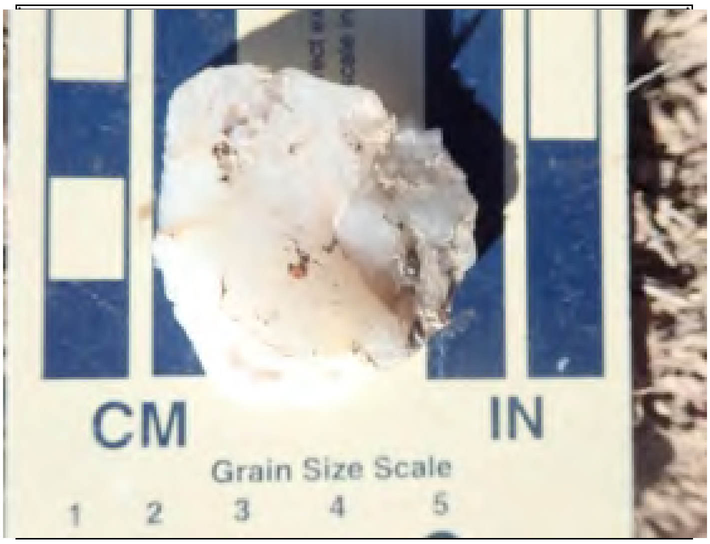
Site plan



Site photographs



Description: Close up of quartz flake, Tilbuster Solar Farm IF43



Description: Close up of quartz flake, Tilbuster Solar Farm IF43.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0306

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF44

Easting: 371460 **Northing:** 6638055 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

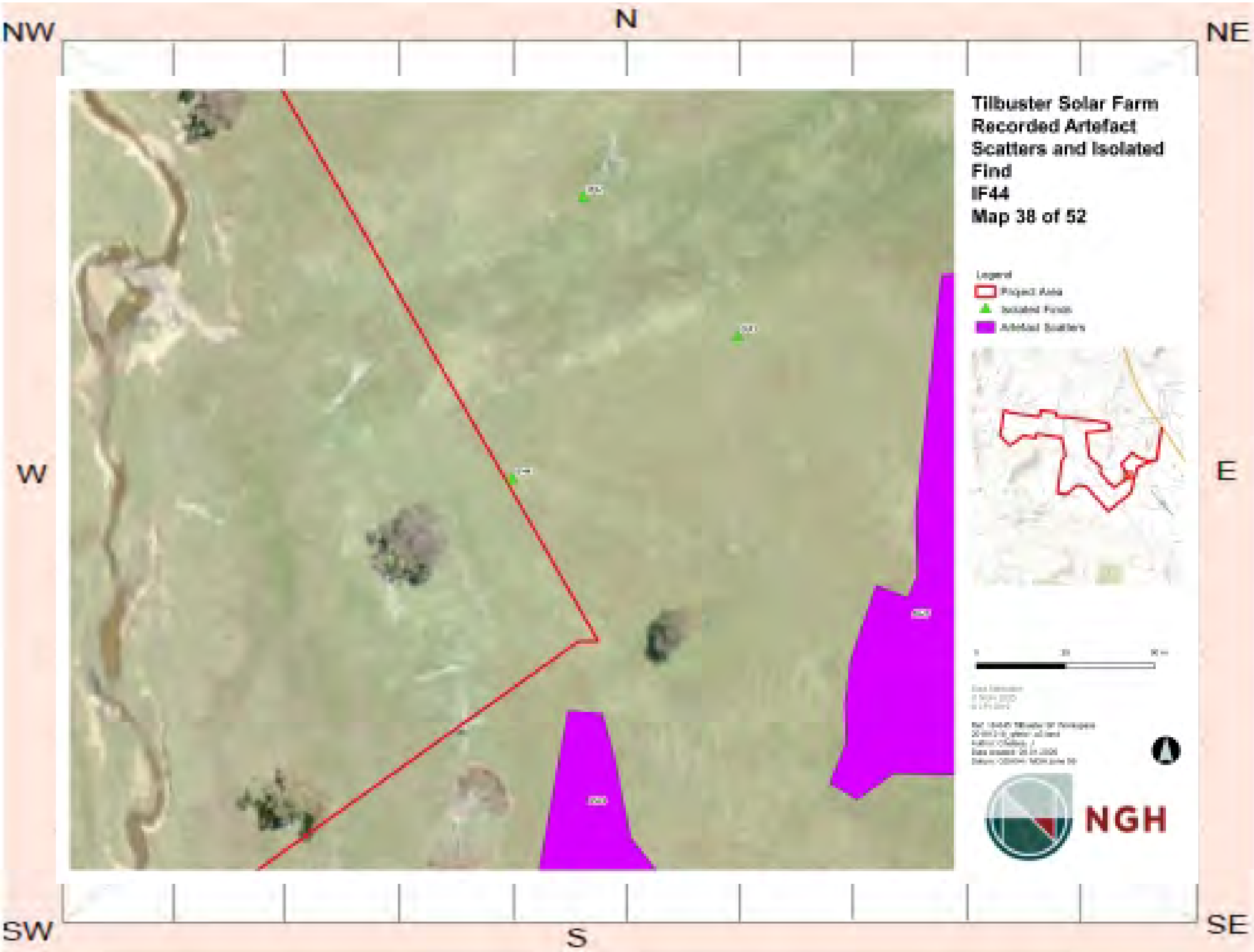
Distance to Water (m): 100

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 602m NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on a lower slope. The artefact was a chert angular fragment with 30% cortex located approximately 100 metres east of Duval Creek.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

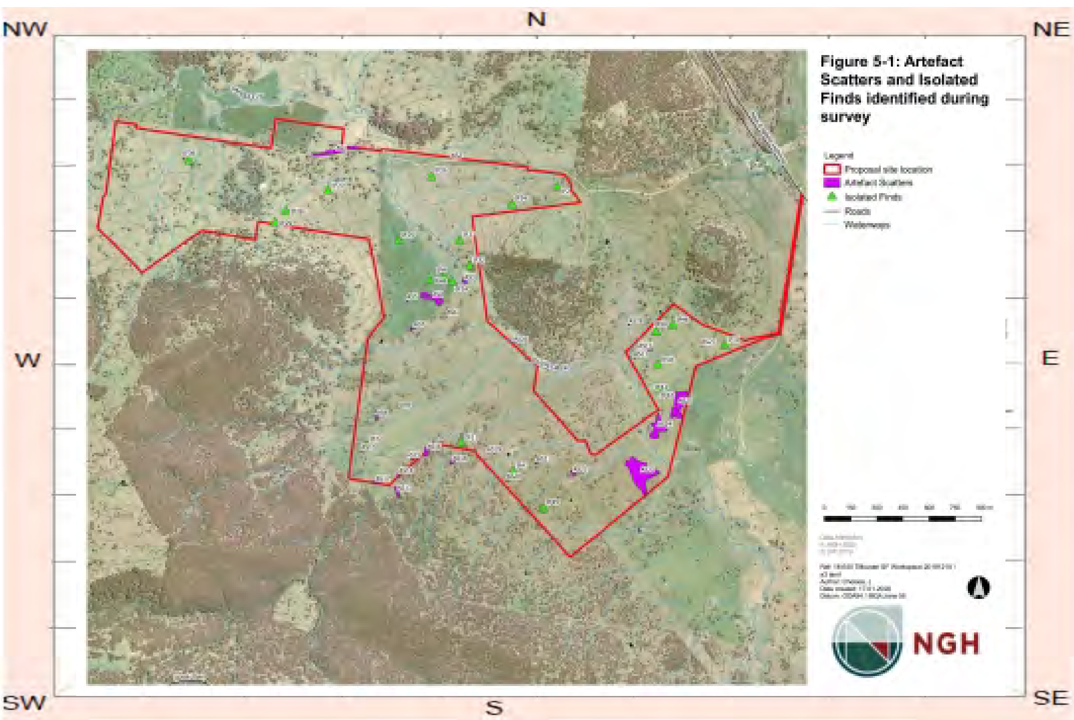
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

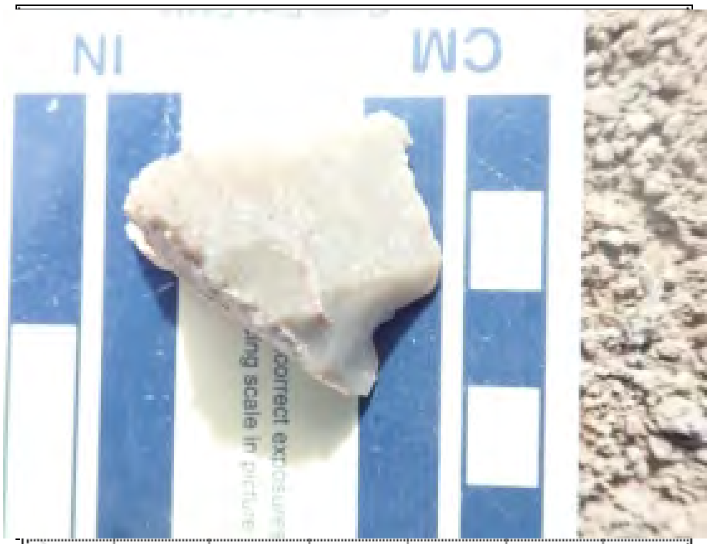
Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs



Description: Close up of chert angular fragment, Tilbuster Solar Farm IF44.

Description: Close up of chert angular fragment, Tilbuster Solar Farm IF44.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0307

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF45

Easting: 370821

Northing: 6637442

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

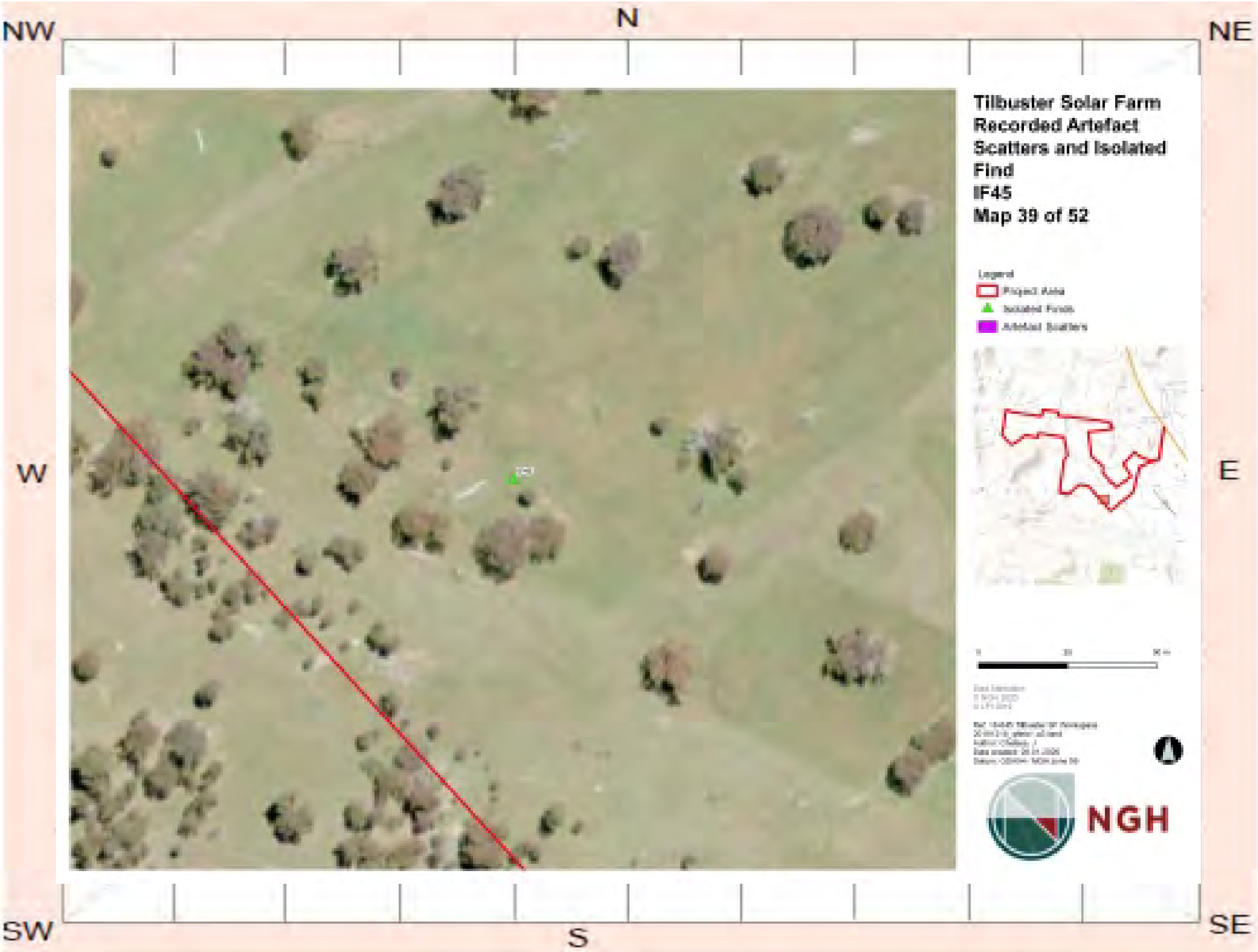
Distance to Water (m): 40

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.2km W of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an alluvial plain adjacent to a fence line in a cleared paddock. The artefact was a silcrete flake located approximately 40 metres south of a second order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

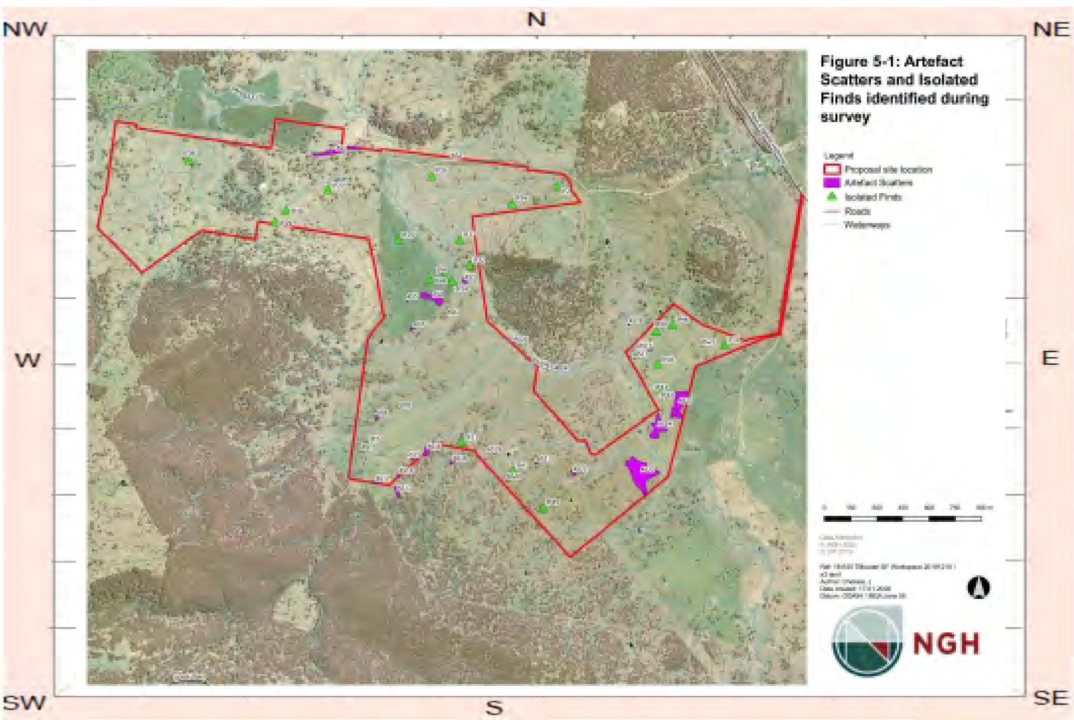
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

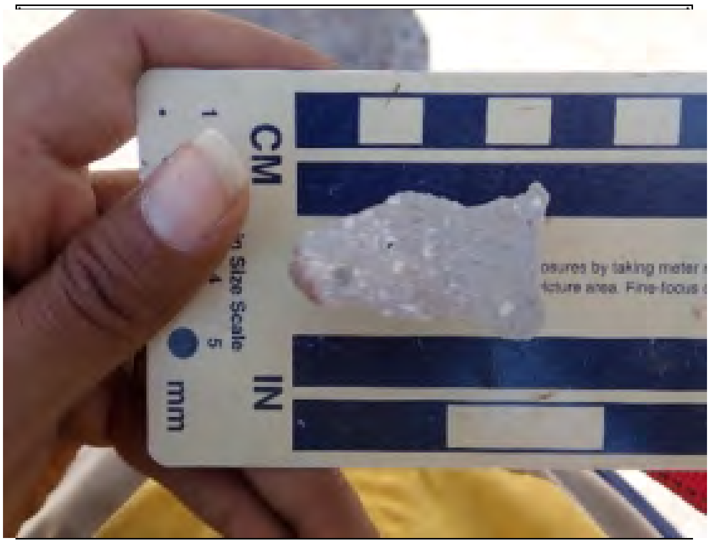
Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF45.



Description: Close up of silcrete flake, Tilbuster Solar Farm IF45.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0308

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF46

Easting: 371566

Northing: 6638492

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

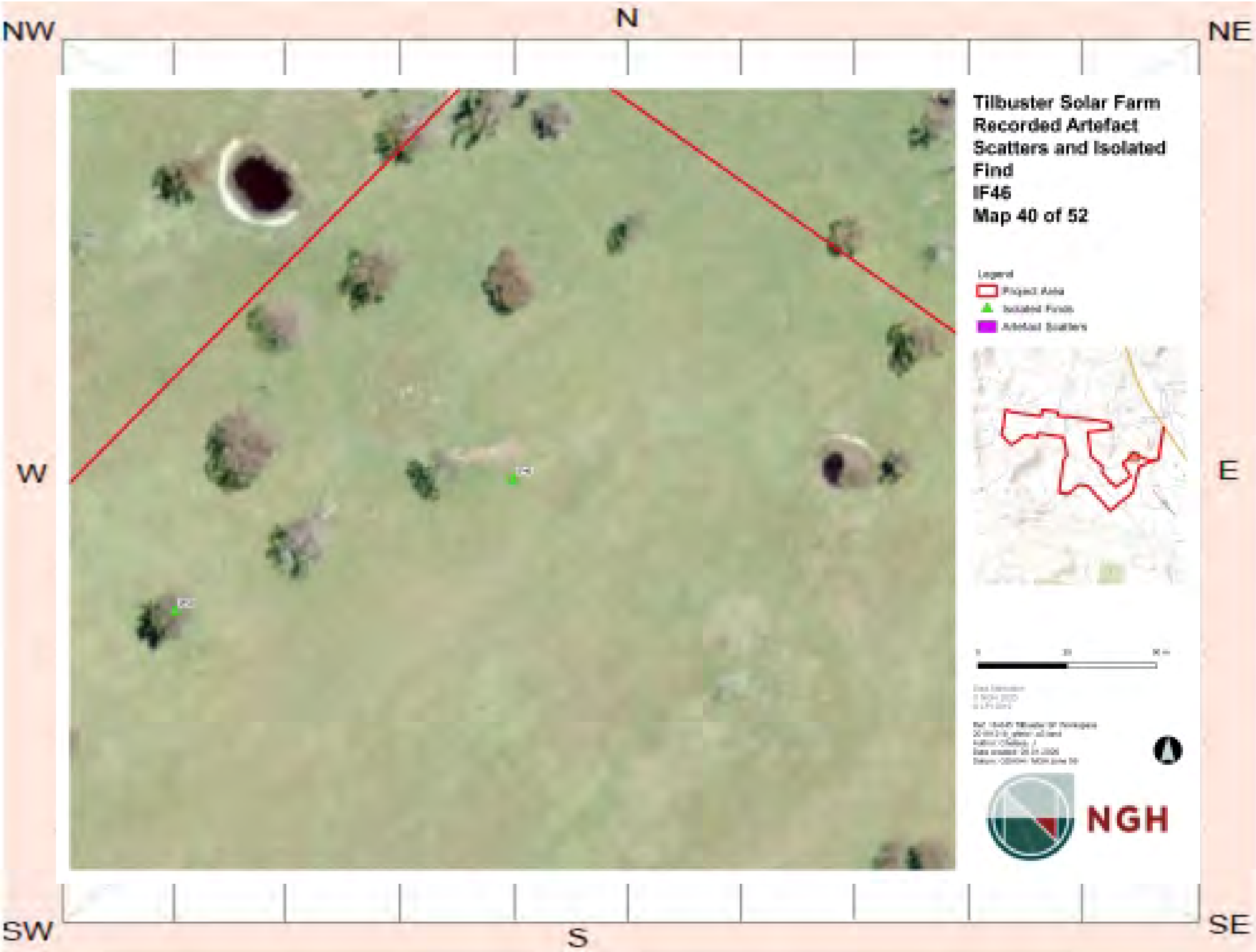
Distance to Water (m): 407

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 826m N of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an alluvial plain in a cleared paddock. The artefact was a possible distal silcrete flake located directly adjacent to an unnamed drainage line.

Features:		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Scarred Trees

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Scarred Trees

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Scarred Trees

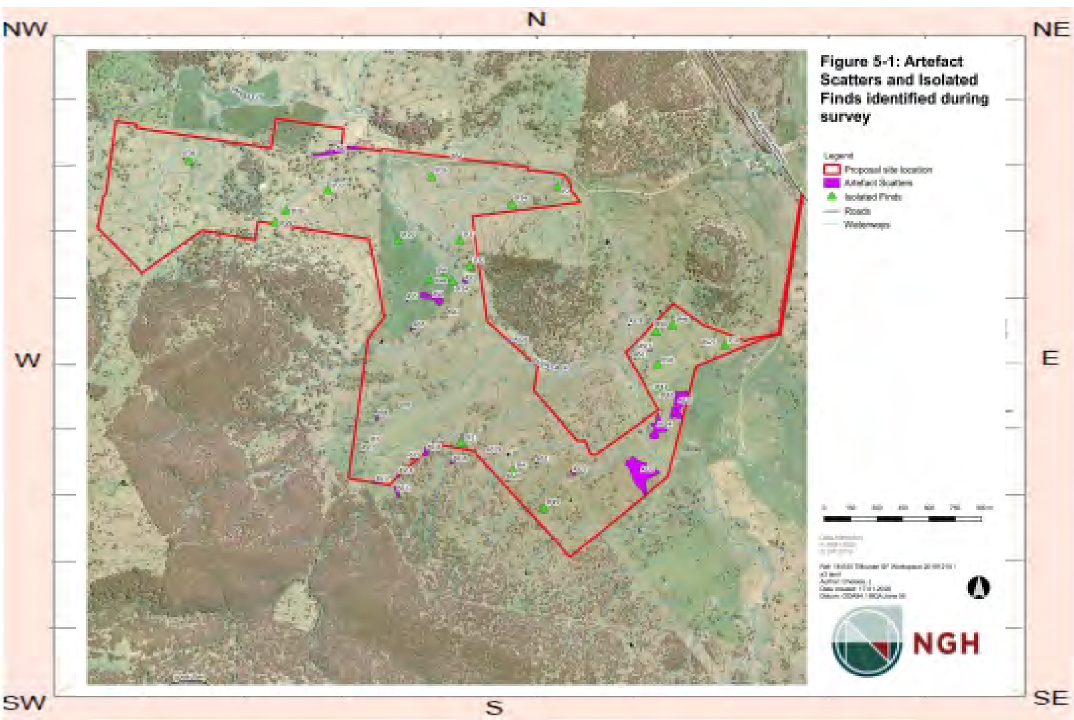
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

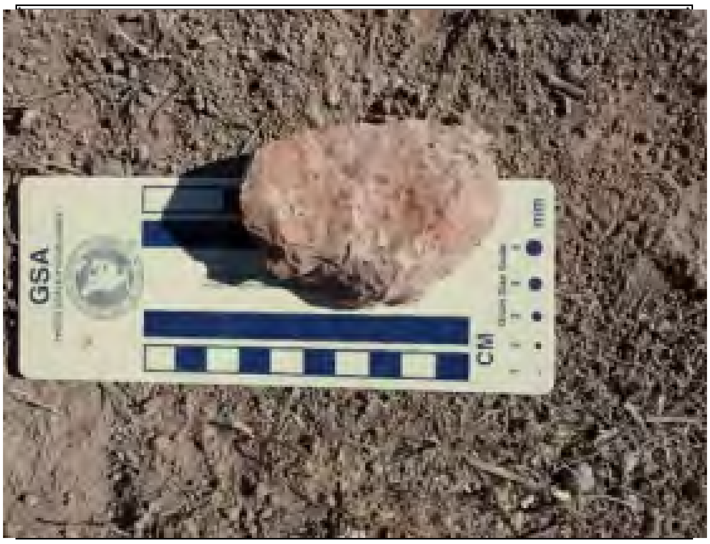
Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: General location of distal silcrete flake, Tilbuster Solar Farm IF46, facing south west.



Description: Close up of possible distal silcrete flake, Tilbuster Solar Farm IF46.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

NSW GOVERNMENT | Office of Environment & Heritage

AHIMS site ID: 21-1-0309

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF47

Easting: 370647 **Northing:** 6637653 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

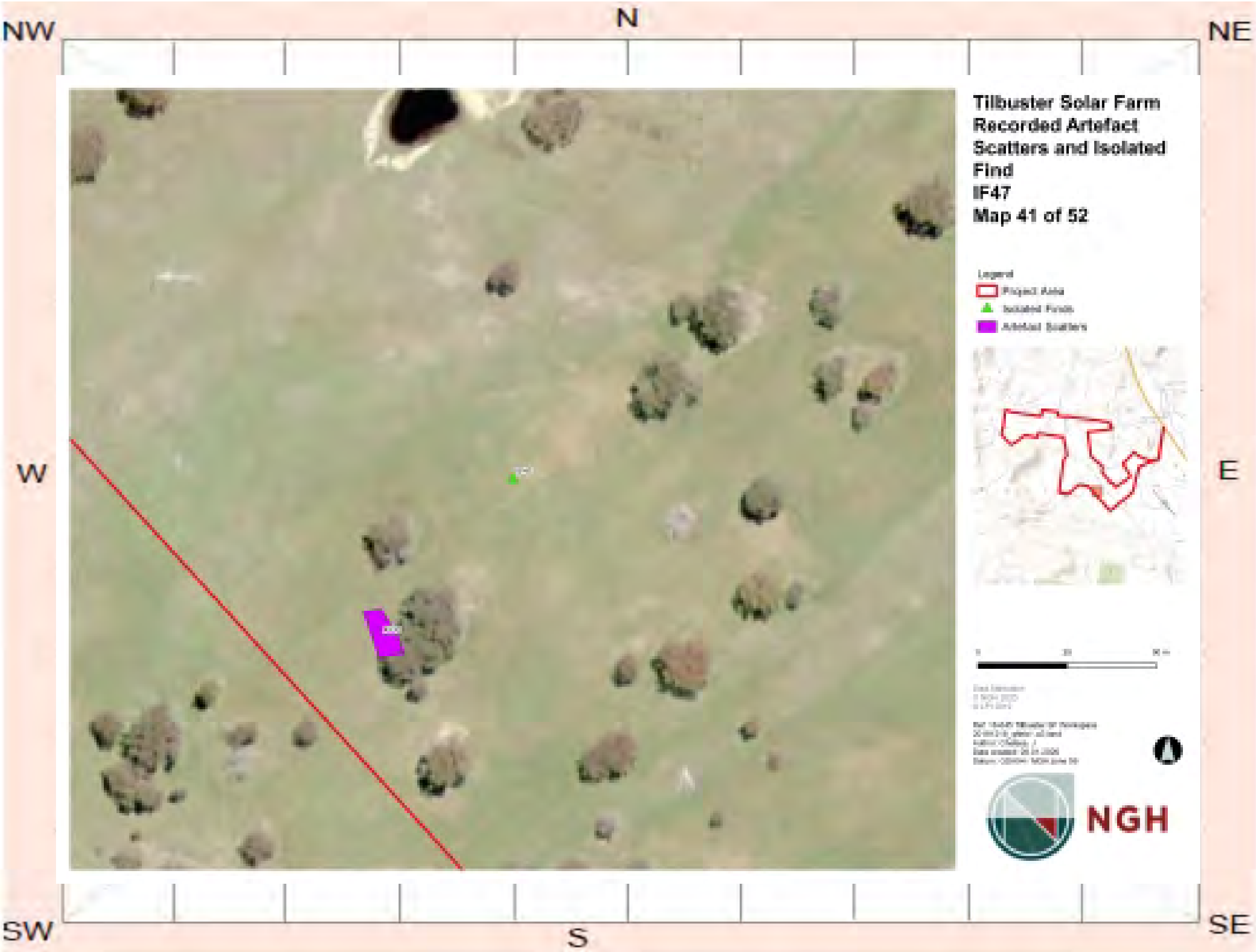
Distance to Water (m): 82

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.3km W of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%. This site is likely associated with AS20 and AS21.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an alluvial plain in a cleared paddock. The artefact was a quartz proximal fragment located approximately 82 metres south east of an unnamed drainage line associated with Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

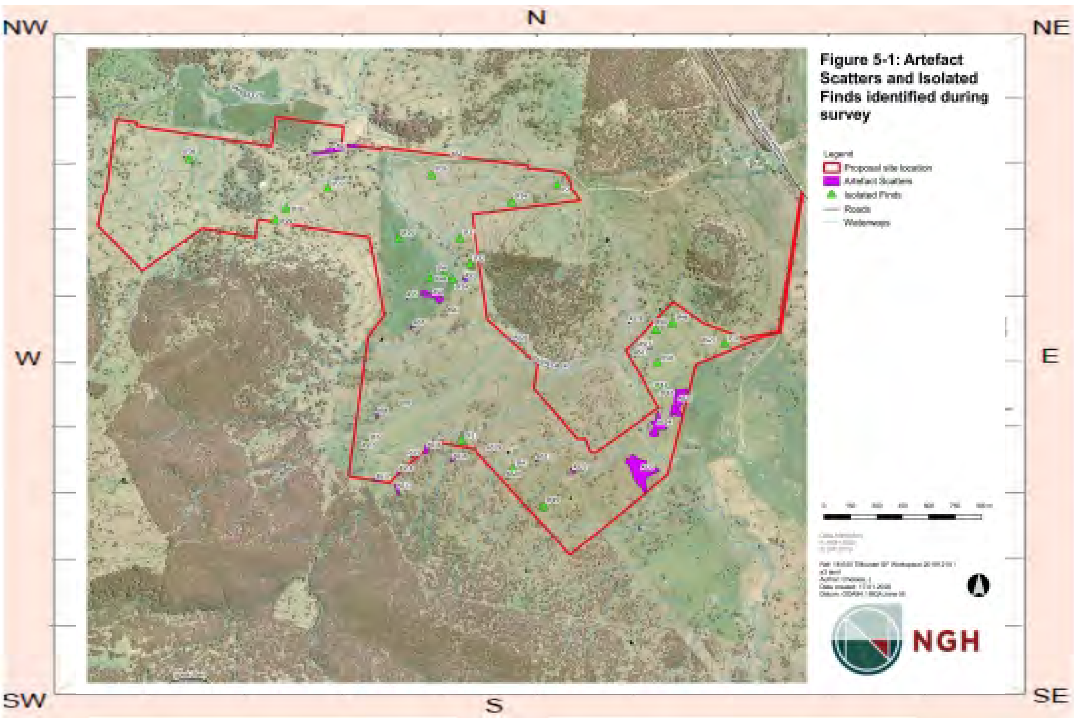
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%. This site is likely associated with AS20 and AS21.

Site plan



Site photographs

Description: Close up of quartz proximal fragment, Tilbuster Solar Farm IF47.

Description: Close up of quartz proximal fragment, Tilbuster Solar Farm IF47.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0310

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF48

Easting: 370170

Northing: 6638750

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

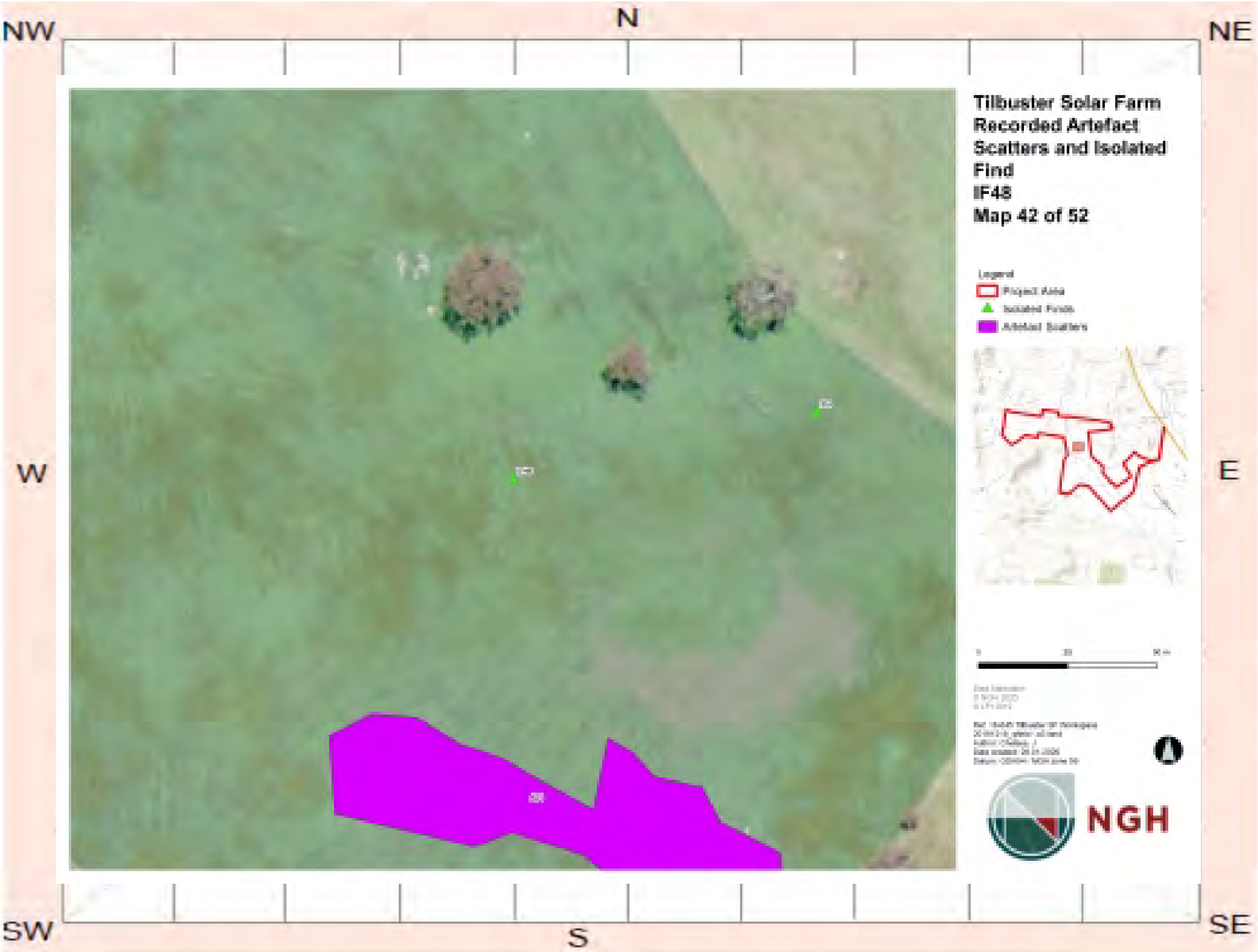
Distance to Water (m): 50

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a cleared paddock on lower slope overlooking Duval Creek, with an easterly aspect. The artefact was a basalt axe.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

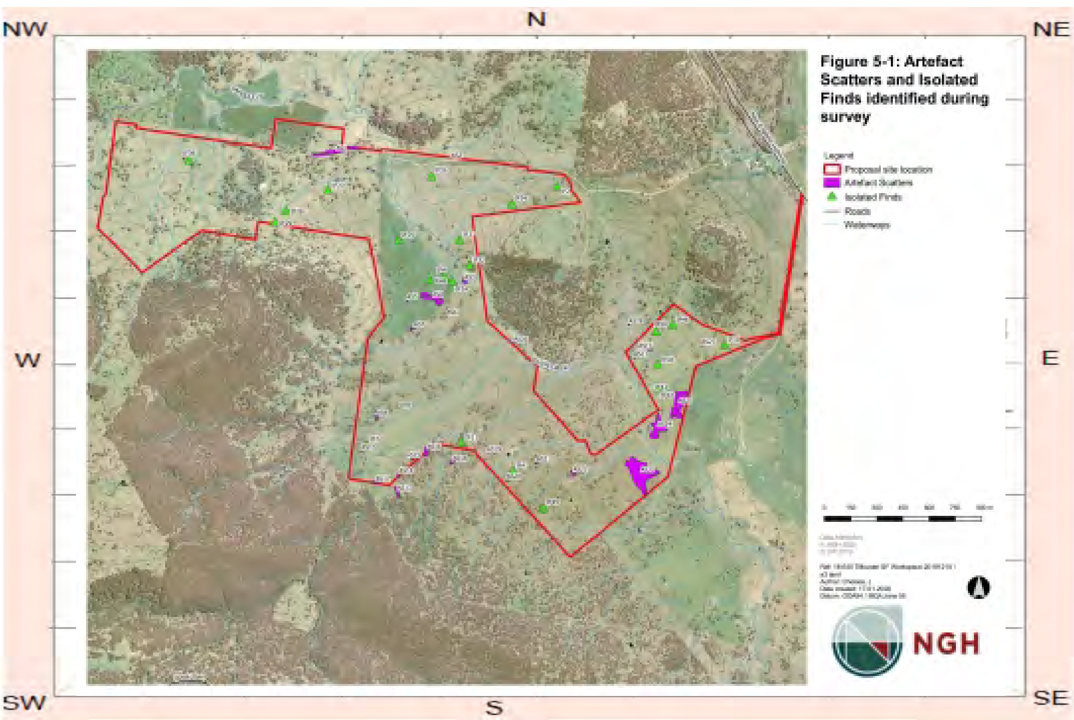
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of basalt axe, Tilbuster Solar Farm IF48.

Description: Close up of basalt axe, Tilbuster Solar Farm IF48.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0311

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF49

Easting: 370375 **Northing:** 6639454 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

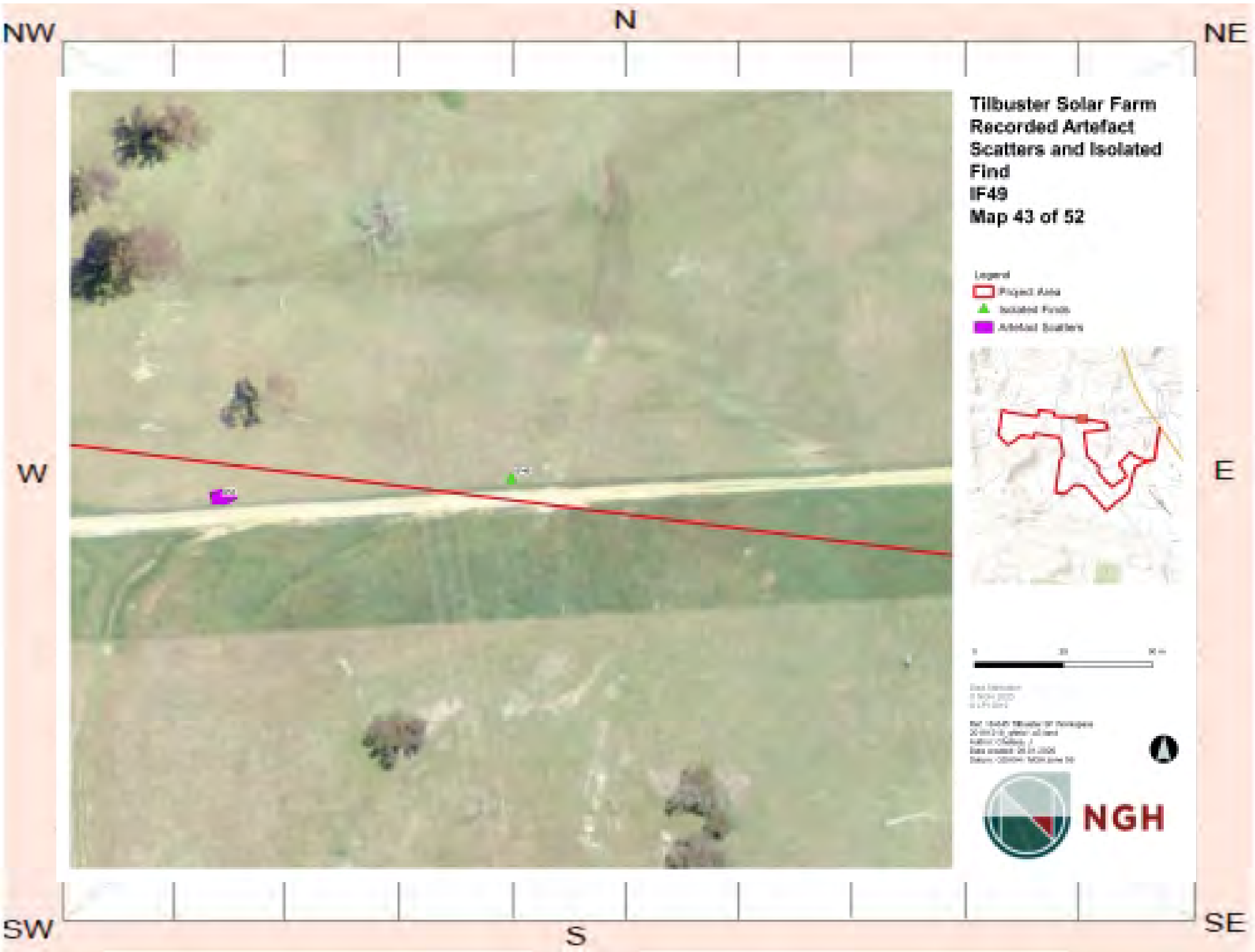
Distance to Water (m): 67

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.3km NNW of house.

Other site information: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact on an existing vehicle track within a cleared paddock. The artefact was a silcrete manuport located approximately 67 metres south of an unnamed drainage line, a tributary of Duval Creek.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

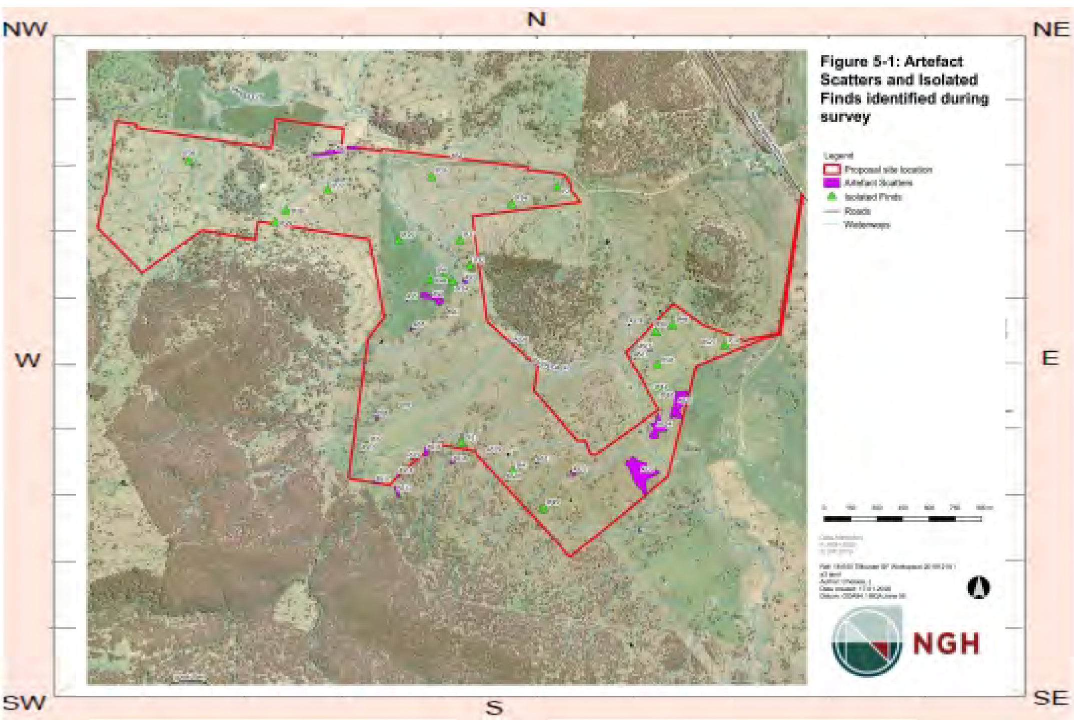
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of an eroded grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete manuport, Tilbuster Solar Farm IF49.

Description: Close up of silcrete manuport, Tilbuster Solar Farm IF49.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0312

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF50

Easting: 371471

Northing: 6638455

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

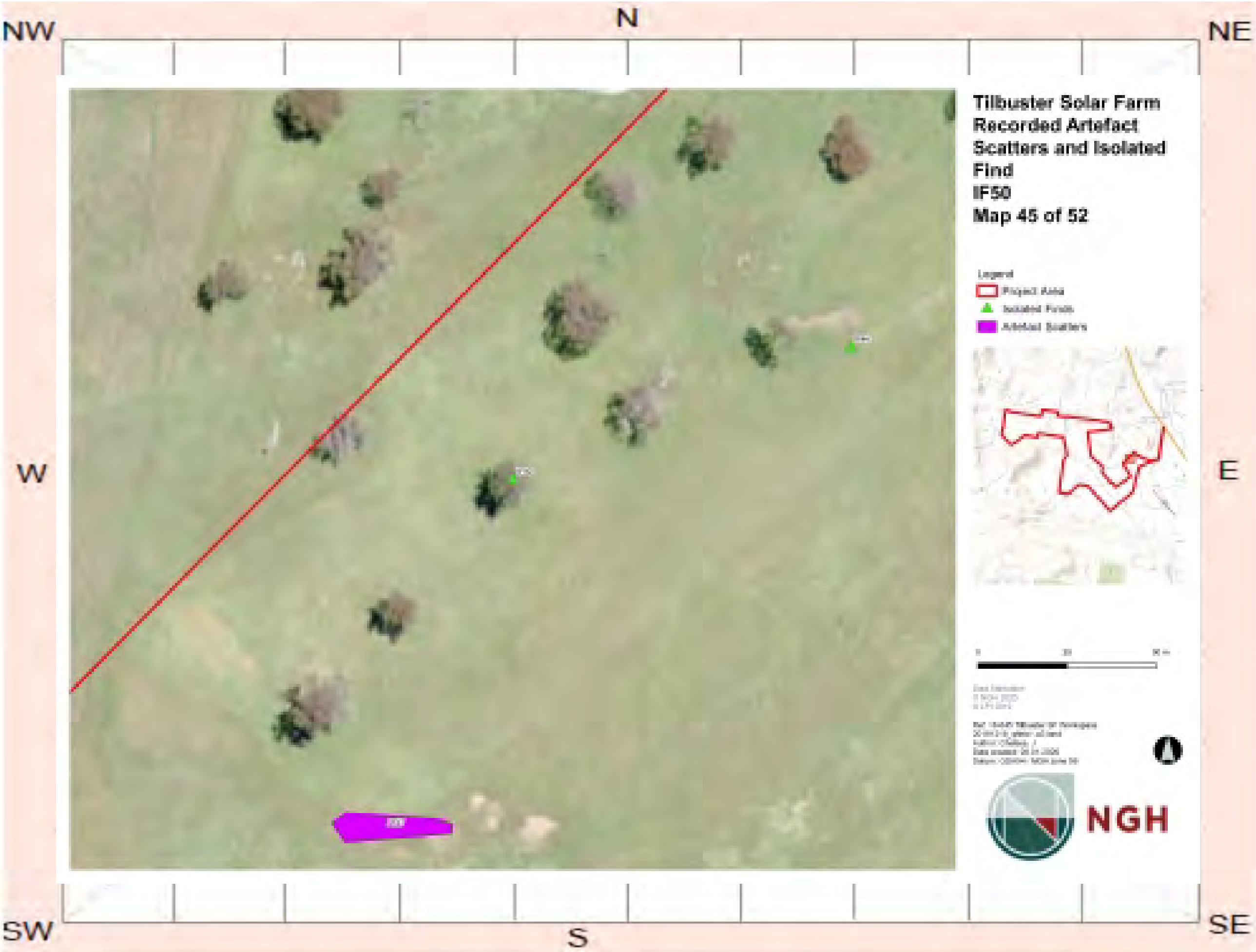
Distance to Water (m): 48

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 861m N of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a predominantly a cleared paddock beside a tree, with a south west aspect overlooking Duval Creek. The artefact was a silcrete flake located approximately 48 metres north west of an unnamed drainage line.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

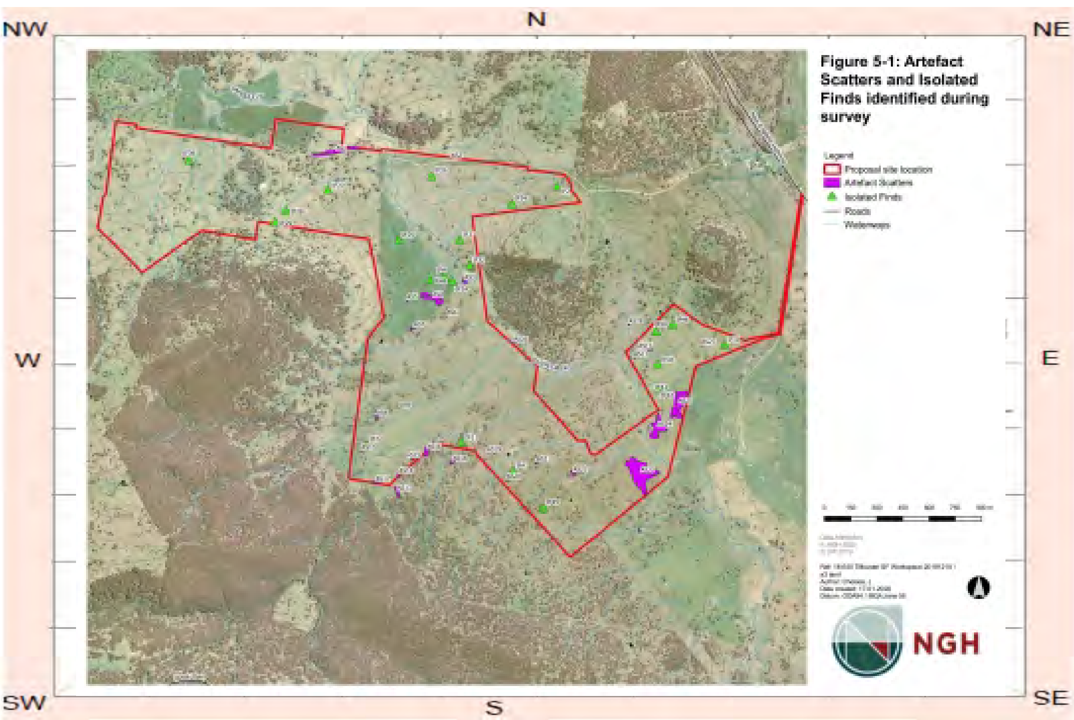
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm IF50.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF50.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW GOVERNMENT

AHIMS site ID: 21-1-0313

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF51

Easting: 369380

Northing: 6639499

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

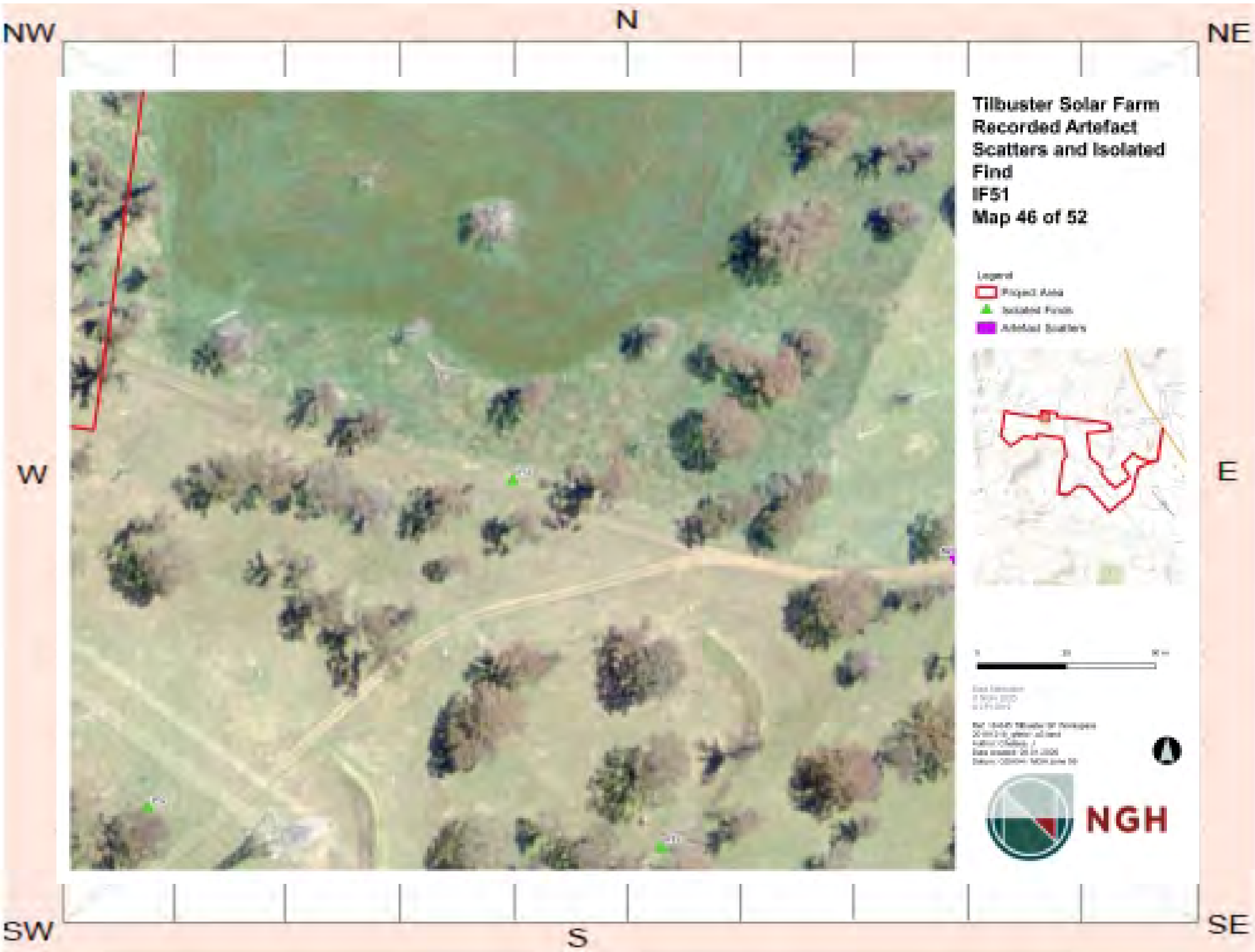
Distance to Water (m): 570

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.0km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along an existing vehicle track on a lower slope with a north-easterly aspect. The artefact was a silcrete proximal fragment.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

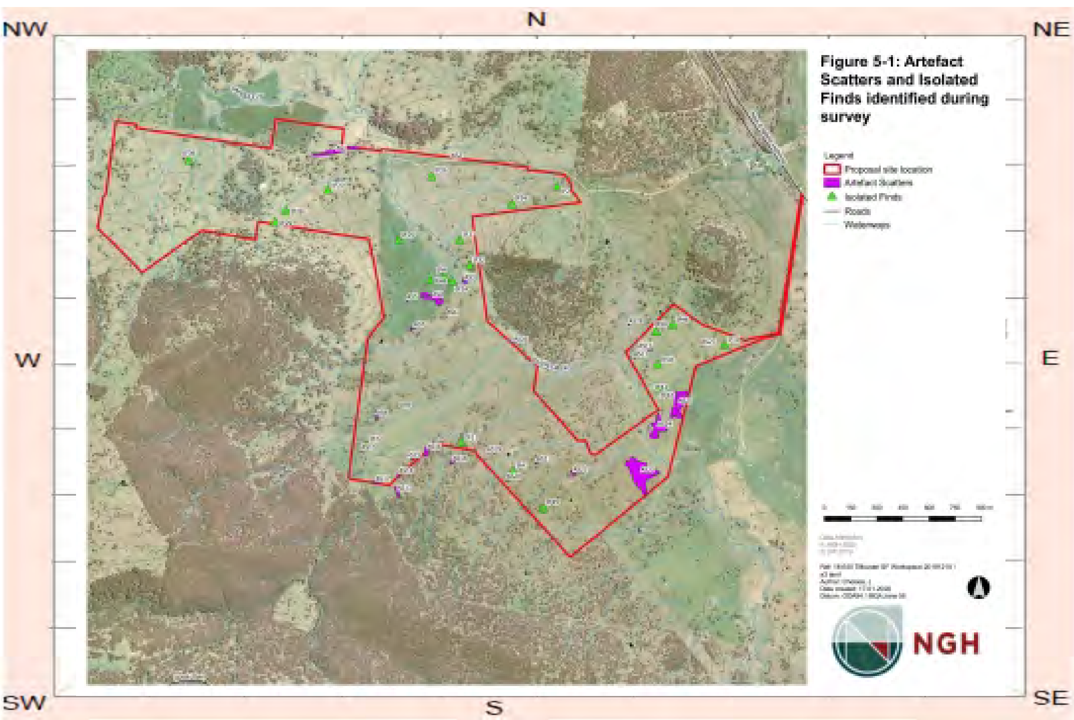
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF51.

Description: Close up of silcrete proximal fragment, Tilbuster Solar Farm IF51.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0314

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF52

Easting: 369277

Northing: 6639407

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 690

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.1km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along an existing transmission line and adjacent to a vehicle track on a lower slope with a north-easterly aspect. The artefact was a silcrete flake.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

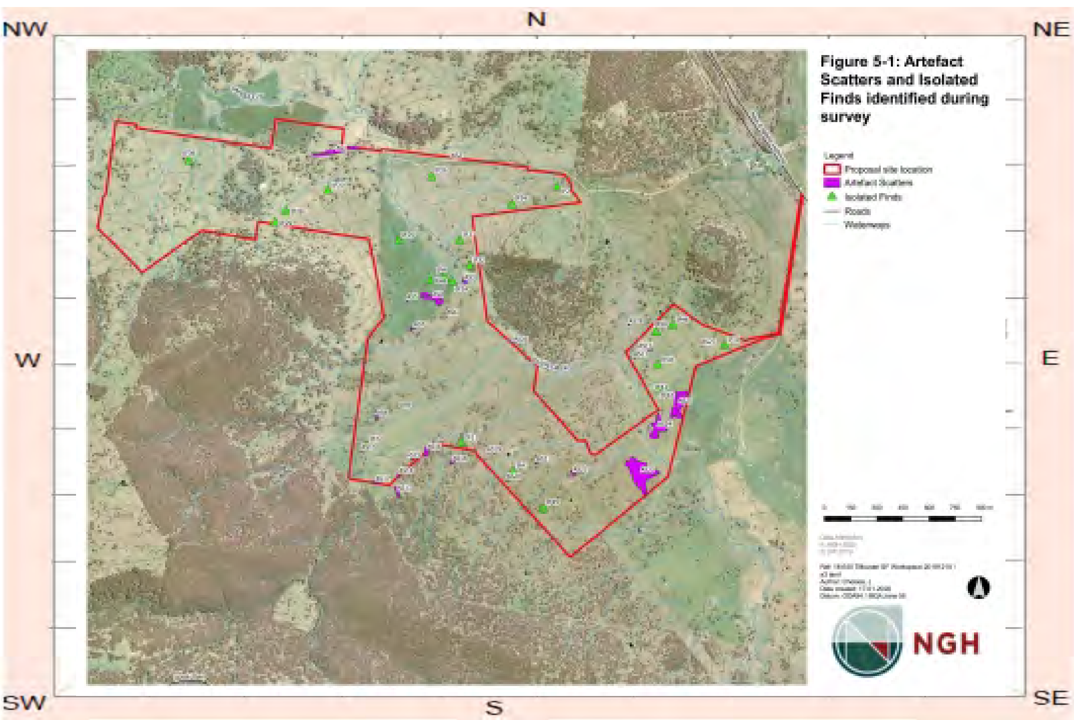
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Location of silcrete flake, Tilbuster Solar Farm IF52.

Description: Close up of silcrete flake, Tilbuster Solar Farm IF52.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0315

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar IF53

Easting: 369421 **Northing:** 6639395 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 510

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.1km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact within a large cluster of trees. The artefact was a secondary quartz flake located east of the existing transmission line.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

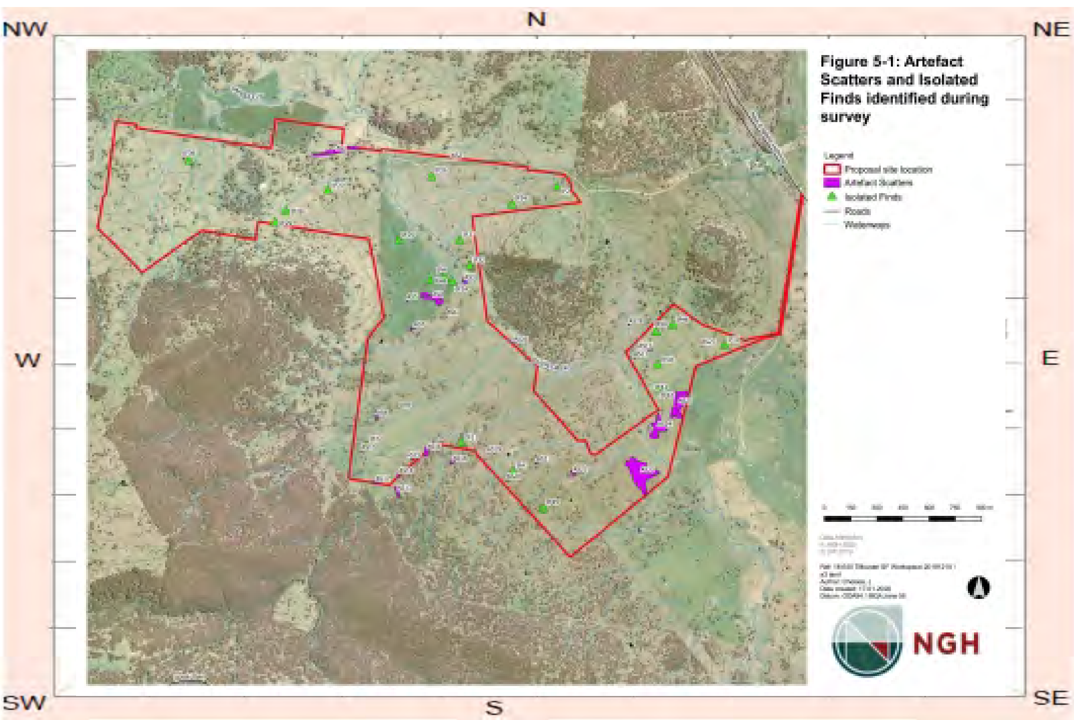
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of quartz flake, Tilbuster Solar Farm IF53.

Description: Close up of quartz flake, Tilbuster Solar Farm IF53.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0316 **Date recorded:** 04-05-2020

Site Location Information

Site name: Tilbuster Solar CT2

Easting: 370018 **Northing:** 6638831 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain **Land Use:** Pastoral/Grazing

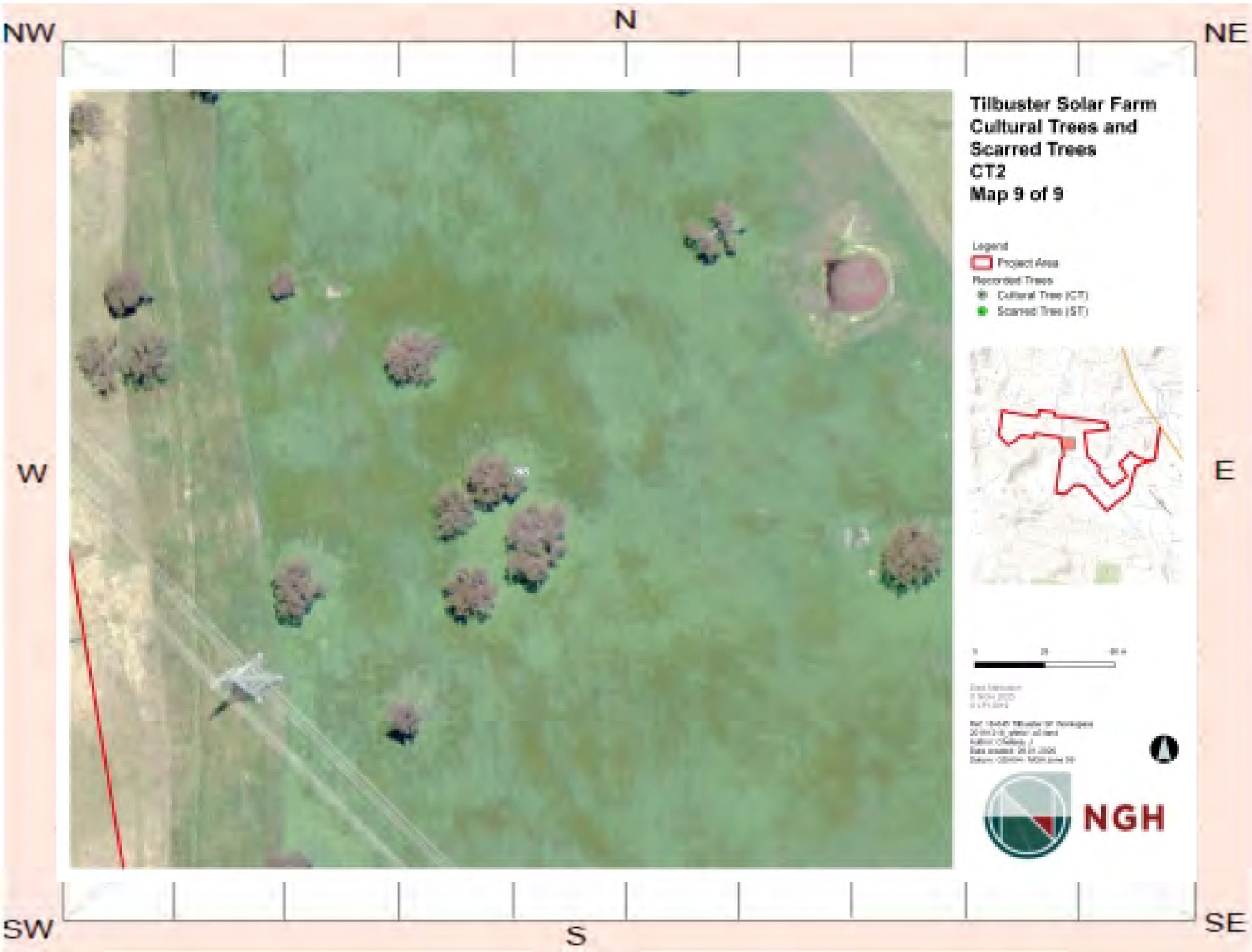
Land Form Unit: Slope **Vegetation:** Isolated clumps of trees

Distance to Water (m): 330 **Primary Report:** Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.3km NW of house.

Other site information: The assessment of the tree concluded it not to be consistent with Aboriginal scarring morphology due to the amorphous shape of the scar and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was determined

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1. Modified Tree	1	00	00	00	00	Other	Other

Description:

The scar identified on this tree were determined to not be archaeological in nature and did not conform to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The morphological characteristics of the scarring are interpreted to conform with natural scarring (cf. Lo

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

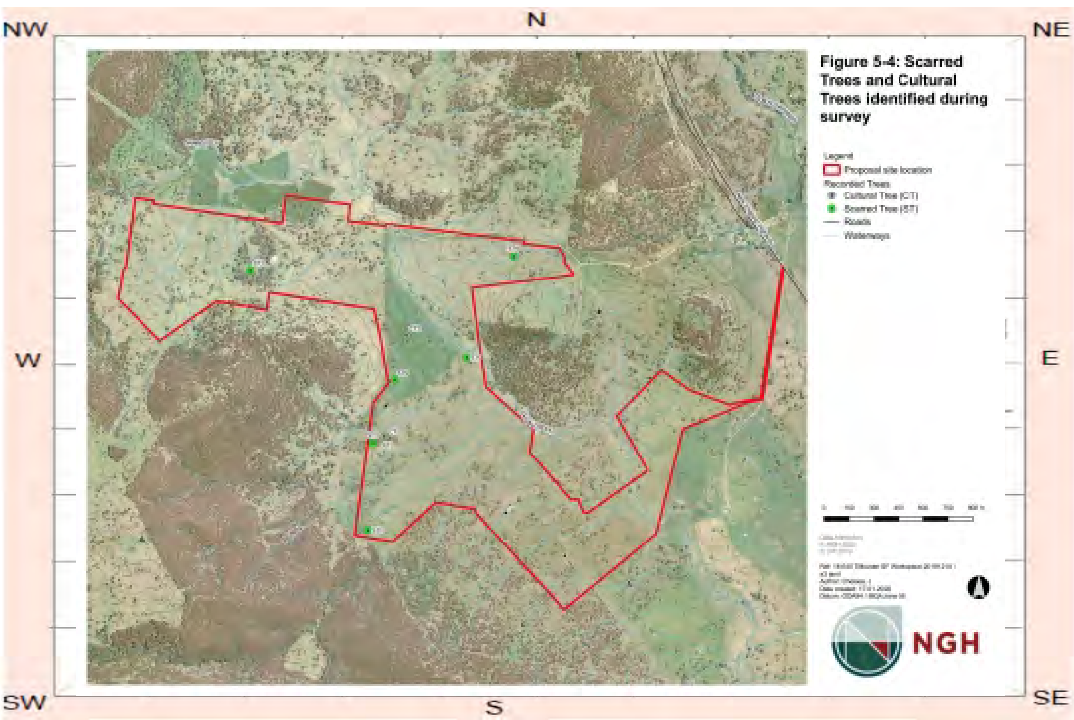
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The assessment of the tree concluded it not to be consistent with Aboriginal scarring morphology due to the amorphous shape of the scar and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was determined

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm CT2.

Description: View north-west of Tilbuster Solar Farm CT2.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0317 **Date recorded:** 04-05-2020

Site Location Information

Site name: Tilbuster Solar ST2

Easting: 369070 **Northing:** 6639228 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain **Land Use:** Pastoral/Grazing

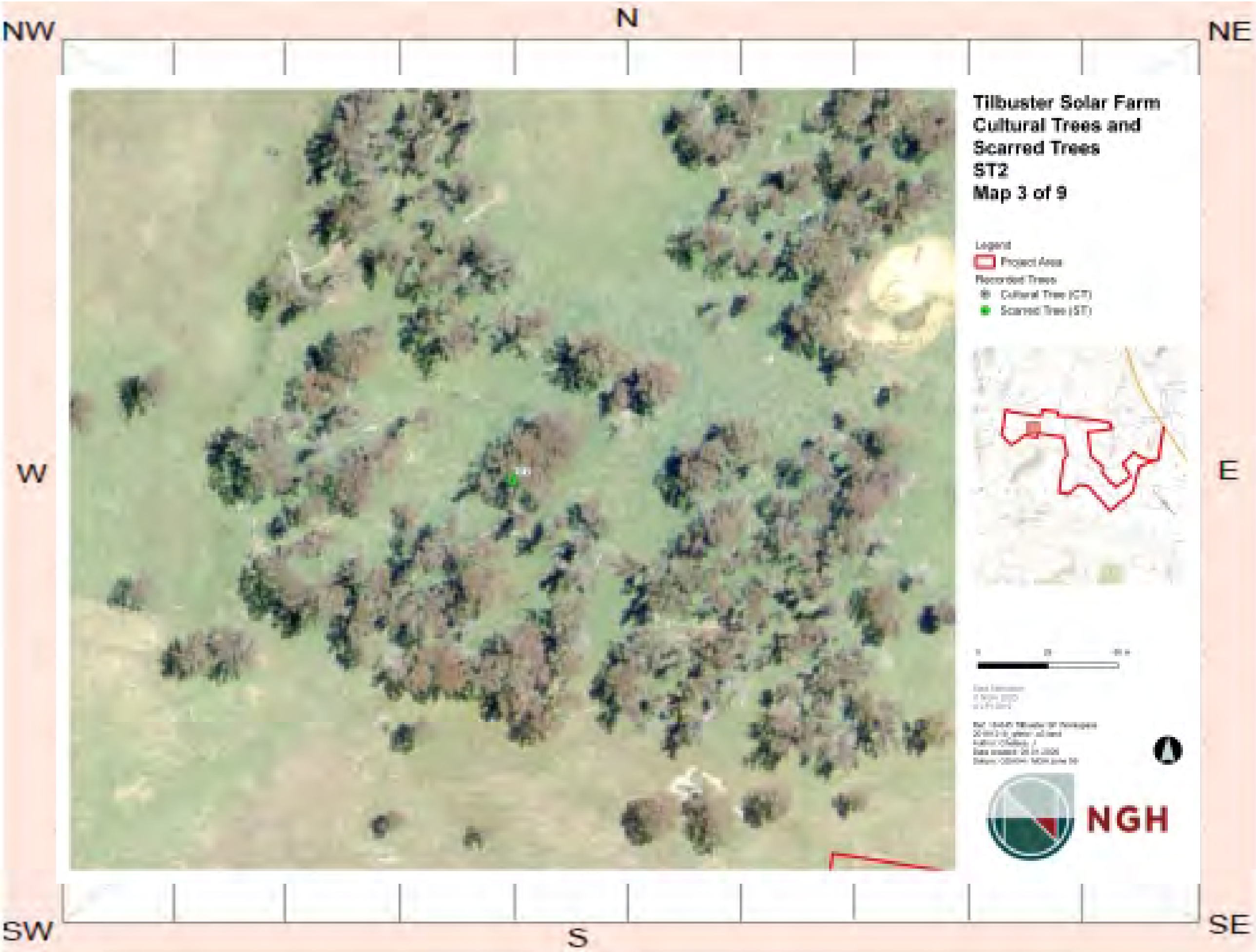
Land Form Unit: Slope **Vegetation:** Isolated clumps of trees

Distance to Water (m): 887 **Primary Report:** Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 3.3km NW of house.

Other site information: The tree is alive, standing and of box species, in poor condition that has a single curved pre-form scar. No axe marks were noted. It was noted that scar was in poor condition with large sections of the dry face missing and generally degraded.

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	187	40	20	10	Oval	Box

Description:

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The oval scar is in poor condition and located on the trunk of the tree facing southwest. The scar measured 187 cm in length by 40 cm in width and has a depth of 20cm.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

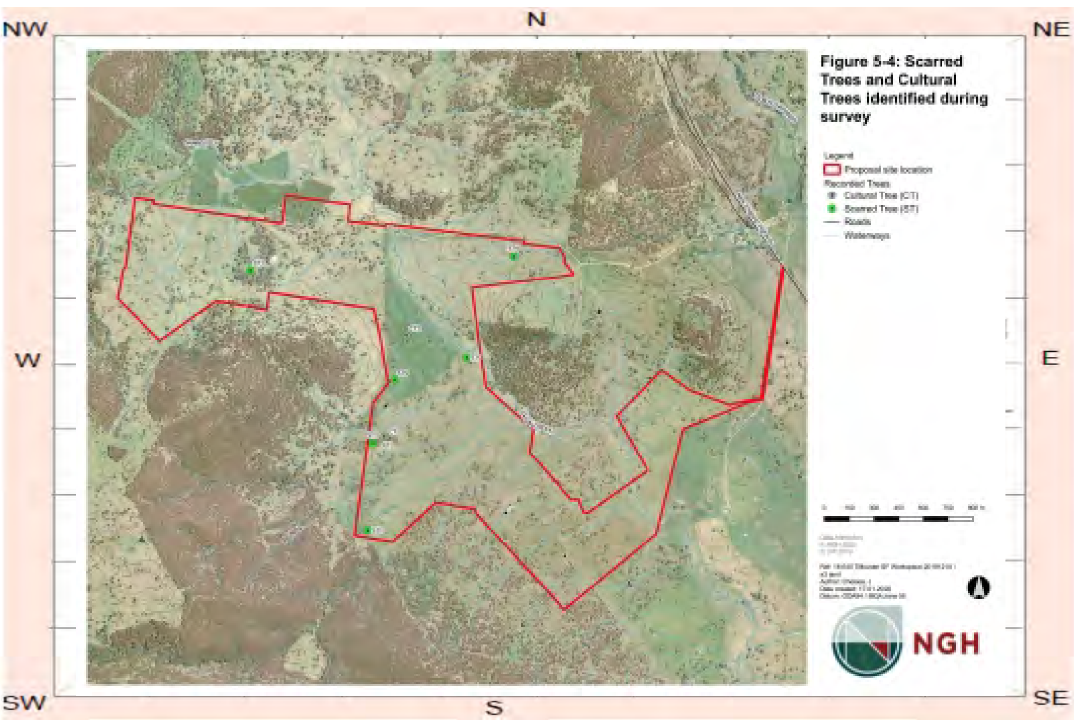
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The tree is alive, standing and of box species, in poor condition that has a single curved pre-form scar. No axe marks were noted. It was noted that scar was in poor condition with large sections of the dry face missing and generally degraded.

Site plan



Site photographs

Description: View north-west of Tilbuster Solar Farm ST2.

Description: View north-west of Tilbuster Solar Farm ST2.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0318 **Date recorded:** 04-05-2020

Site Location Information

Site name: Tilbuster Solar ST3

Easting: 369813 **Northing:** 6638179 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

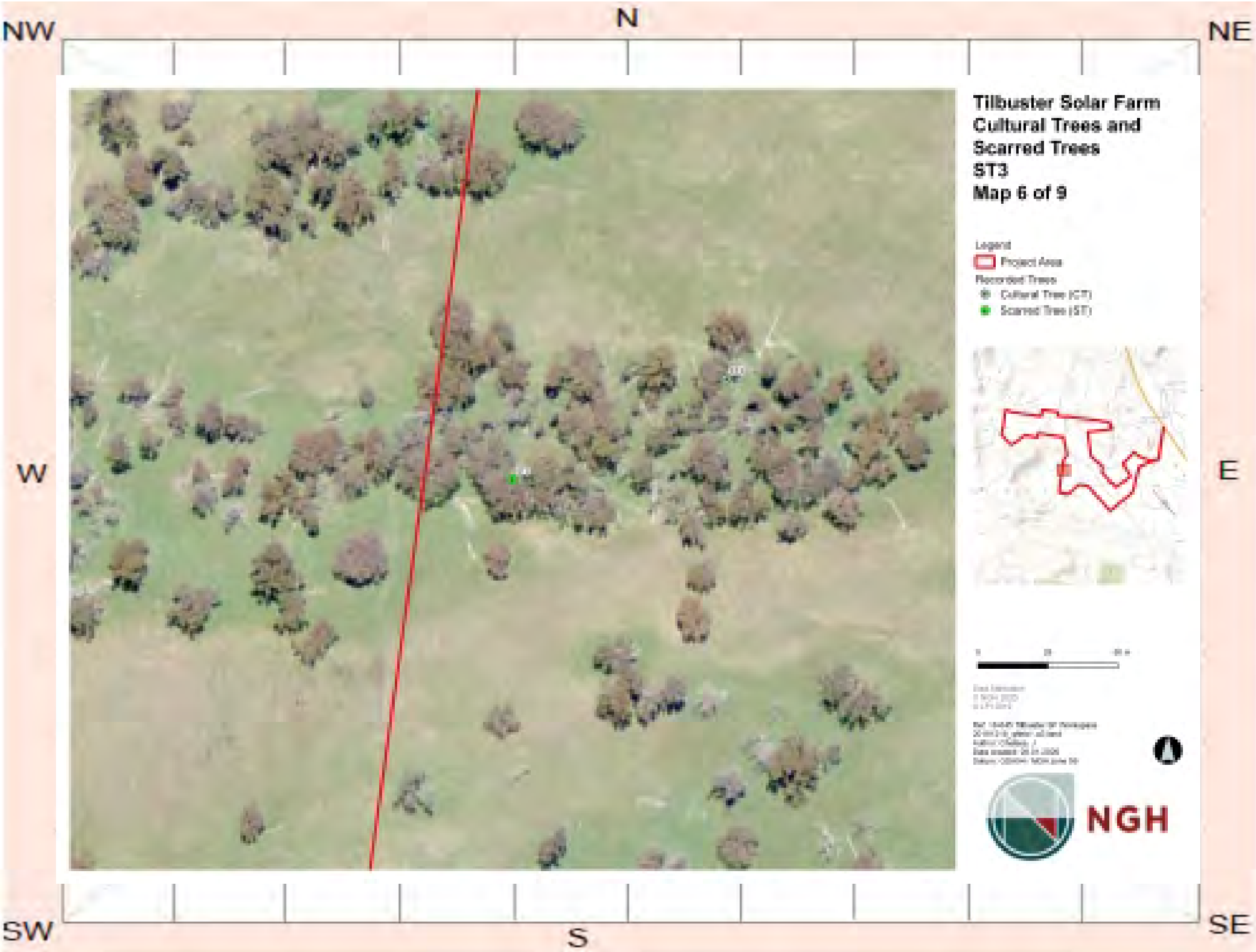
Distance to Water (m): 926

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.3km W of house.

Other site information: The tree is a dead, standing and of undetermined species, in poor condition that has a single curved pre-form scar . No axe marks were noted It was noted that the scar preservation was poor, while the oval shape and possible regrowth were evident the scar timber had physically decayed and hollowed.

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	110	20	7	00	Oval	Other

Description:

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The oval scar is located on the trunk of the tree facing northeast. The scar measures 110 centimetres in length by 20 centimetres in width and has a depth of 7 centimetres.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

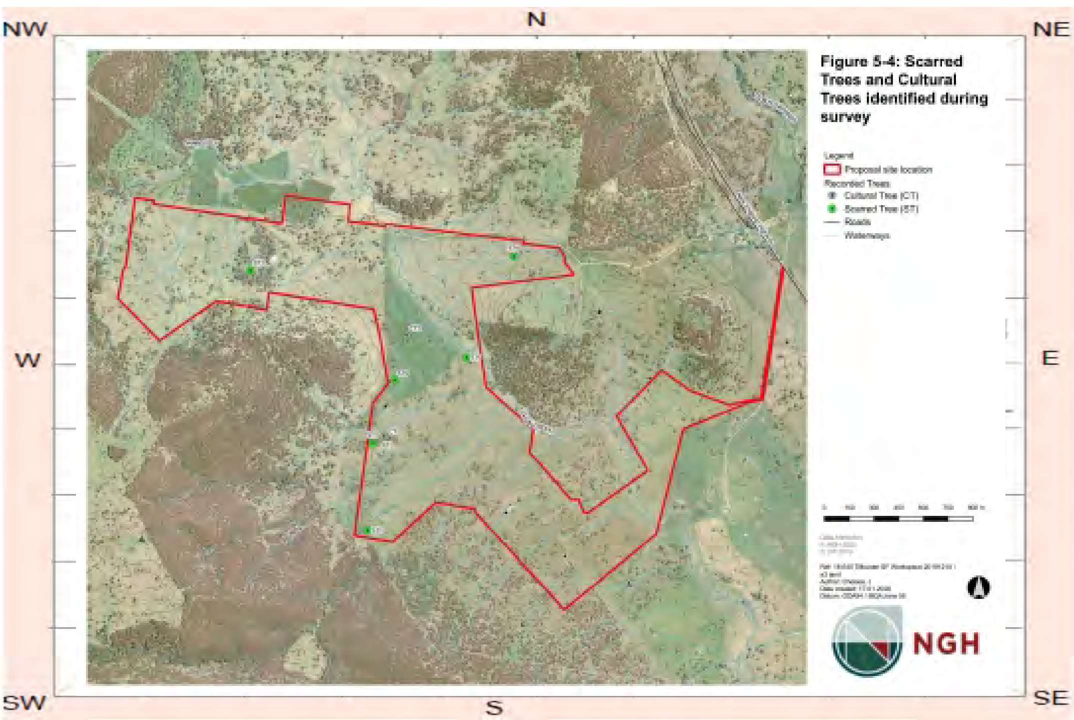
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The tree is a dead, standing and of undetermined species, in poor condition that has a single curved pre-form scar . No axe marks were noted It was noted that the scar preservation was poor, while the oval shape and possible regrowth were evident the scar timber had physically decayed and hollowed.

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm ST3.

Description: View north-west of Tilbuster Solar Farm ST3.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0319

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar ST4

Easting: 370669 **Northing:** 6639312 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

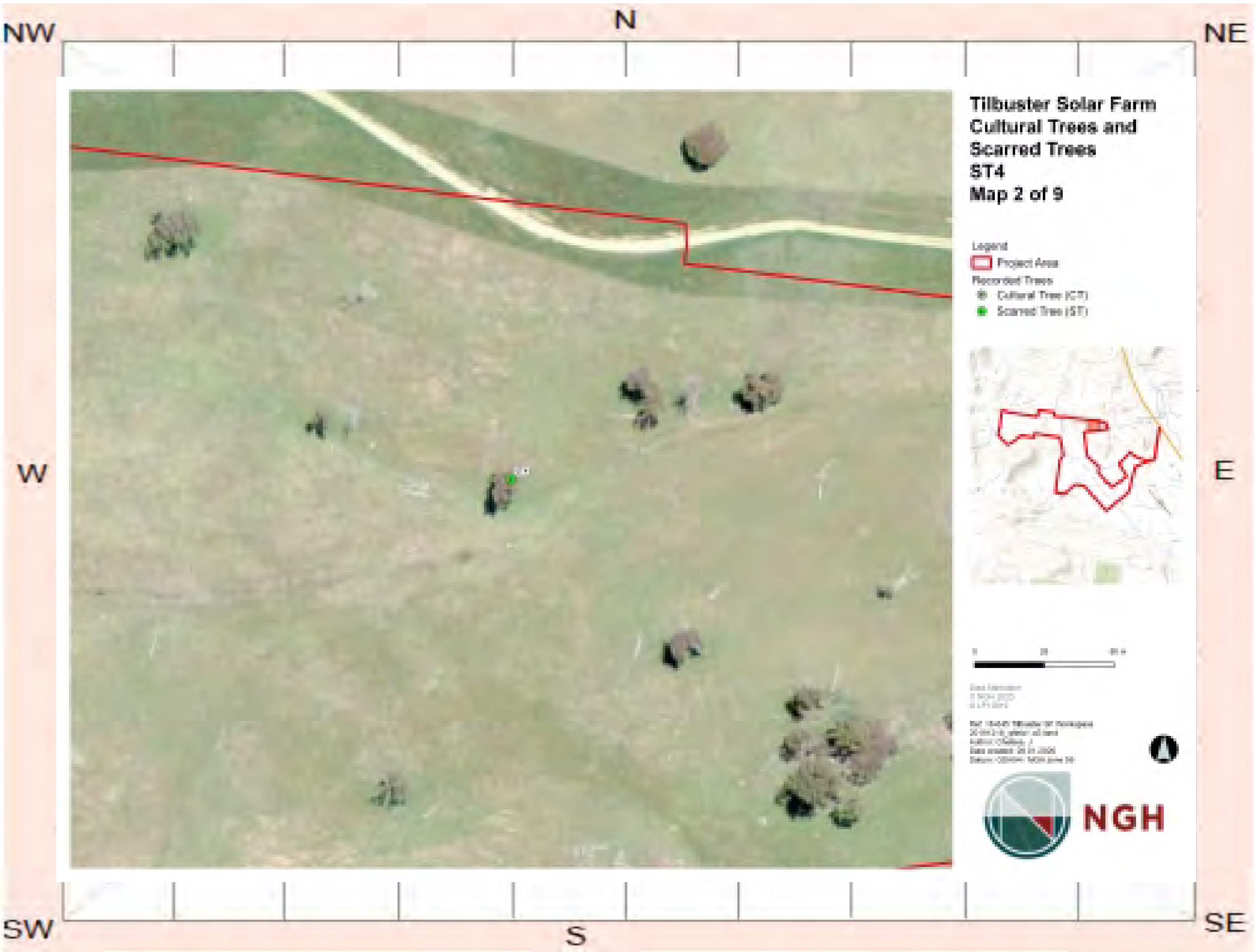
Distance to Water (m): 700

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.7km NW of house.

Other site information: The tree is alive, standing and is a stringybark species, in good condition that has a curved pre-form single scar . No axe marks were noted It was noted that the scar preservation was poor, while the oval shape and possible regrowth were evident the scar timber had physically decayed and hollowed.

Site location map



Site contents information

open/closed site: Open **Site condition:** Good

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	370	36	20	10	Oval	Stringy Bark

Description:

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The oval scar is located on the trunk of the tree facing north east. The scar measure 370 centimetres in length by 36 centimetres in width and has a depth of 20 centimetres.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

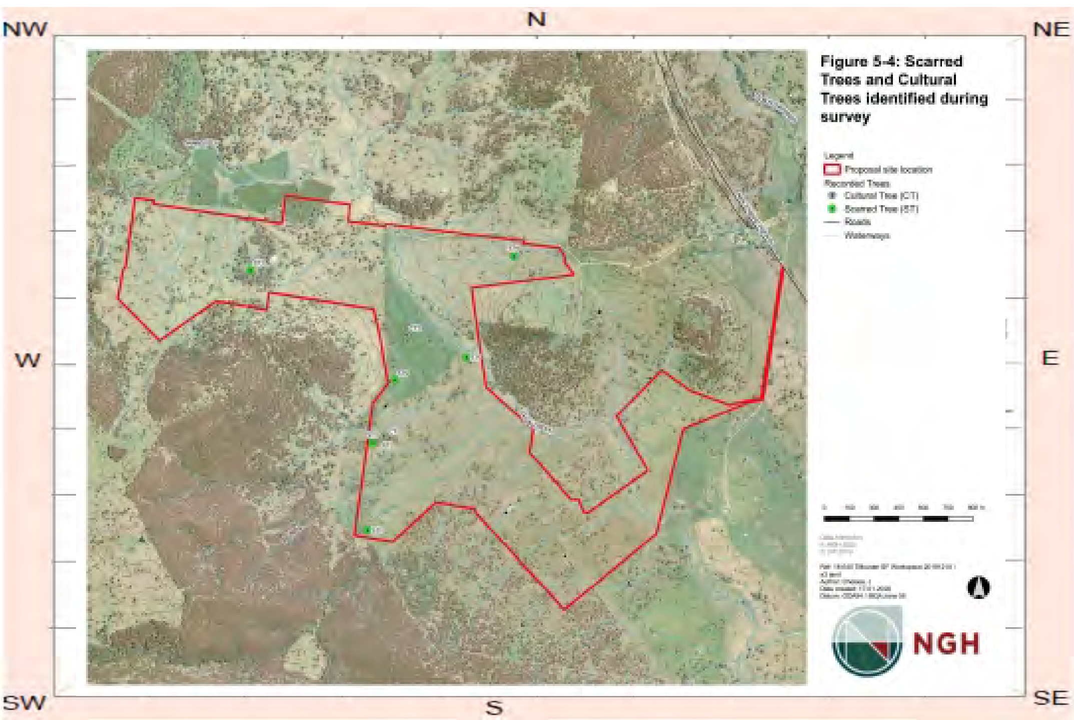
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The tree is alive, standing and is a stringybark species, in good condition that has a curved pre-form single scar . No axe marks were noted It was noted that the scar preservation was poor, while the oval shape and possible regrowth were evident the scar timber had physically decayed and hollowed.

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm ST4.

Description: View south-west of Tilbuster Solar Farm ST4.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0320

Date recorded: 04-05-2020

Site Location Information

Site name: Tilbuster Solar ST5

Easting: 370382

Northing: 6638699

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

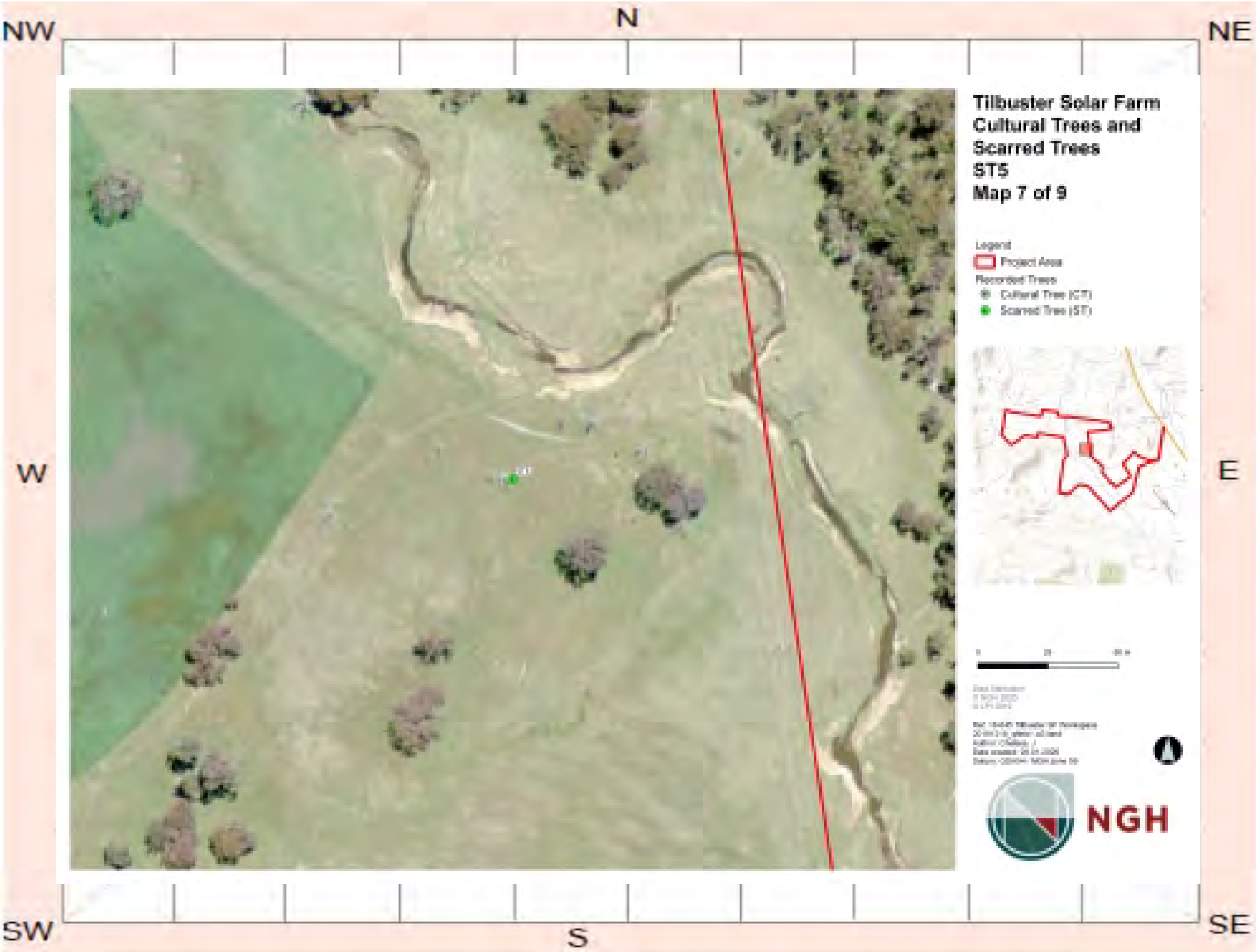
Distance to Water (m): 50

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.8km NW of house.

Other site information: The tree is dead, standing and is of unknown species. Considered to be a possible marker tree.

Site location map



Site contents information

open/closed site: Open

Site condition: Good

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	2	65	40	7	7	Rectangura	Other

Description:

This site consists of a single scarred tree (2 scars) considered to be Aboriginal in origin within a predominantly cleared paddock. The south facing scar measures 65cm in length by 40cm in width and has a depth of 6cm. The west facing scar is approx. 61cm in length by 37 cm and has a depth of 5cm.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Scarred Trees

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Scarred Trees

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Scarred Trees

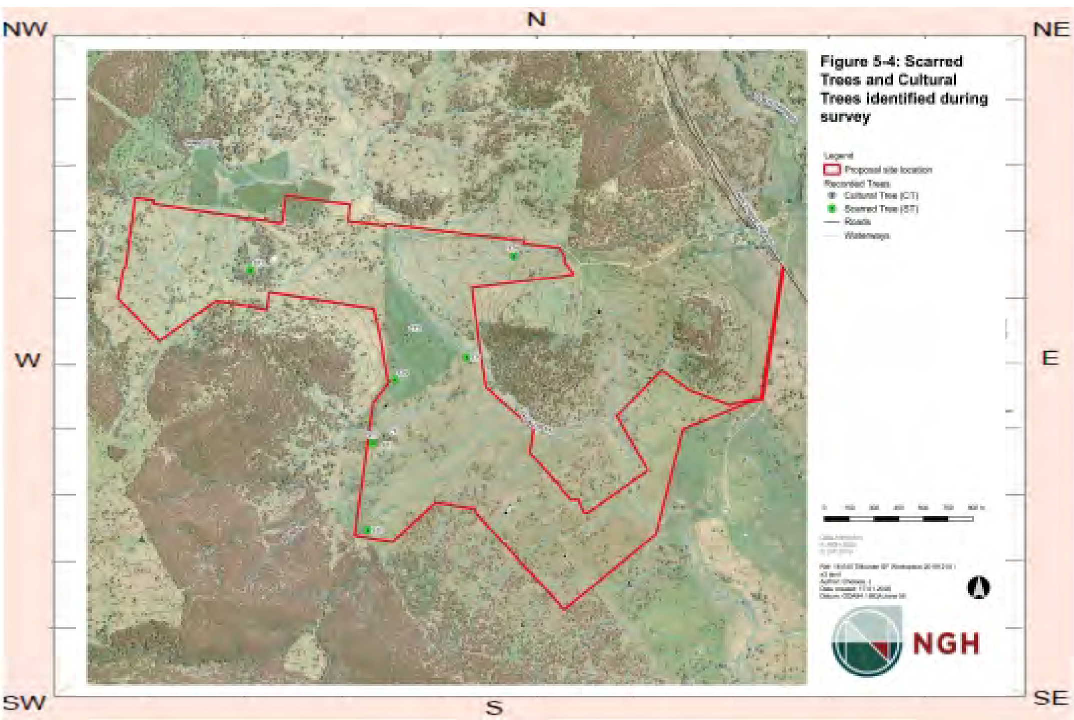
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The tree is dead, standing and is of unknown species. Considered to be a possible marker tree.

Site plan



Site photographs

Description: Close up of west scar at Tilbuster Solar Farm ST5.

Description: Close up of south scar Tilbuster Solar Farm ST5.

Description: View of west scar, facing east of Tilbuster Solar Farm ST5.

Description: View of south scar, facing north of Tilbuster Solar Farm ST5.

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0321

Date recorded: 03-05-2020

Site Location Information

Site name: Tilbuster Solar IF14

Easting: 370192

Northing: 6637846

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

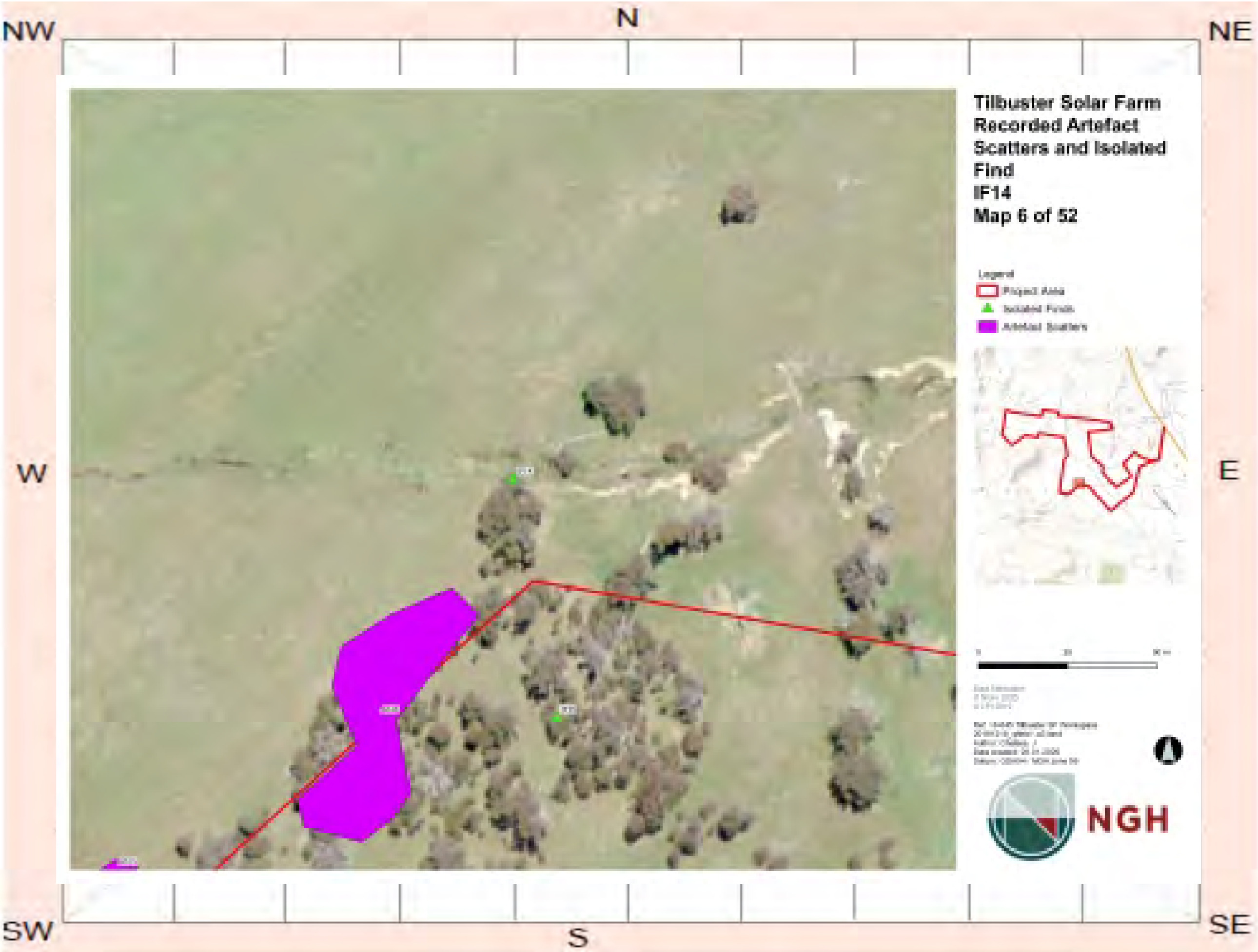
Distance to Water (m): 1190

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.7km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a cluster of trees. The artefact was a cream chert flake located along an unnamed third order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
3.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
4.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

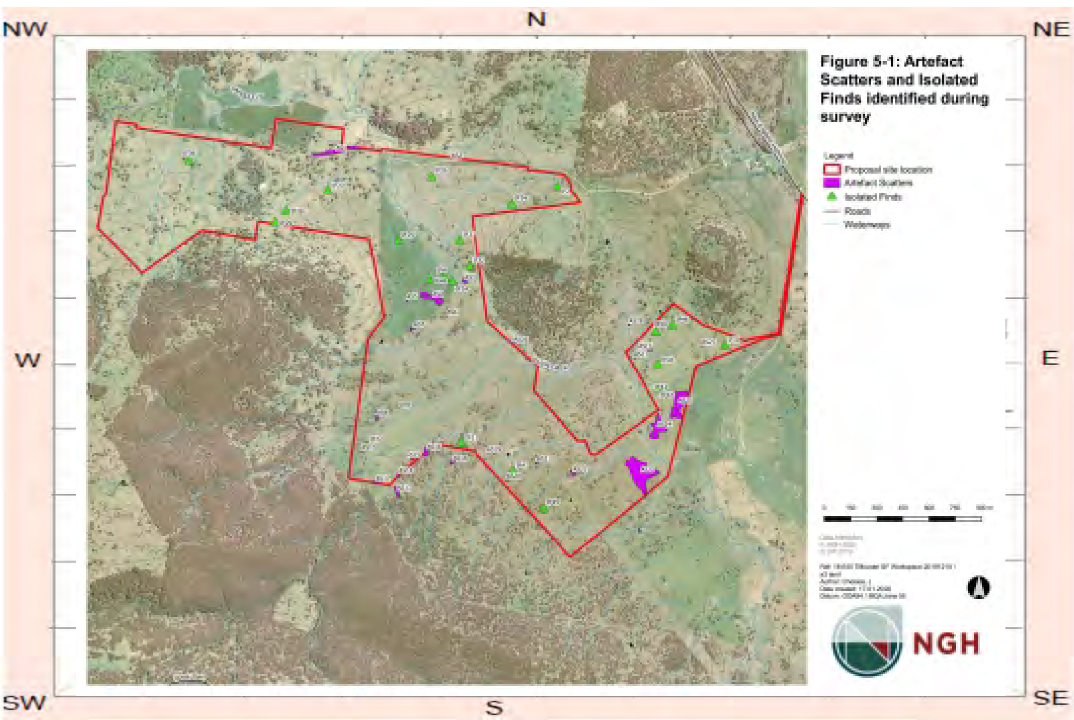
	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
5.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of chert flake, Tilbuster Solar Farm IF14.

Description: Close up of chert flake, Tilbuster Solar Farm IF14.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage (NSW Government)

AHIMS site ID: 21-1-0322

Date recorded: 03-05-2020

Site Location Information

Site name: Tilbuster Solar IF15

Easting: 370432 **Northing:** 6637882 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

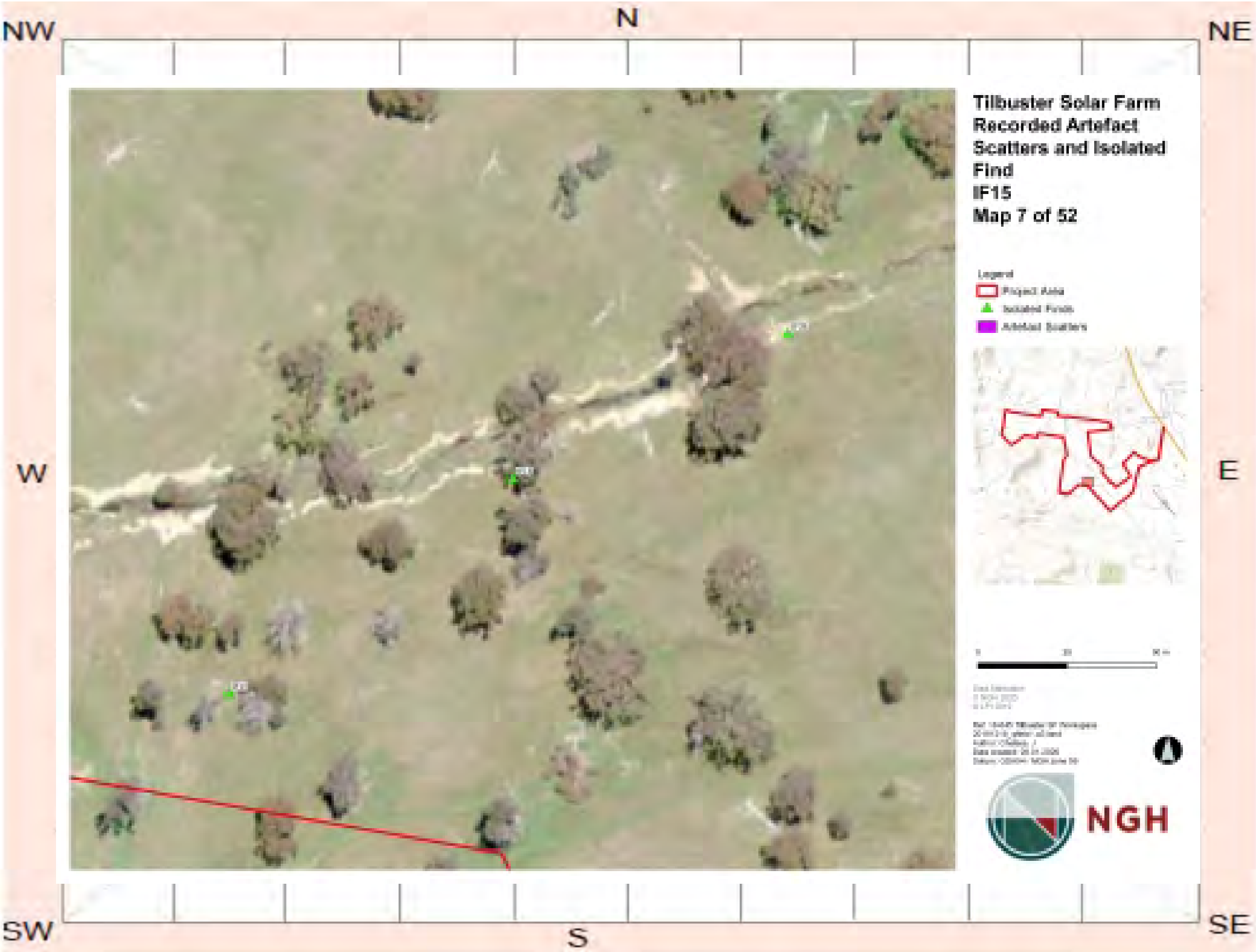
Distance to Water (m): 10

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.5km NW of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single unifacial silcrete flake core located approximately 10 metres south of a third order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

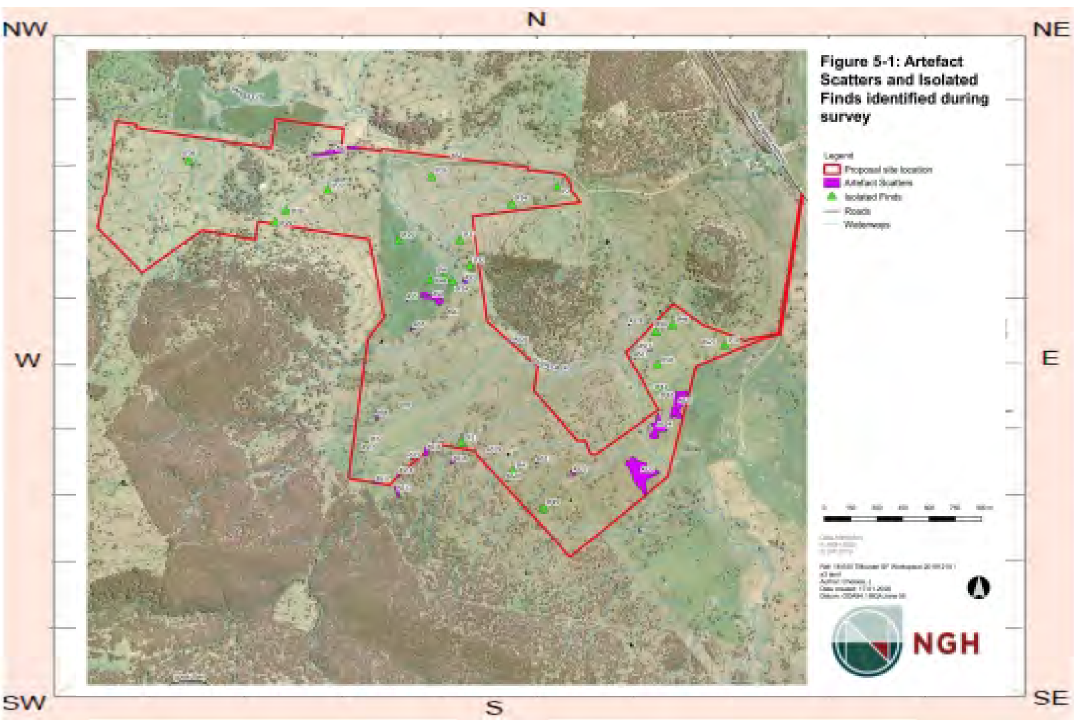
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of unifacial silcrete flake core, Tilbuster Solar Farm IF15.

Description: Close up of unifacial silcrete flake core, Tilbuster Solar Farm IF15.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0323

Date recorded: 03-05-2020

Site Location Information

Site name: Tilbuster Solar IF16

Easting: 370714 **Northing:** 6637855 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 655

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.3km W of house.

Other site information: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map

Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact along the existing transmission line easement adjacent to a small cluster of trees. The artefact was a quartz flake located approximately 145 metres south of a third order tributary and 60 metres north of a first order tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

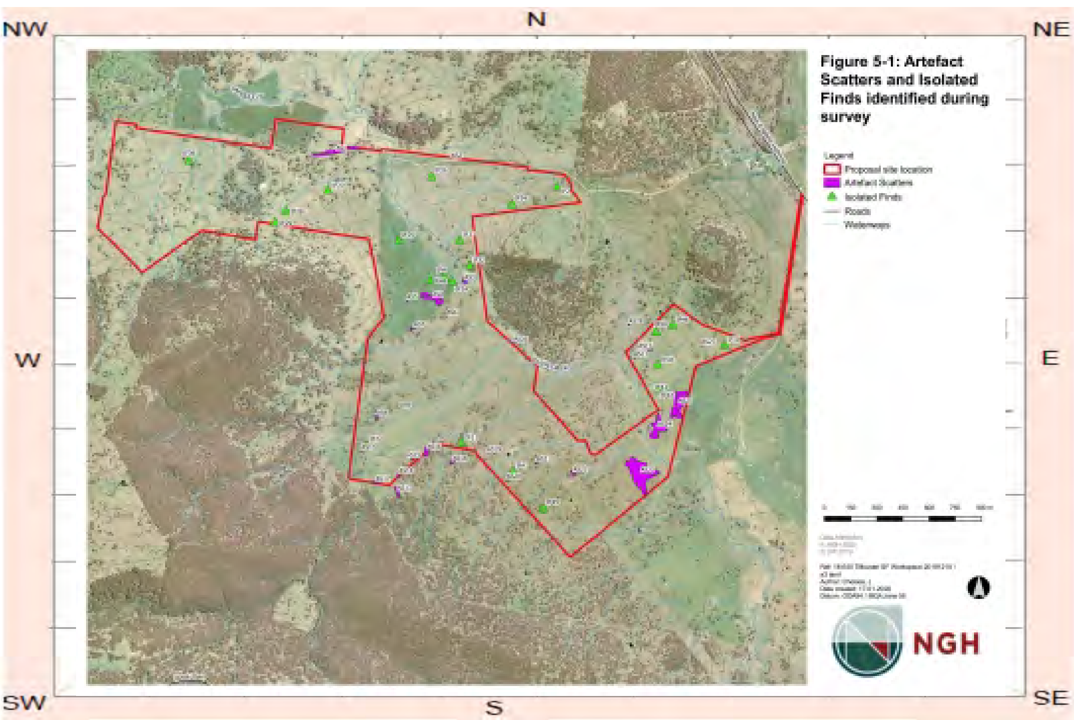
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of quartz flake, Tilbuster Solar Farm IF16.

Description: Close up of quartz flake, Tilbuster Solar Farm IF16.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0324

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF4

Easting: 370255 **Northing:** 6638769 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

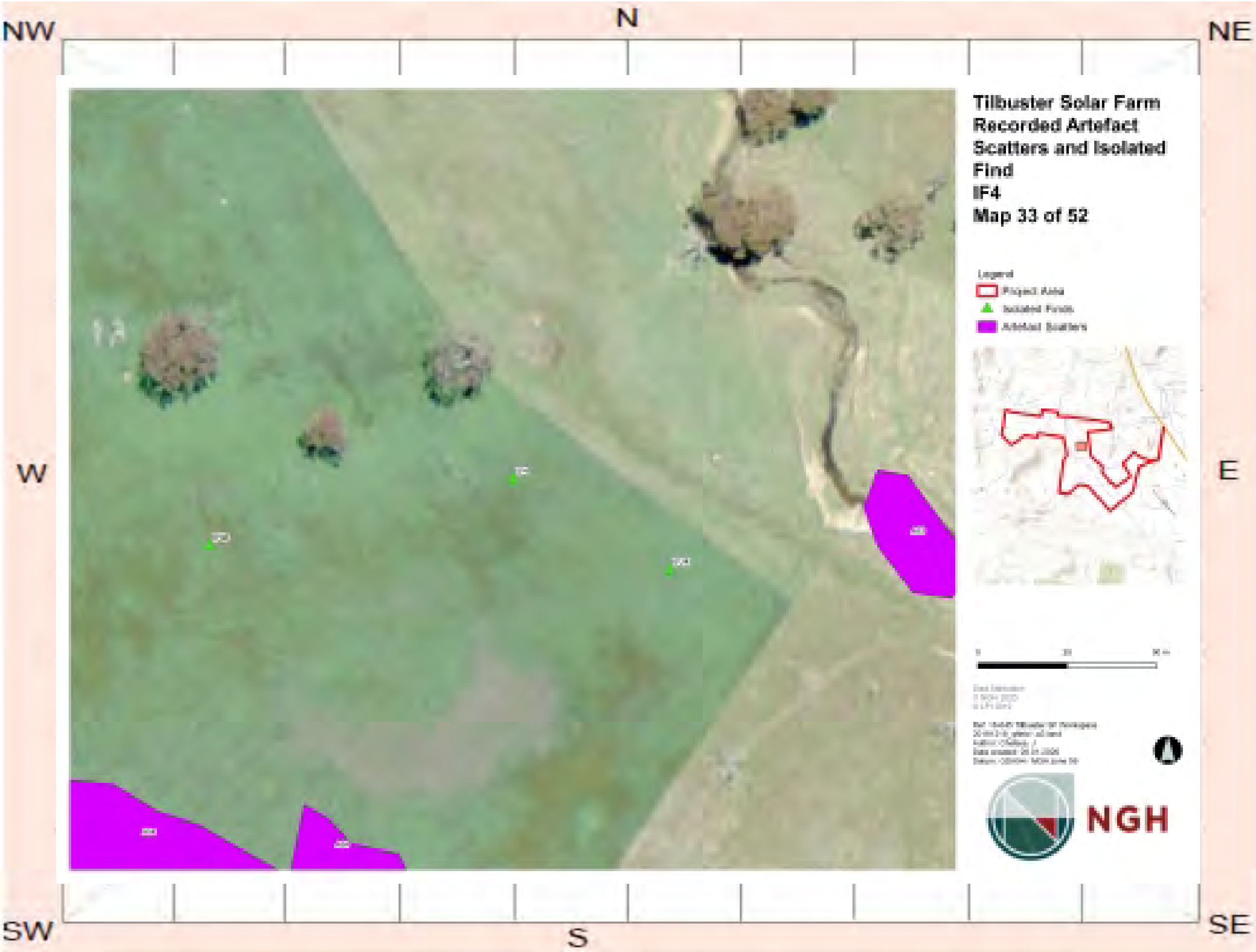
Distance to Water (m): 47

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NW of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Good

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact with a predominantly cleared paddock that has previously been used for cropping. The artefact was a silcrete scraper located approximately 47 metres west of an unnamed tributary of Duval Creek and less than 100 metres west of Duval Creek itself.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

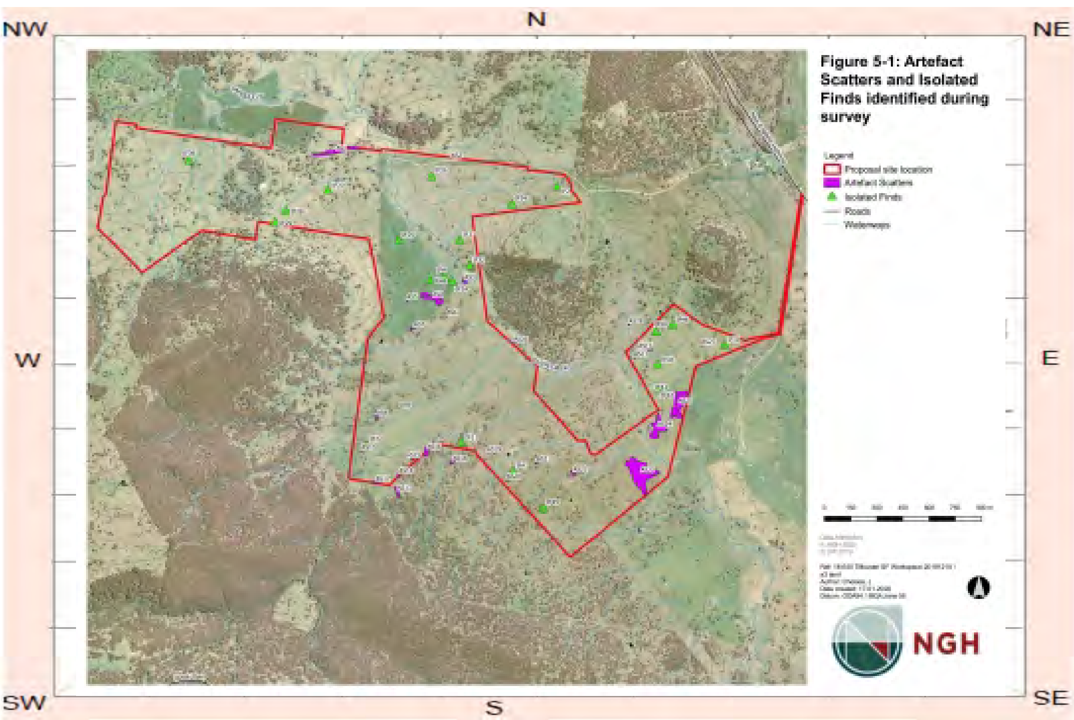
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of silcrete scraper, Tilbuster Solar Farm IF4.

Description: Close up of silcrete scraper Tilbuster Solar Farm IF4.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0325

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF2

Easting: 370899 **Northing:** 6639288 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

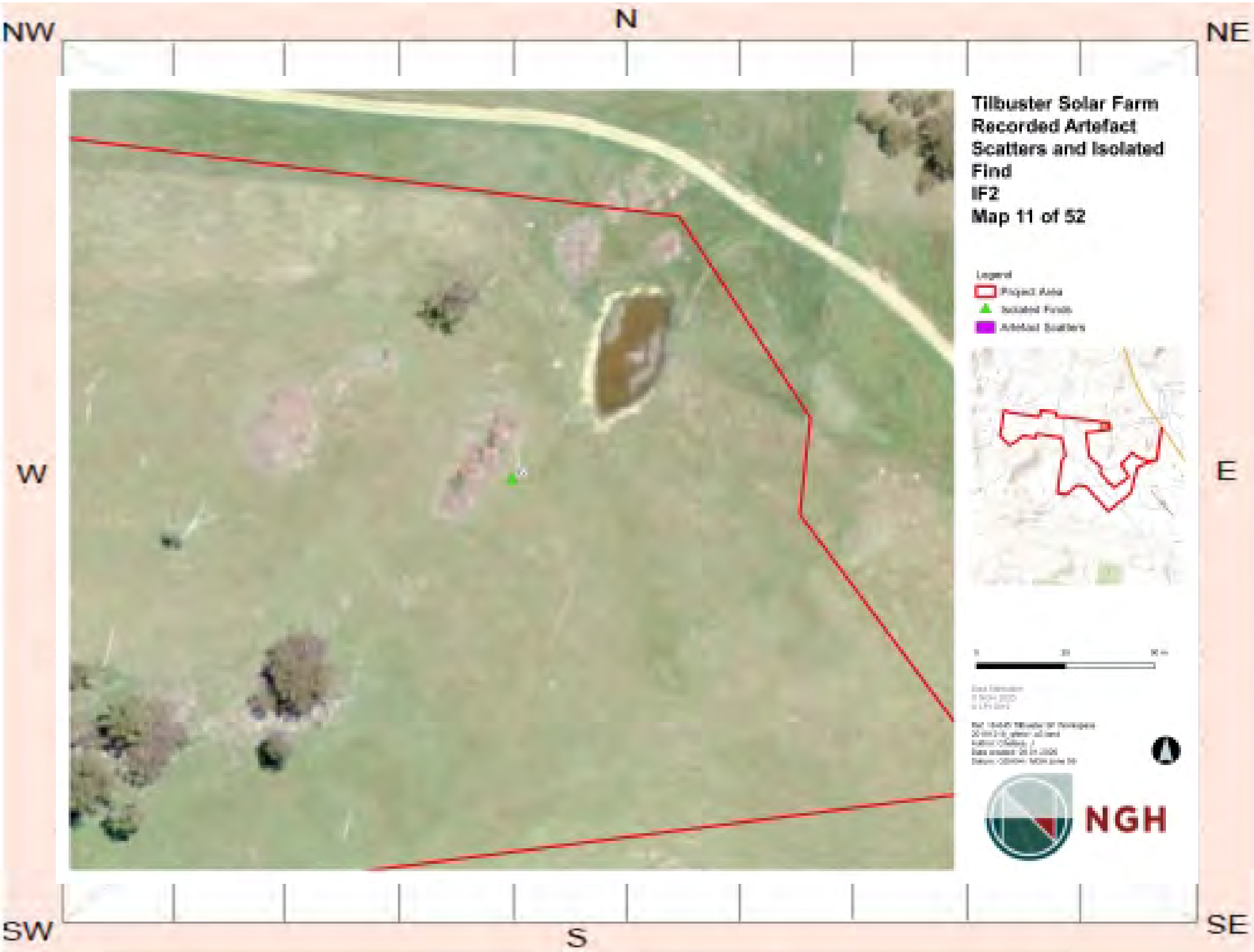
Distance to Water (m): 30

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.85km NNW of house.

Other site information: The soil consisted of a grey-brown sandy loam A horizon deposit atop visible B horizon clay. Visibility within the area was 70%.

Site location map



Site contents information

open/closed site: Open

Site condition: Good

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact in a predominantly cleared paddock on an upper slope. The artefact was a volcanic core with only one flake scar located approximately 80 metres south of a vehicle track, 30 metres south of an unnamed tributary of Duval Creek.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

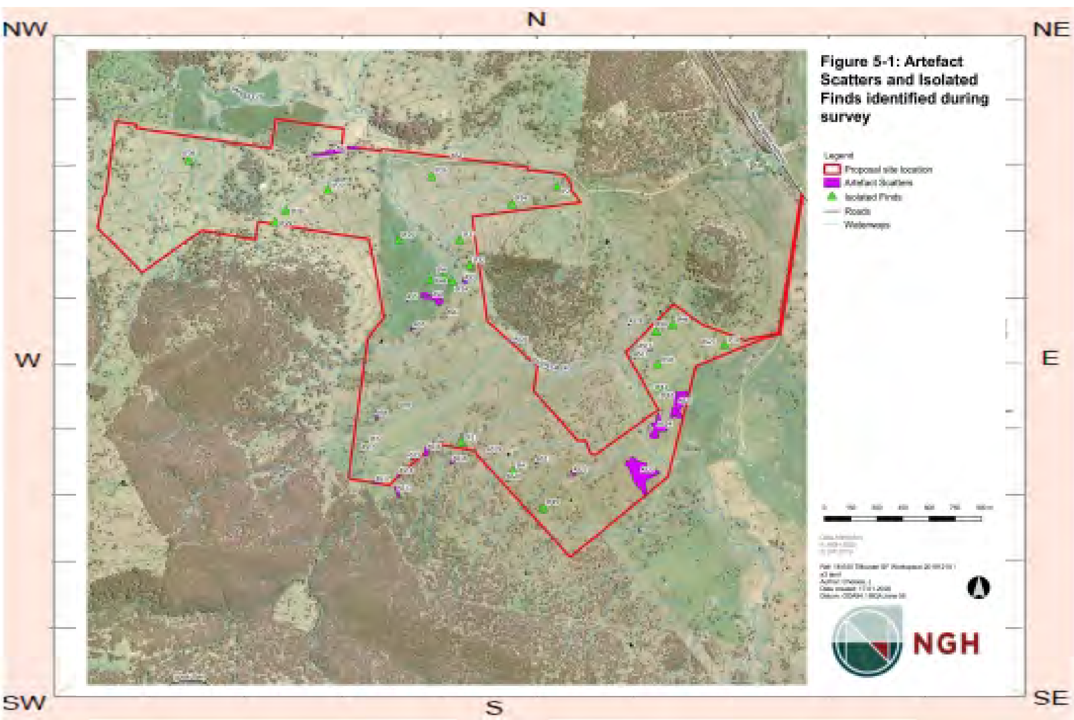
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soil consisted of a grey-brown sandy loam A horizon deposit atop visible B horizon clay. Visibility within the area was 70%.

Site plan



Site photographs

Description: Close up of volcanic core, Tilbuster Solar Farm IF2.

Description: Close up of volcanic core, Tilbuster Solar Farm IF2.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0326

Date recorded: 20-04-2020

Site Location Information

Site name: Tilbuster Solar Farm IF12

Easting: 369936 **Northing:** 6638111 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

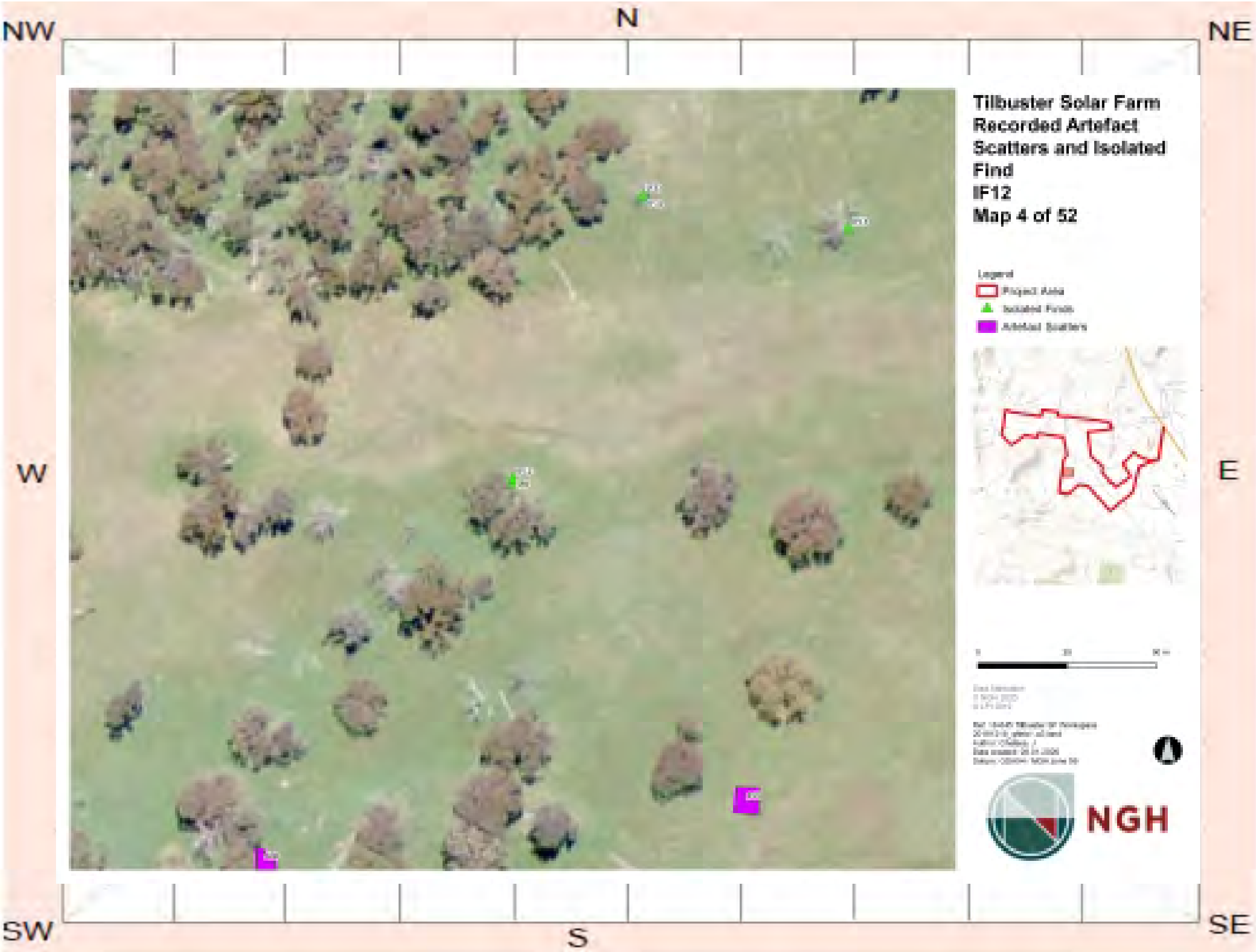
Distance to Water (m): 18

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km W of house.

Other site information: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	1	.1	.1				

Description:

This site consisted of a single artefact adjacent to a sparse collection of trees. The artefact was a chert proximal fragment located approximately 18 metres south of an unnamed drainage line and 154 metres north of an unnamed first order tributary of Duval Creek.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

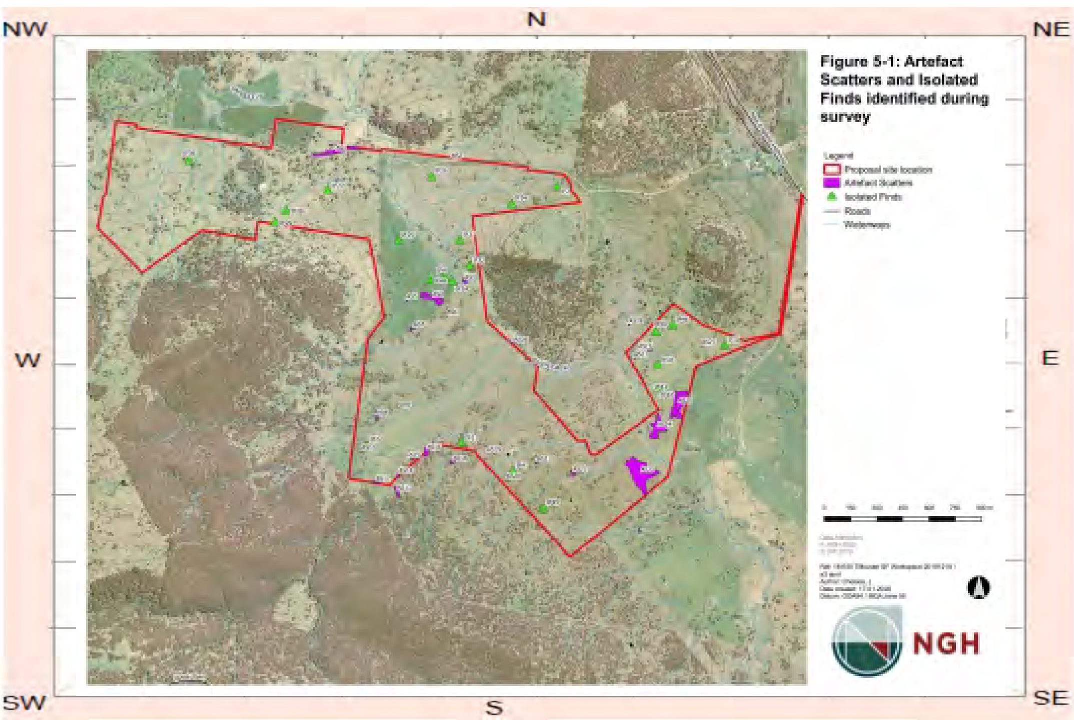
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The soils consisted of a shallow grey-brown sandy loam deposit and visibility within the area was 80%.

Site plan



Site photographs

Description: Close up of chert proximal fragment, Tilbuster Solar Farm IF12.

Description: Close up of chert proximal fragment, Tilbuster Solar Farm IF12.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0327

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS11

Easting: 371341 **Northing:** 6638355 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

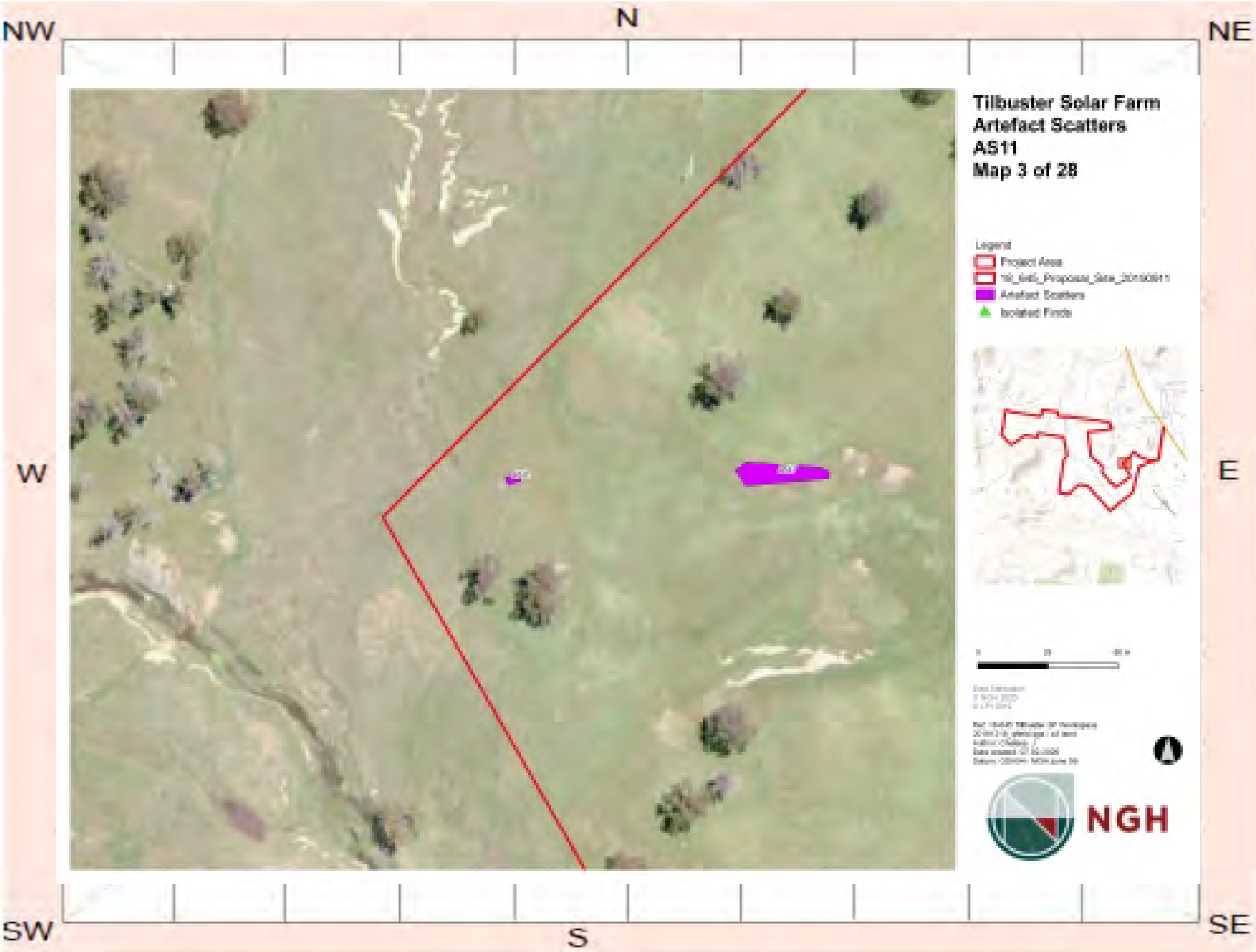
Distance to Water (m): 134

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 885m NW of house.

Other site information: The artefacts were located on a grey-brown sandy loam and visibility was approximately 90% within the cleared paddock.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	4	2				

Description:

he scatter included a retouched silcrete flake (n=1) with a point and a retouched chert flake (n=2)

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

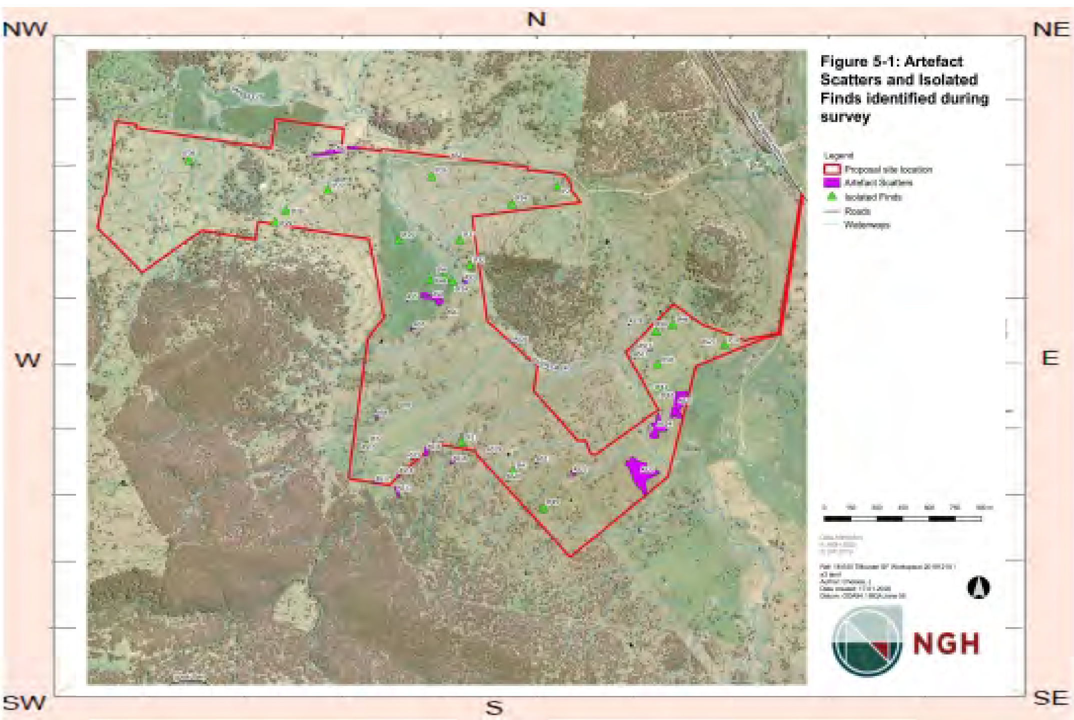
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam and visibility was approximately 90% within the cleared paddock.

Site plan



Site photographs

Description: Close up of chert flake, part of Tilbuster Solar Farm AS11.

Description: Close up of silcrete flake with point, part of Tilbuster Solar Farm AS11.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0328

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS10

Easting: 369779 **Northing:** 6637783 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

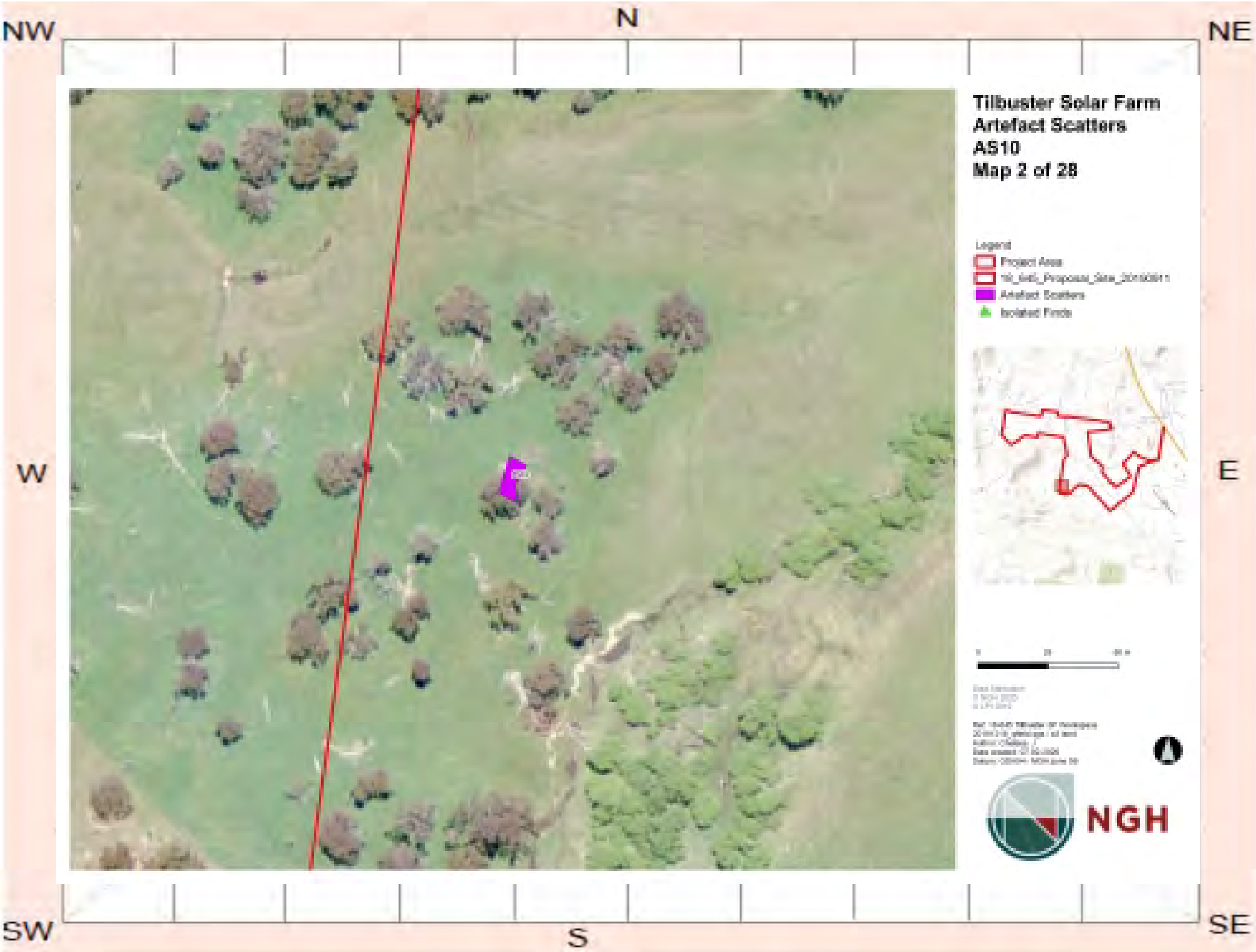
Distance to Water (m): 1170

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site:
From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.2km W of house.

Other site information:
The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the small cluster of trees was approximately 50% due to surrounding leaf litter material.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1. Artefact	11	13	6				

Description:

The scatter was predominantly characterised by silcrete material with single instances of chert, volcanic and quartz made items.
Artefact types included flakes (n=4), proximal fragments (n=3), distal fragments (n=1) and manuports (n=3).

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.							

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

3.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

4.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

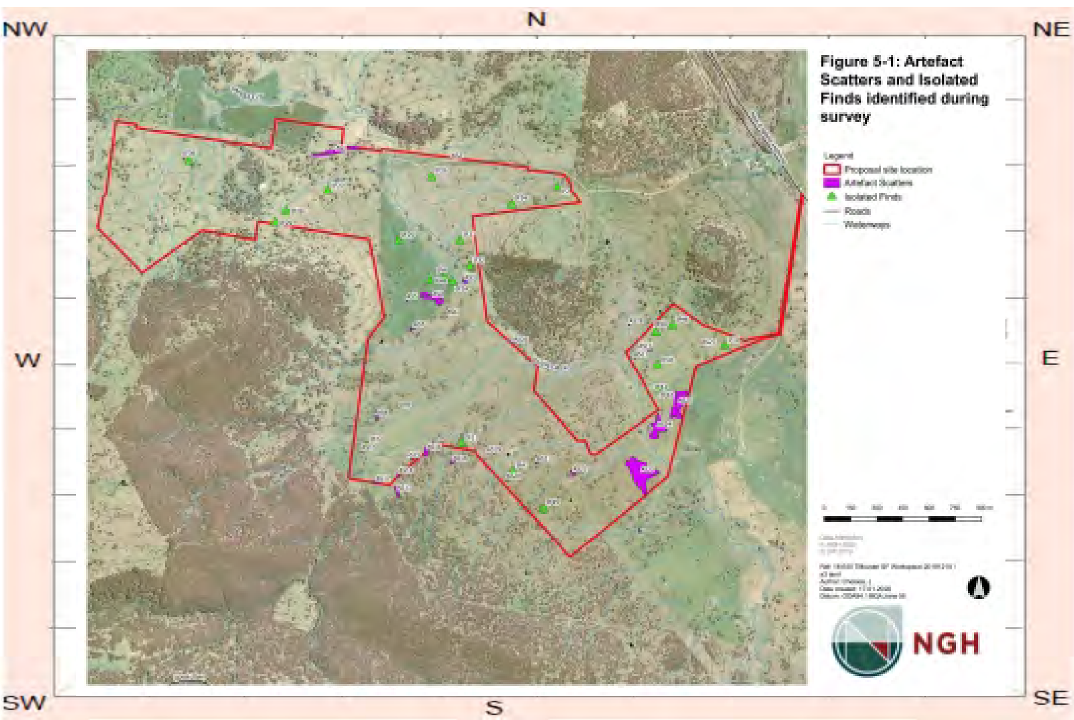
Scarred Trees: Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

5.

Description:

Other Site Info: The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the small cluster of trees was approximately 50% due to surrounding leaf litter material.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS10.

Description: Context of Tilbuster Solar Farm AS10.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0329

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS9

Easting: 370002
Northing: 6638021
Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56
Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018
E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

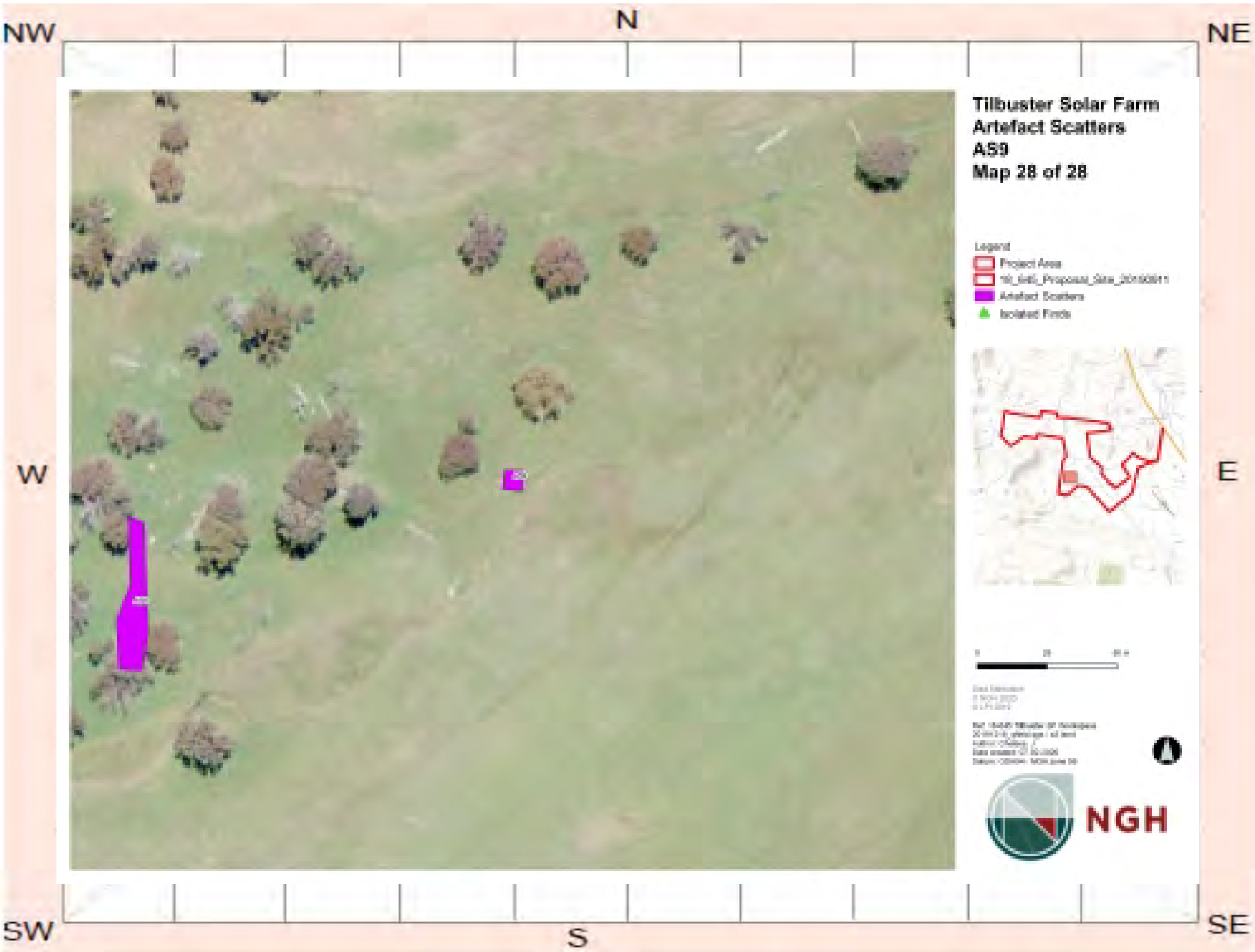
Distance to Water (m): 798

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site:
From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km W of house.

Other site information:
The artefacts were located on a grey-brown sandy loam and visibility within a previously ploughed paddock was approximately 90% visibility along the cleared paddock.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	2	7	7				

Description:

The scatter comprised one silcrete flake (n=10) and one medial chert fragment (n=1).

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

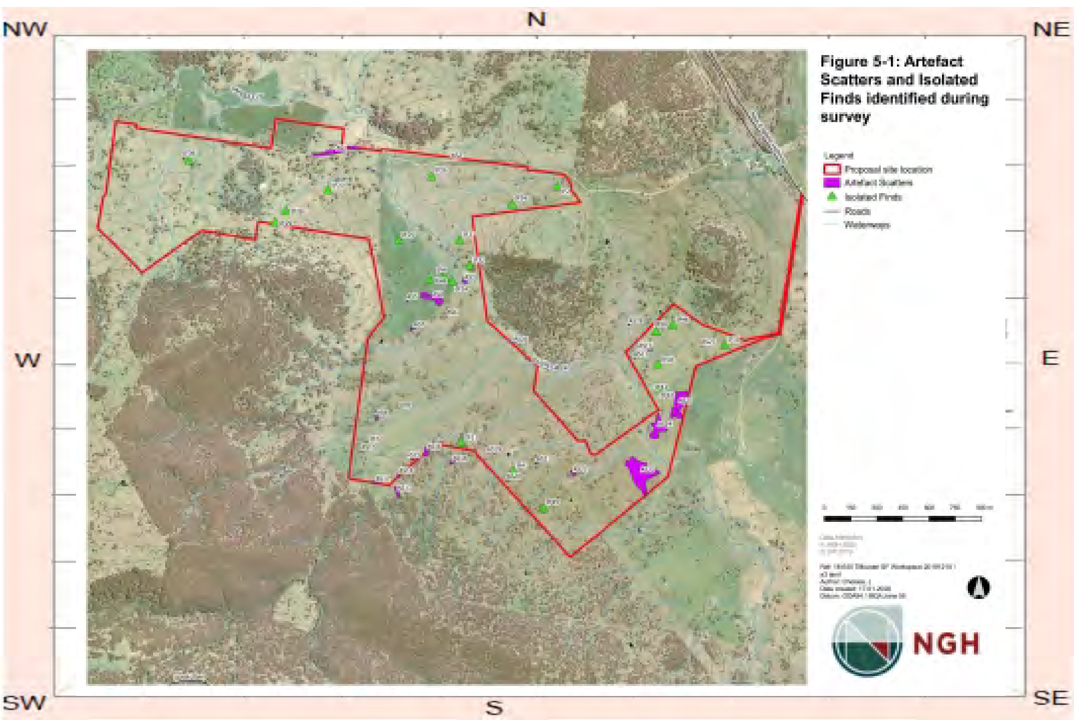
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam and visibility within a previously ploughed paddock was approximately 90% visibility along the cleared paddock.

Site plan



Site photographs

Description: Close up of silcrete flake, Tilbuster Solar Farm AS9.

Description: Close up of silcrete flake, Tilbuster Solar Farm AS9.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0330 **Date recorded:** 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS8

Easting: 369866 **Northing:** 6637976 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

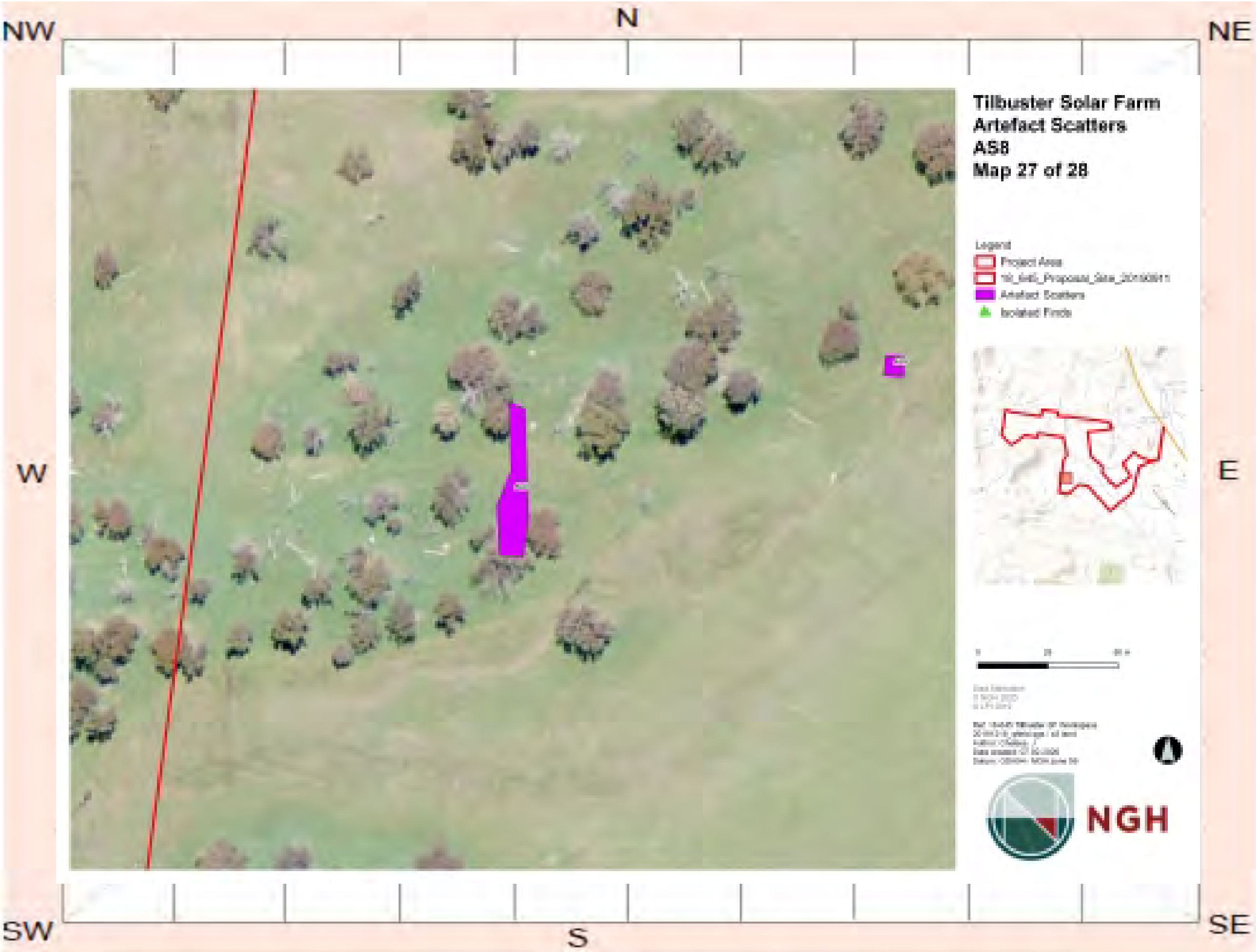
Distance to Water (m): 962

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km W of house.

Other site information: The artefacts were located on an eroded orange grey-brown sandy loam deposit and visibility within a previously ploughed paddock was approximately 70% visibility along the cleared paddock.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	4	56	15				

Description:

The scatter was predominantly characterised by quartz material with one chert artefact. Artefact types included flake (n=2), one proximal fragment (n=1) and one manuport (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

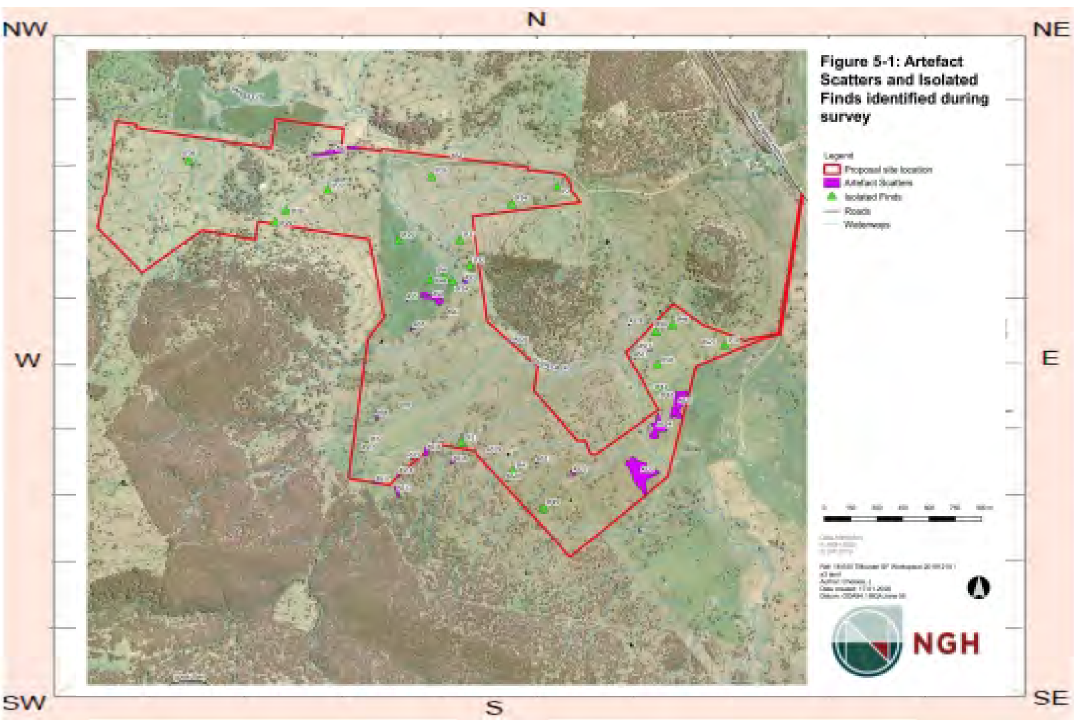
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on an eroded orange grey-brown sandy loam deposit and visibility within a previously ploughed paddock was approximately 70% visibility along the cleared paddock.

Site plan



Site photographs

Description: Close up of quartz flake, part of Tilbuster Solar Farm AS8.

Description: Close up of quartz flake, part of Tilbuster Solar Farm AS8.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0331

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS7

Easting: 370080 **Northing:** 6638481 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

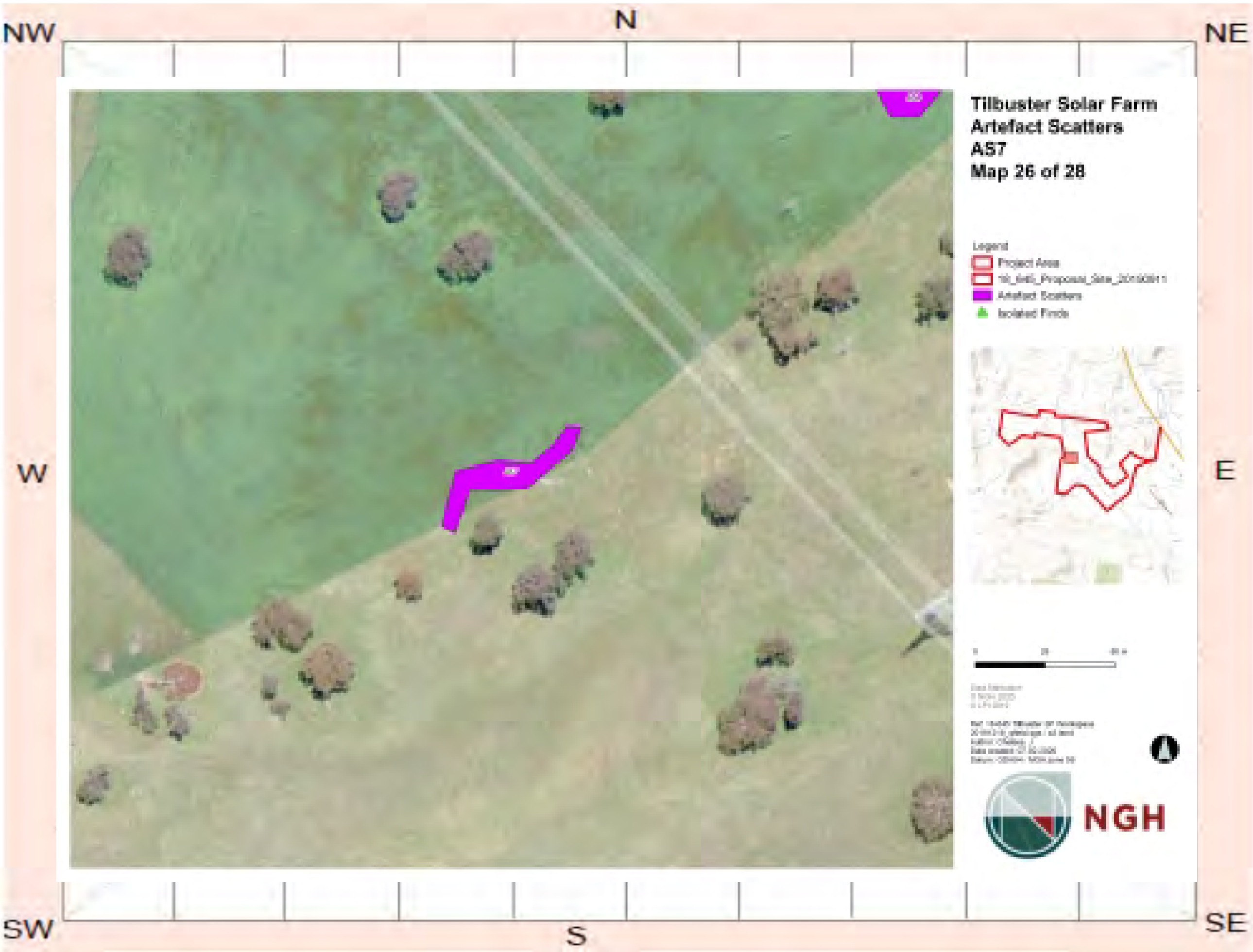
Distance to Water (m): 495

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km NW of house.

Other site information: The artefacts were located on an eroded grey-brown sandy loam A horizon and visibility within a previously ploughed paddock was approximately 80% visibility along the cleared paddock.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	9	58	13				

Description:

The scatter was predominantly characterised by silcrete and chert material with some inclusions of quartz and greywacke. Artefact types included silcrete flakes (n=4), manuports (n=2), a core (n=1), a broken flake (n=1) and a proximal flake (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

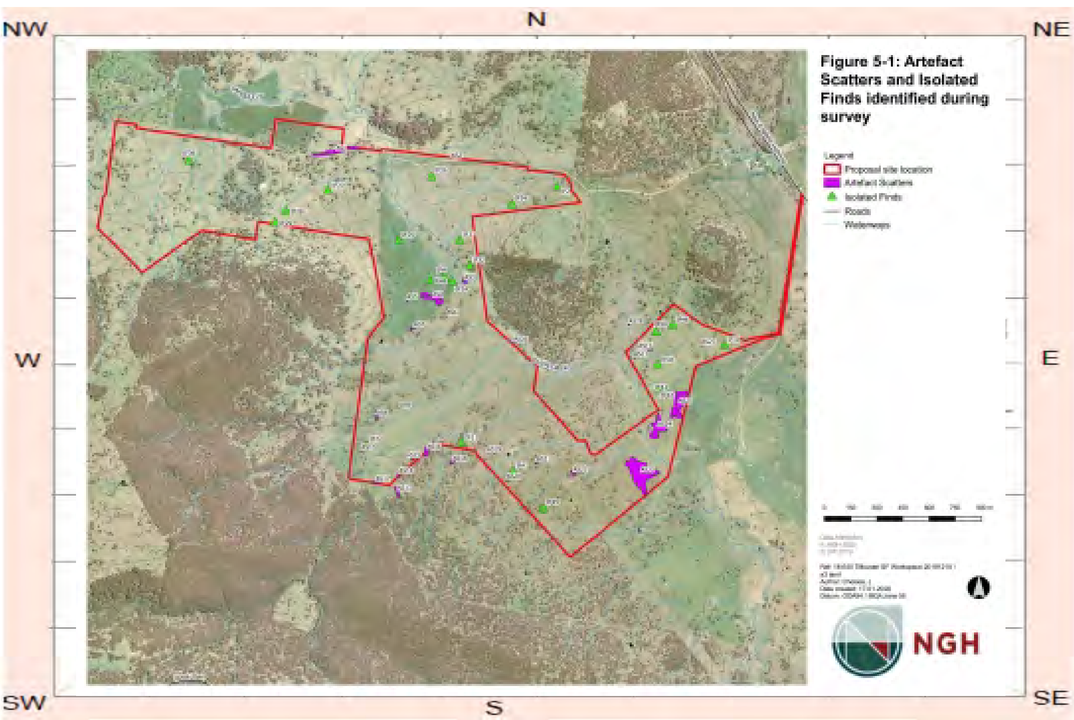
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on an eroded grey-brown sandy loam A horizon and visibility within a previously ploughed paddock was approximately 80% visibility along the cleared paddock.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS7.

Description: Close up of greywacke flake, part of Tilbuster Solar Farm AS7.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0332

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS6

Easting: 370268 **Northing:** 6638552 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

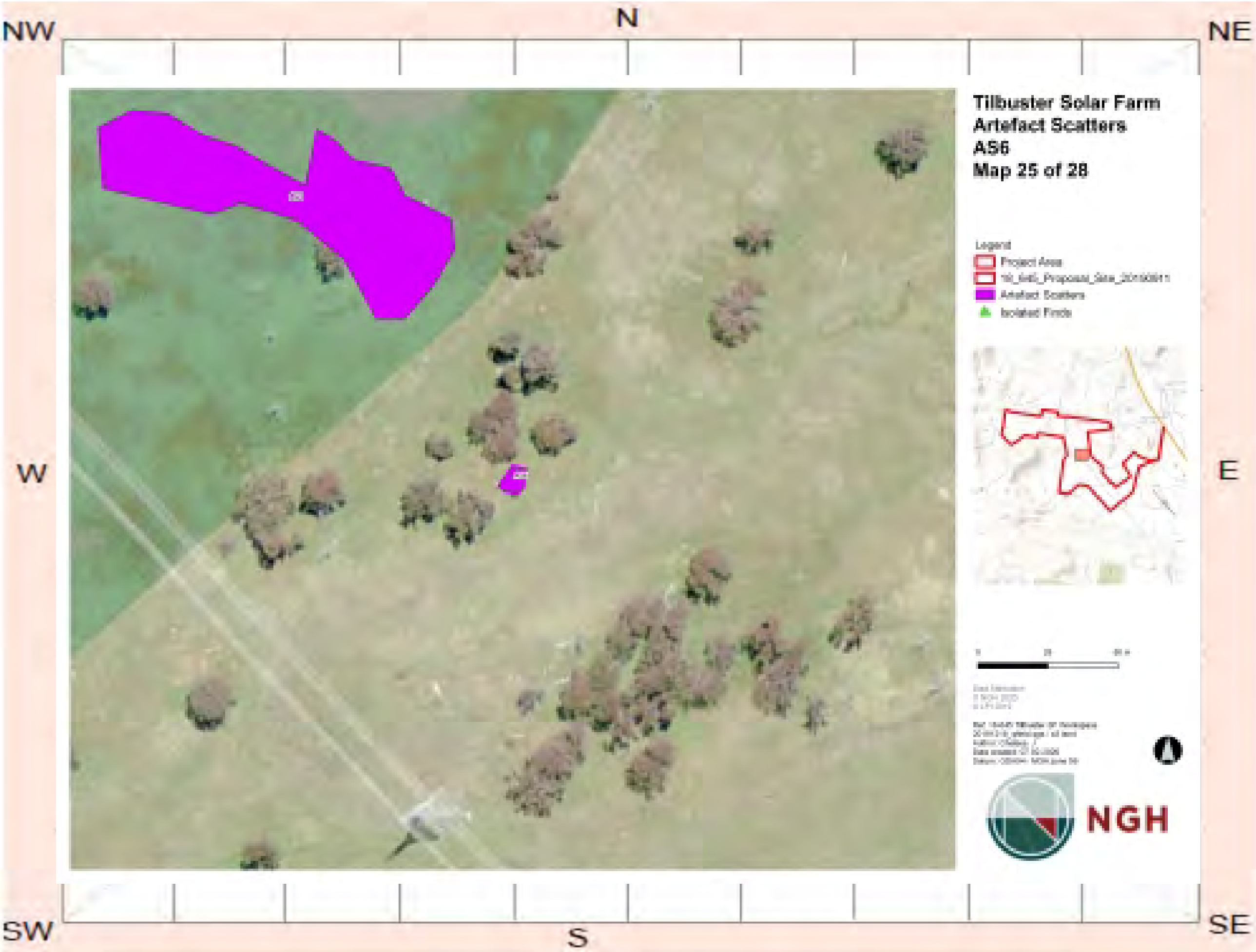
Distance to Water (m): 257

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km NW of house.

Other site information: The artefacts were located on an eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility along the cleared paddock.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1. Artefact	2	11	8				

Description:

The scatter included two silcrete flakes.

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

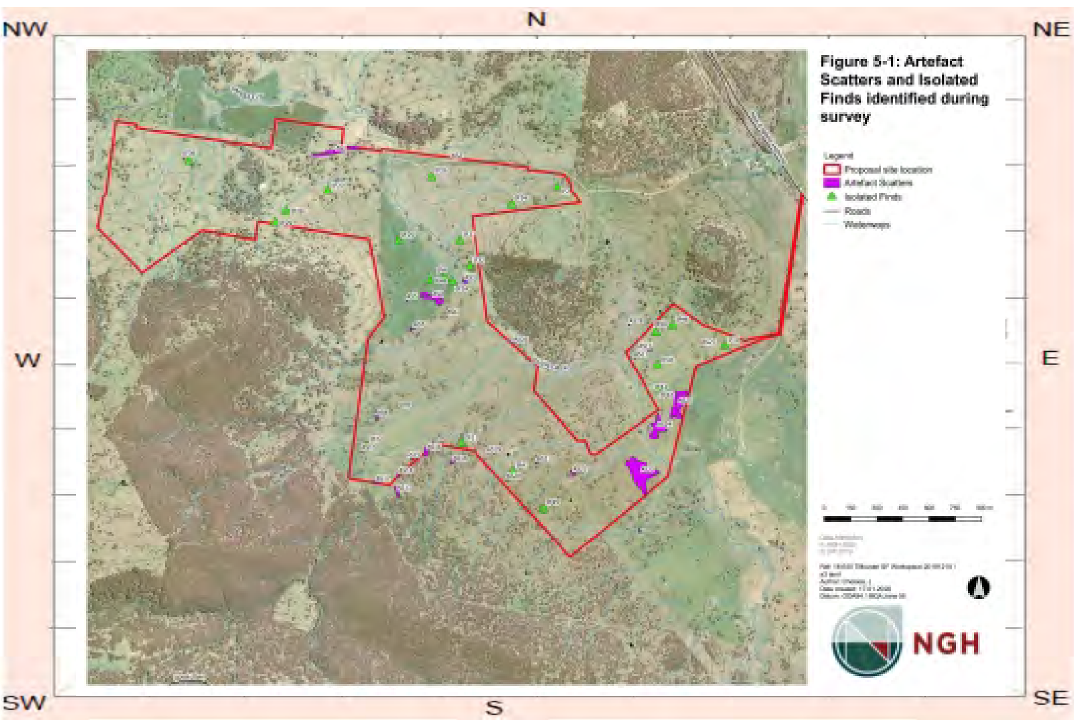
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The artefacts were located on an eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility along the cleared paddock.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS6.

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS6.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW GOVERNMENT

AHIMS site ID: 21-1-0333

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS5

Easting: 370039 **Northing:** 6638639 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

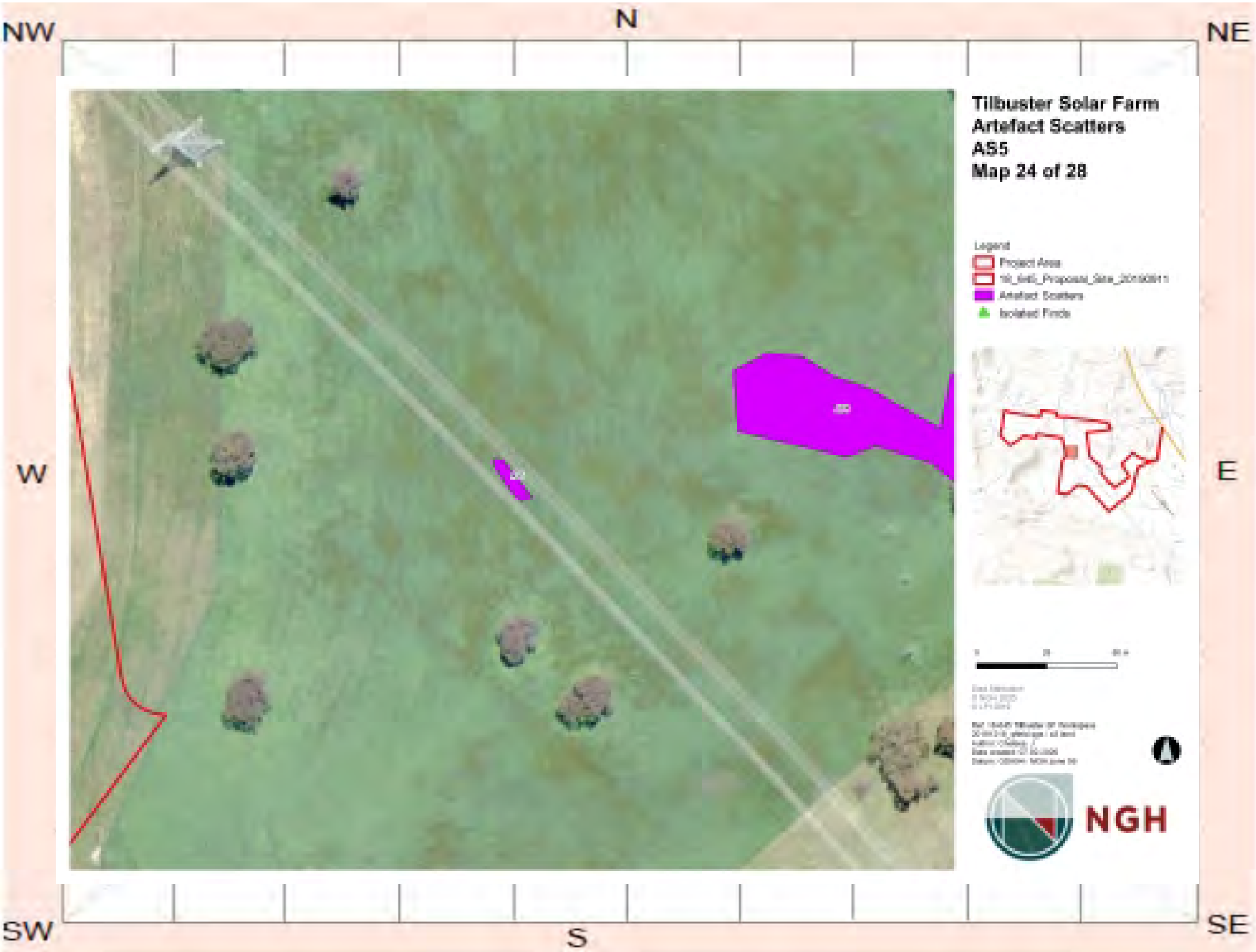
Distance to Water (m): 333

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km NW of house.

Other site information: The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 80% visibility along the vehicle track.

Site location map



Site contents information

open/closed site: Open **Site condition:** Erosion

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1. Artefact	2	18	4				

Description:

The scatter included one silcrete flake and one silcrete axe.

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

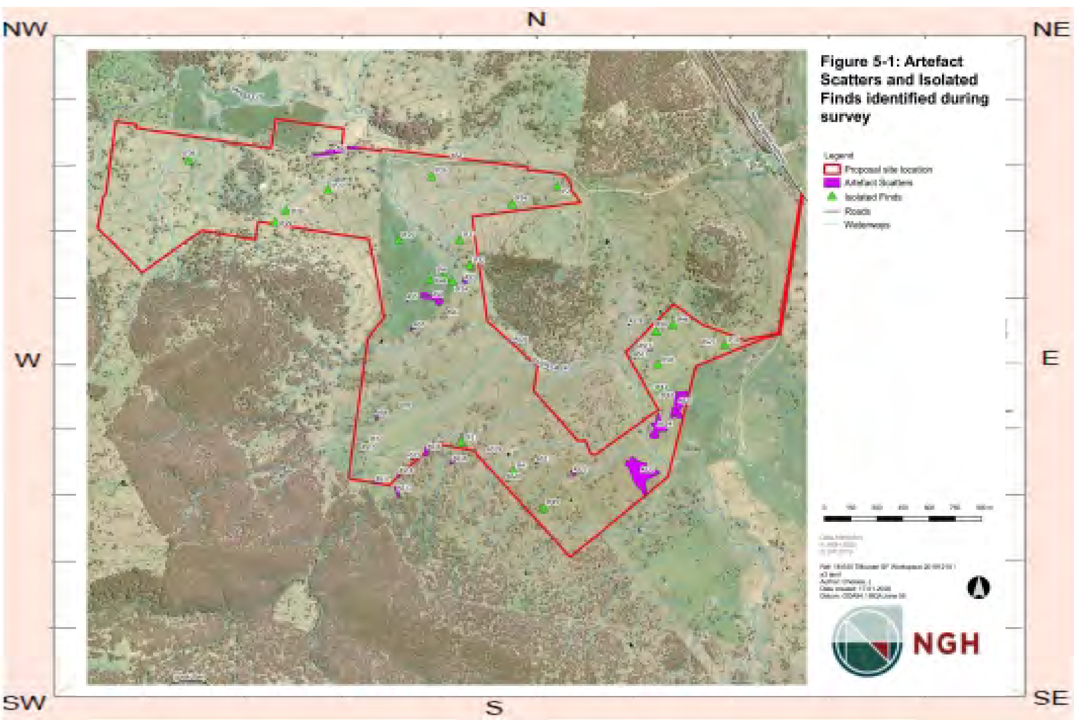
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 80% visibility along the vehicle track.

Site plan



Site photographs

Description: Close up of silcrete axe, part of Tilbuster Solar Farm AS5.

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS5.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0334

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS4

Easting: 370187 **Northing:** 6638652 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

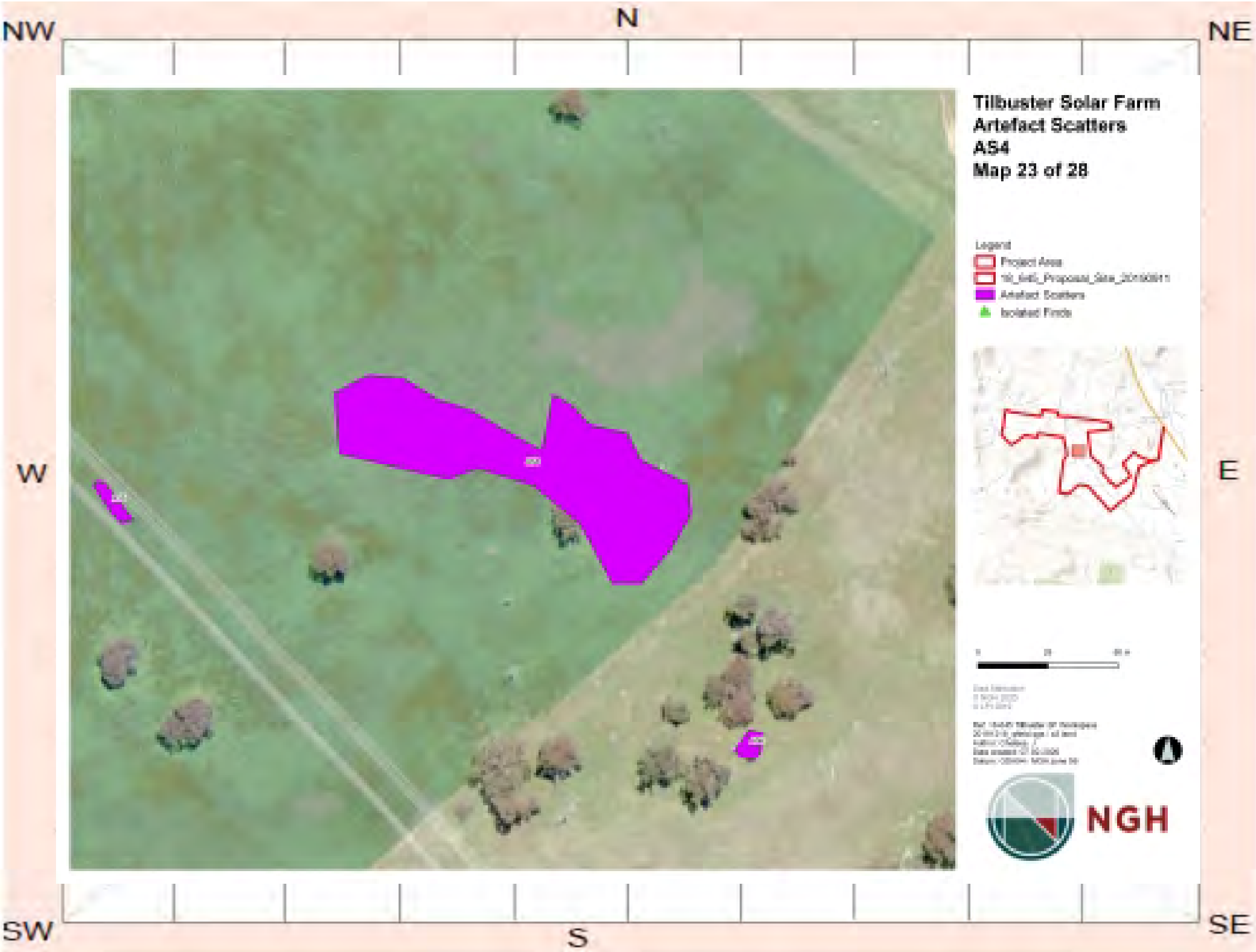
Distance to Water (m): 324

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2km NW of house.

Other site information: The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility within a cleared paddock along an existing fence line. The area has been subject to disturbance through alluvial processes.

Site location map



Site contents information

open/closed site: Open **Site condition:** Disturbed

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	39	134	31				

Description:

Flakes (22),cores (6), broken flakes (3), proximal fragments (2), split flakes (1), two scrapers (2), one axe (1), core tool (1) and one flake tool (1, possibly an implement for piercing). Mainly silcrete material with some of chert, greywacke, volcanic and quartz materials.

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

Scarred Trees

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.								

Description:

Features:

Scarred Trees

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.								

Description:

Features:

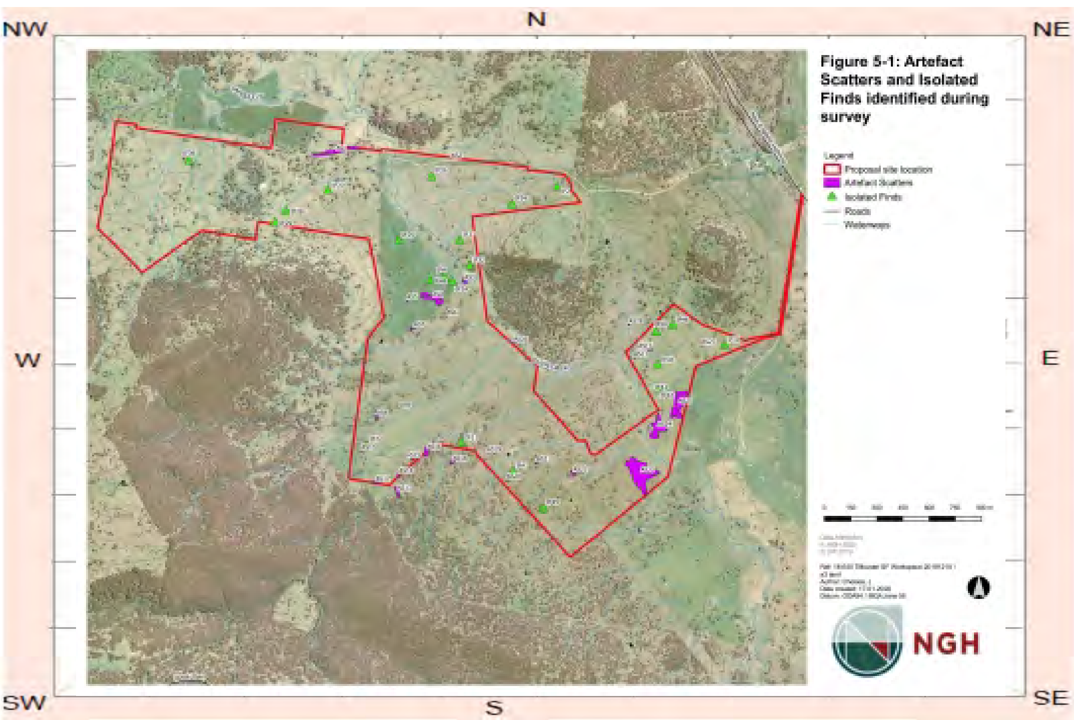
Scarred Trees

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.								

Description:

Other Site Info: The artefacts were located on a heavily eroded grey-brown sandy loam and visibility within the area was approximately 70% visibility within a cleared paddock along an existing fence line. The area has been subject to disturbance through alluvial processes.

Site plan



Site photographs

Description: Close up of greywacke axe, part of Tilbuster Solar Farm AS4.

Description: Close up of chert flake tool, part of Tilbuster Solar Farm AS4.

Description: Location of Tilbuster Solar farm AS4, facing east.

Description: General location of Tilbuster Solar farm AS4, facing west.

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0335

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS3

Easting: 370368

Northing: 6638752

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

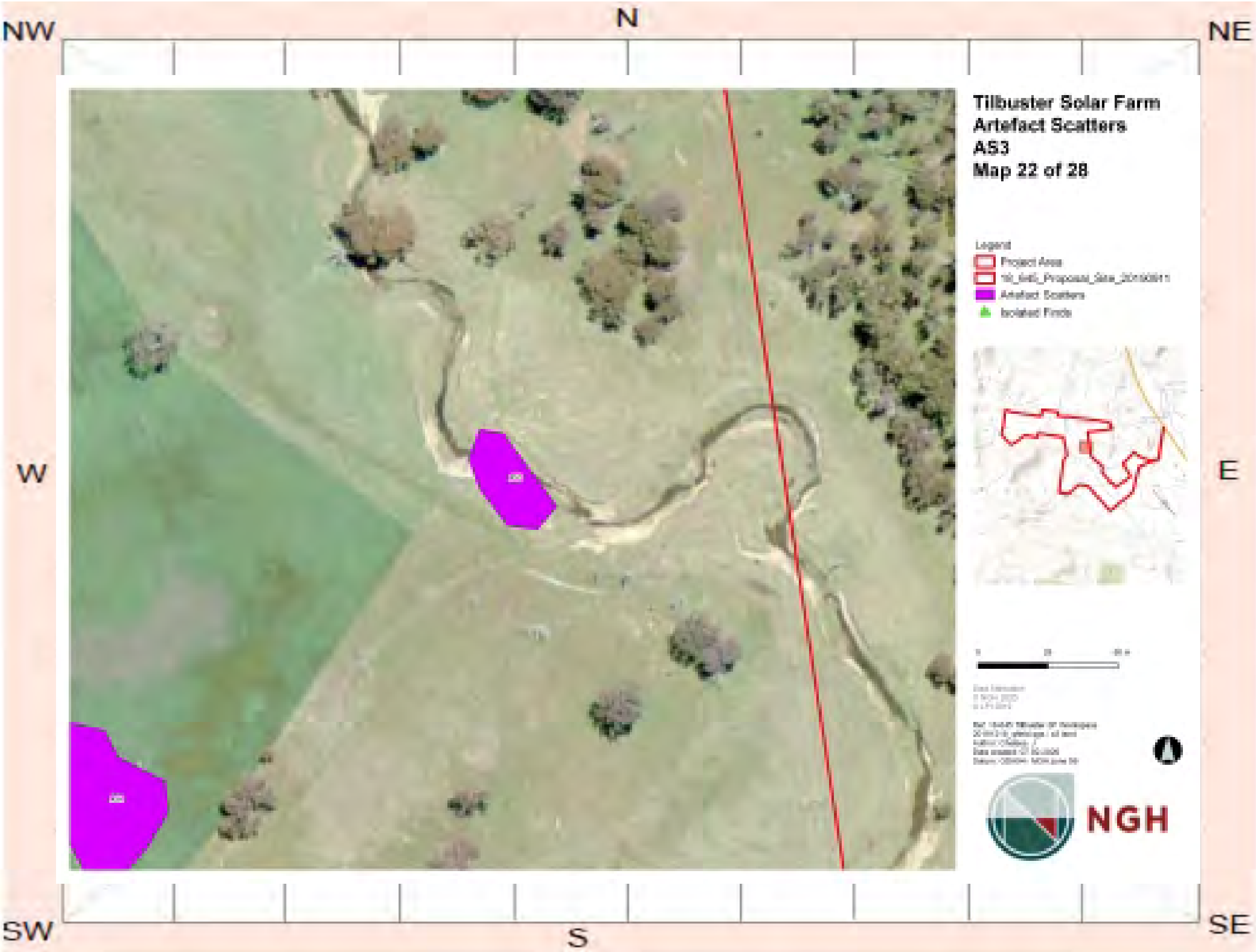
Distance to Water (m): 1

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.8km NW of house.

Other site information: The artefacts were located on a redeposited grey-brown sandy loam and visibility within the area was approximately 80% visibility along the creek bed. The area has been subject to disturbance through alluvial processes and these artefacts are likely to have been washed to this location.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	3	38	16				

Description:

The scatter included two flakes (silcrete (n=1) and chert (n=1)) and a greywacke core (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

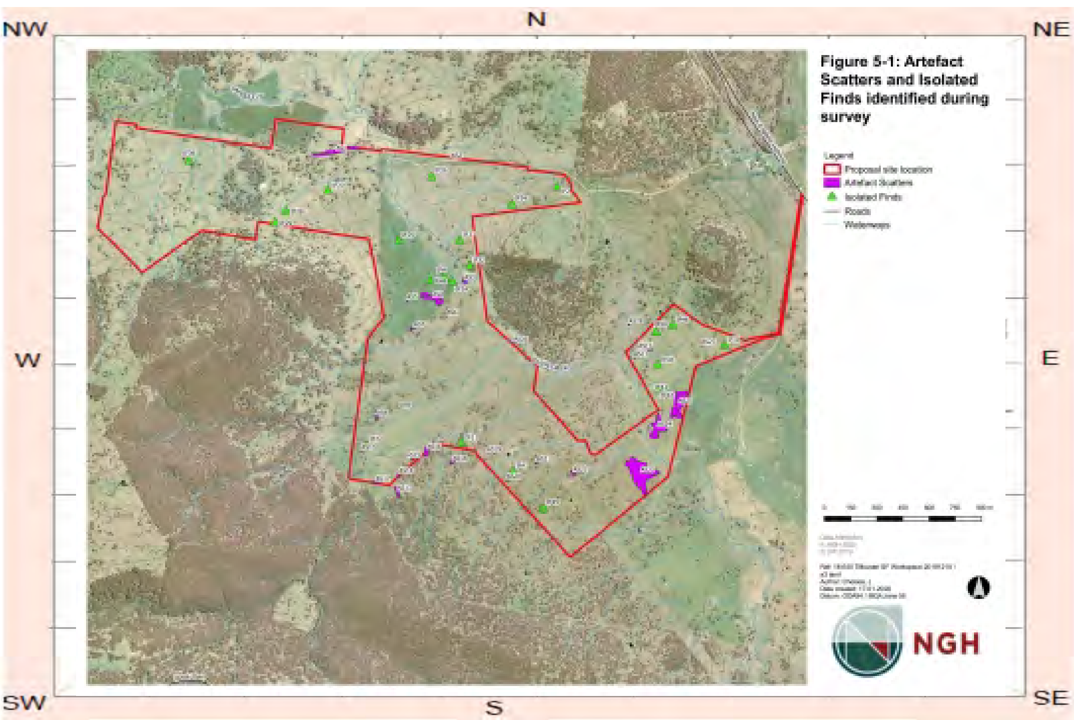
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a redeposited grey-brown sandy loam and visibility within the area was approximately 80% visibility along the creek bed. The area has been subject to disturbance through alluvial processes and these artefacts are likely to have been washed to this location.

Site plan



Site photographs

Description: Close up of chert flake, part of Tilbuster Solar Farm AS3.

Description: Termite mound located near Tilbuster Solar Farm AS3.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage, NSW Government

AHIMS site ID: 21-1-0336

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS2

Easting: 370294 **Northing:** 6639449 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

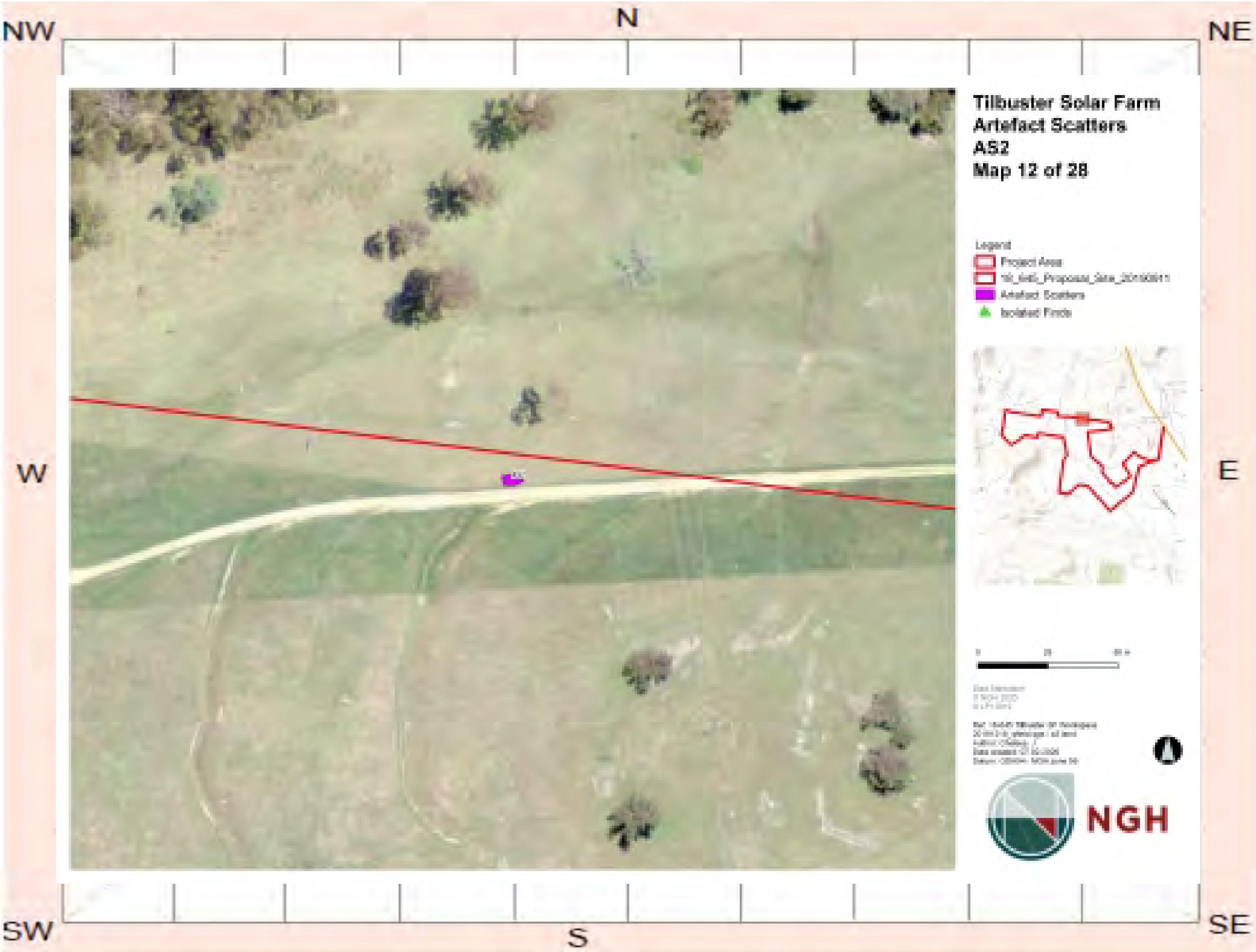
Distance to Water (m): 337

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.3km NNW of house.

Other site information: The artefacts were located on a grey-brown sandy loam redeposited on clay and visibility within the area was approximately 80% visibility along the vehicle track. The area has been subject to disturbance associated with continued vehicle use of the track.

Site location map



Site contents information

open/closed site: Open

Site condition: Disturbed

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	3	6	4				

Description:

The scatter included one silcrete flake (n=1), one silcrete proximal fragment (n=1) and one silcrete manuport (n=1).

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.								

Description:

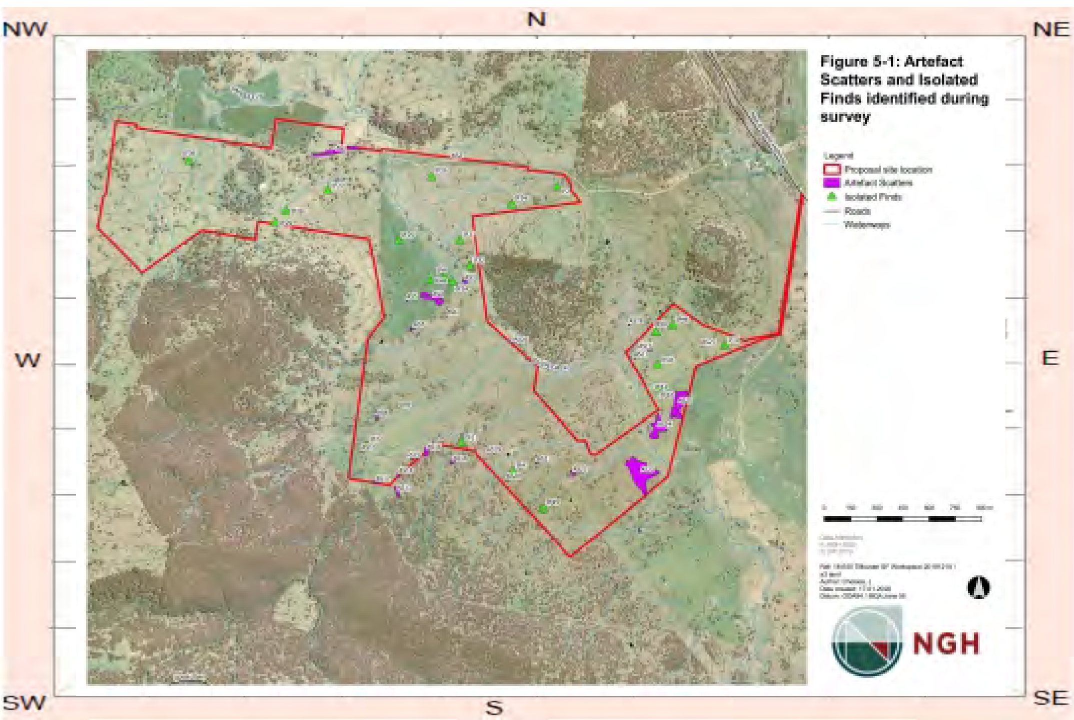
Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.								

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam redeposited on clay and visibility within the area was approximately 80% visibility along the vehicle track. The area has been subject to disturbance associated with continued vehicle use of the track.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS2.

Description: Context of Tilbuster Solar Farm AS2.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0337

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS1

Easting: 369633

Northing: 6639494

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

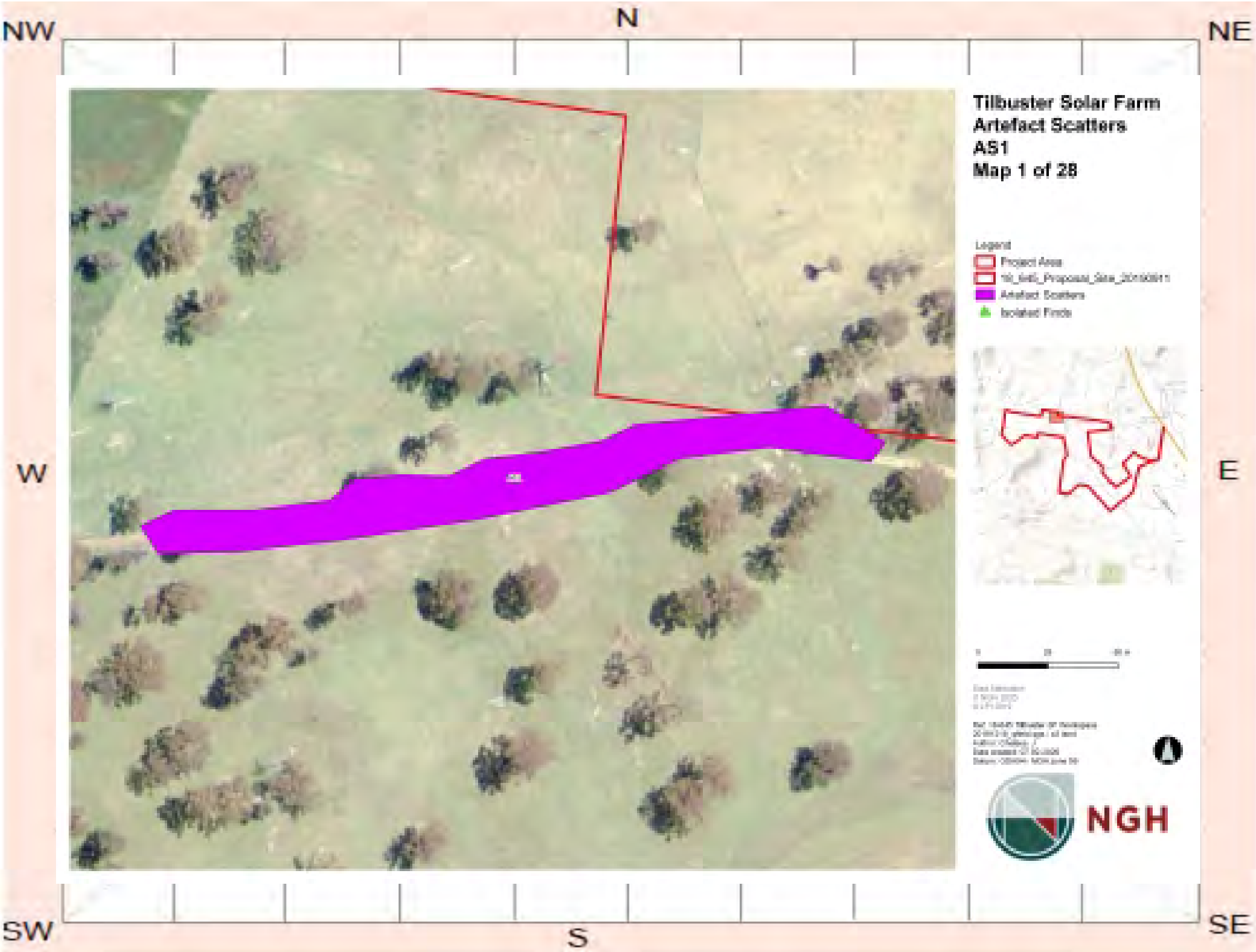
Distance to Water (m): 338

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.9km NW of house.

Other site information: The site was on a level to very gently sloping low ridge overlooking Duval Creek, with an easterly aspect. The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 100% along the vehicle track and 80% adjacent to the vehicle track.

Site location map



Site contents information

open/closed site: Open

Site condition: Vehicle damage

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	48	268	18				

Description:

Materials included silcrete and chert material and basalt, quartz and volcanic. Flakes (26), proximal flakes (6), retouched flakes (3), cores (3), distal flakes (2), broken flakes (2), singular medial fragment (1), basalt ground-edge axes (2), geometric microliths (2), core tool (1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

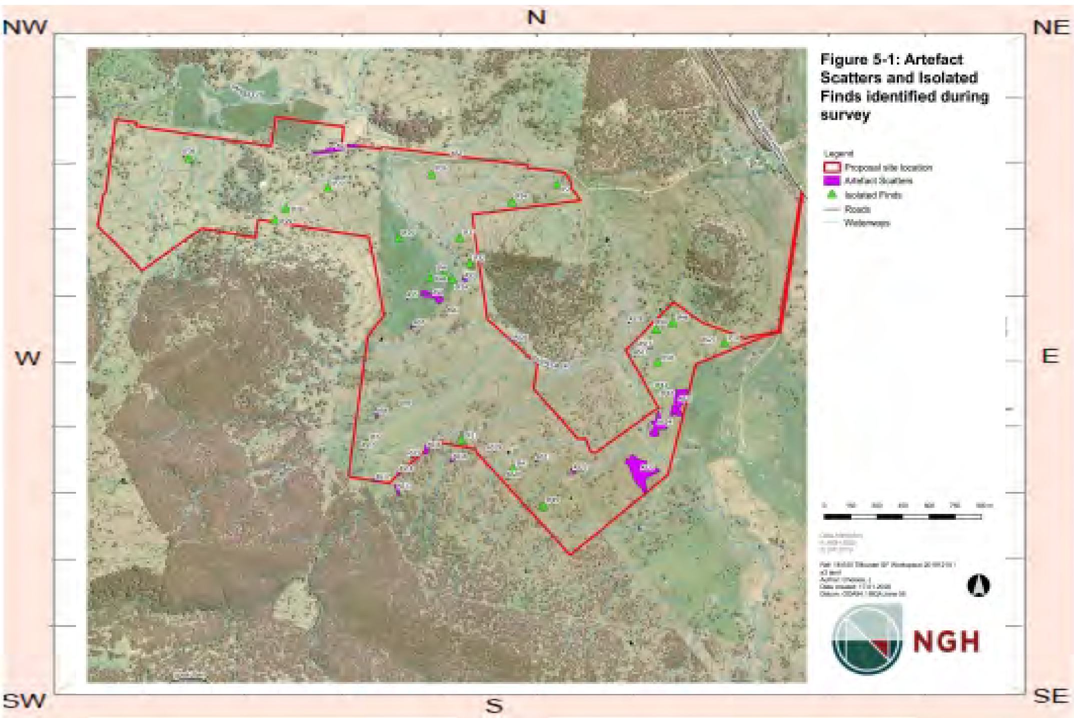
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The site was on a level to very gently sloping low ridge overlooking Duval Creek, with an easterly aspect. The artefacts were located on a grey-brown sandy loam deposit and visibility within the area was approximately 100% along the vehicle track and 80% adjacent to the vehicle track.

Site plan



Site photographs

Description: Close up of one basalt axe, part of Tilbuster Solar Farm AS1.

Description: Close up of retouched silcrete flake, part of Tilbuster Solar Farm AS1.

Description: Looking east along the track main cluster of artefacts from Tilbuster Solar Farm AS1

Description: Looking west along track, west extent of Tilbuster Solar Farm AS1

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar

PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0338

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar ST1

Easting: 369781

Northing: 6637652

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

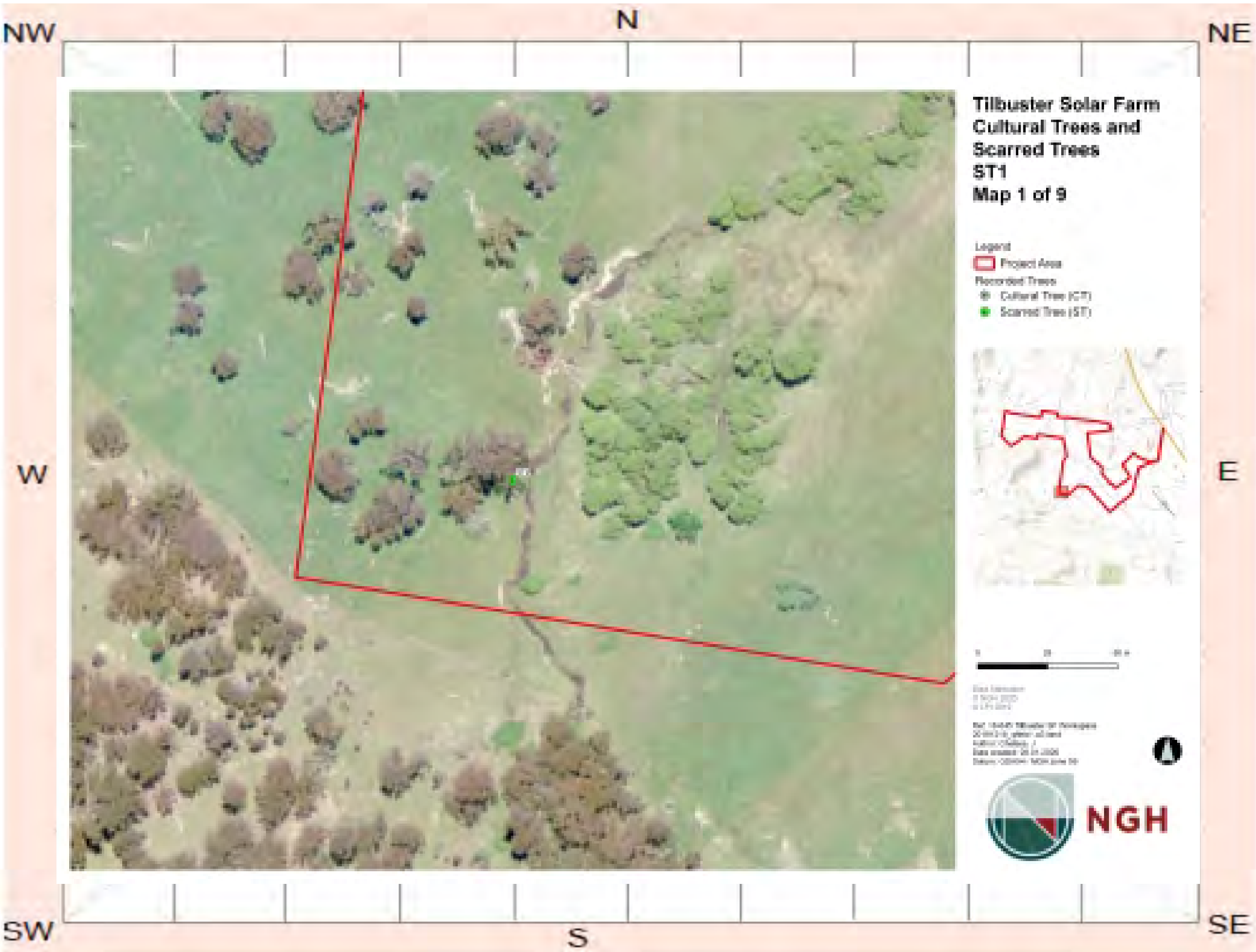
Distance to Water (m): 2500

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.2km W of house.

Other site information: The tree is a dead, standing and of undetermined species, in poor condition that has a single curved pre-form scar. No axe marks were noted. It was noted that perimeter of the scar appeared hollowed and the general degradation of the tree was likely due to age and insect damage.

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	90	23	20	10	Oval	Other

Description:

This site consists of a single scarred tree considered to be Aboriginal in origin within a predominantly cleared paddock. The oval scar is in good condition and located on the trunk of the tree facing north. The scar measures 90 cm in length by 23 cm in width and has a depth of 20 cm.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.								

Description:

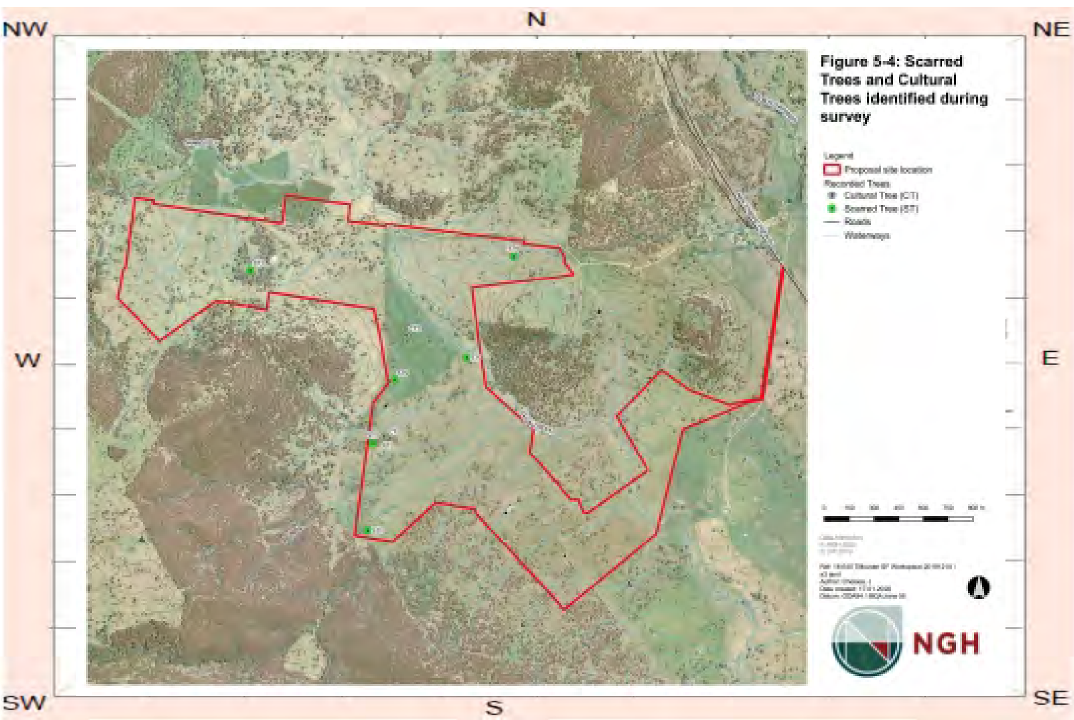
Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.								

Description:

Other Site Info: The tree is a dead, standing and of undetermined species, in poor condition that has a single curved pre-form scar. No axe marks were noted. It was noted that perimeter of the scar appeared hollowed and the general degradation of the tree was likely due to age and insect damage.

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm ST1.

Description: View south south-west of Tilbuster Solar Farm ST1.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0339

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar ST6

Easting: 369947

Northing: 6638562

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

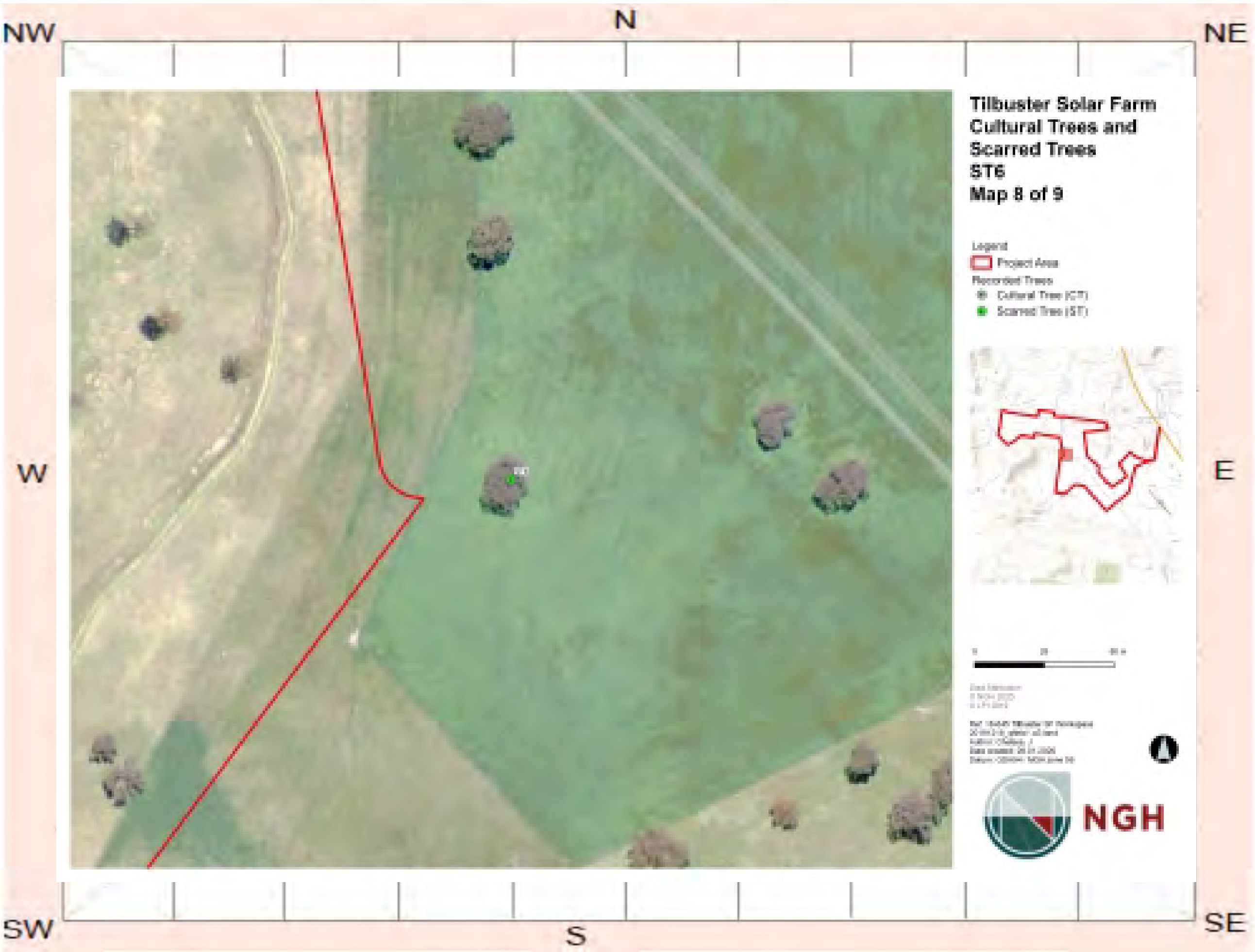
Distance to Water (m): 570

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km NW of house.

Other site information: The tree is alive, standing and appears to be a box species, in moderate condition that has two scars . No axe marks were noted. The registered Aboriginal parties present during the survey indicated that the narrow oval scar may reflect manufacture of cooloman and the larger oval scar some sort of f

Site location map



Site contents information

open/closed site: Open

Site condition: Good

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	2	40	19	5	5	Oval	Box

Description:

This site consists of a single scarred tree (2 scars) considered to be Aboriginal in origin within a predominantly cleared paddock. The narrow oval scar measures 40 cm in length by 19 cm in width. The misshapen larger oval scar measures 40 cm in length and 10 cm in width.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

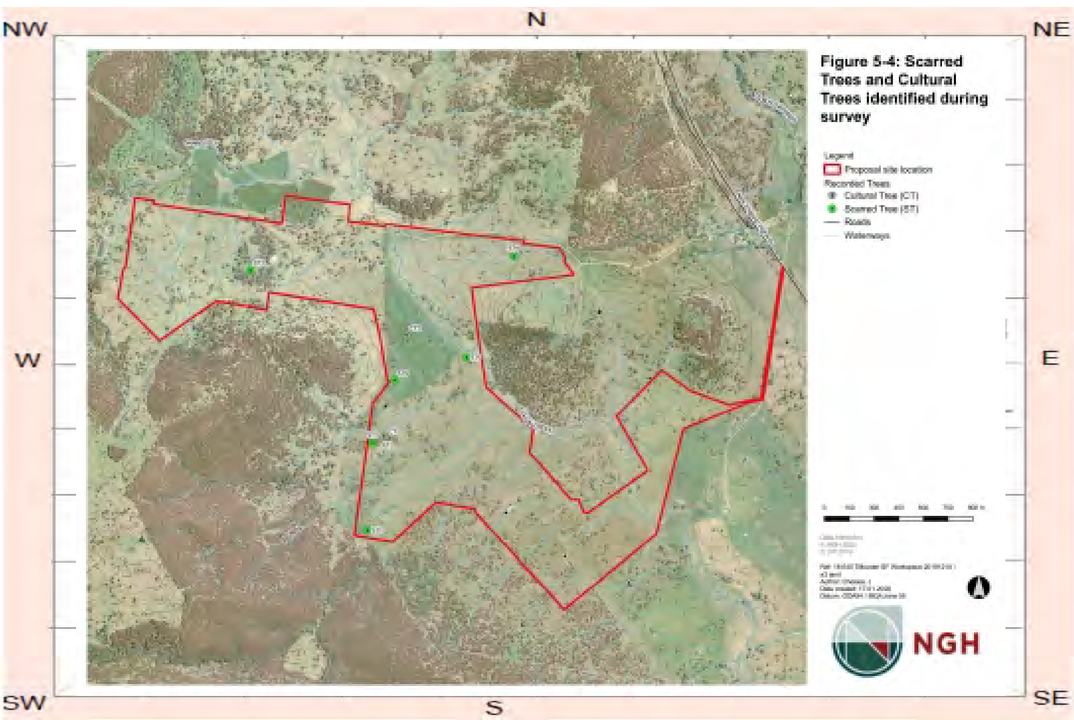
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The tree is alive, standing and appears to be a box species, in moderate condition that has two scars . No axe marks were noted. The registered Aboriginal parties present during the survey indicated that the narrow oval scar may reflect manufacture of cooloman and the larger oval scar some sort of f

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm ST6.

Description: View north-west of Tilbuster Solar Farm ST6.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0340

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar CT1

Easting: 369889 **Northing:** 6638215 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

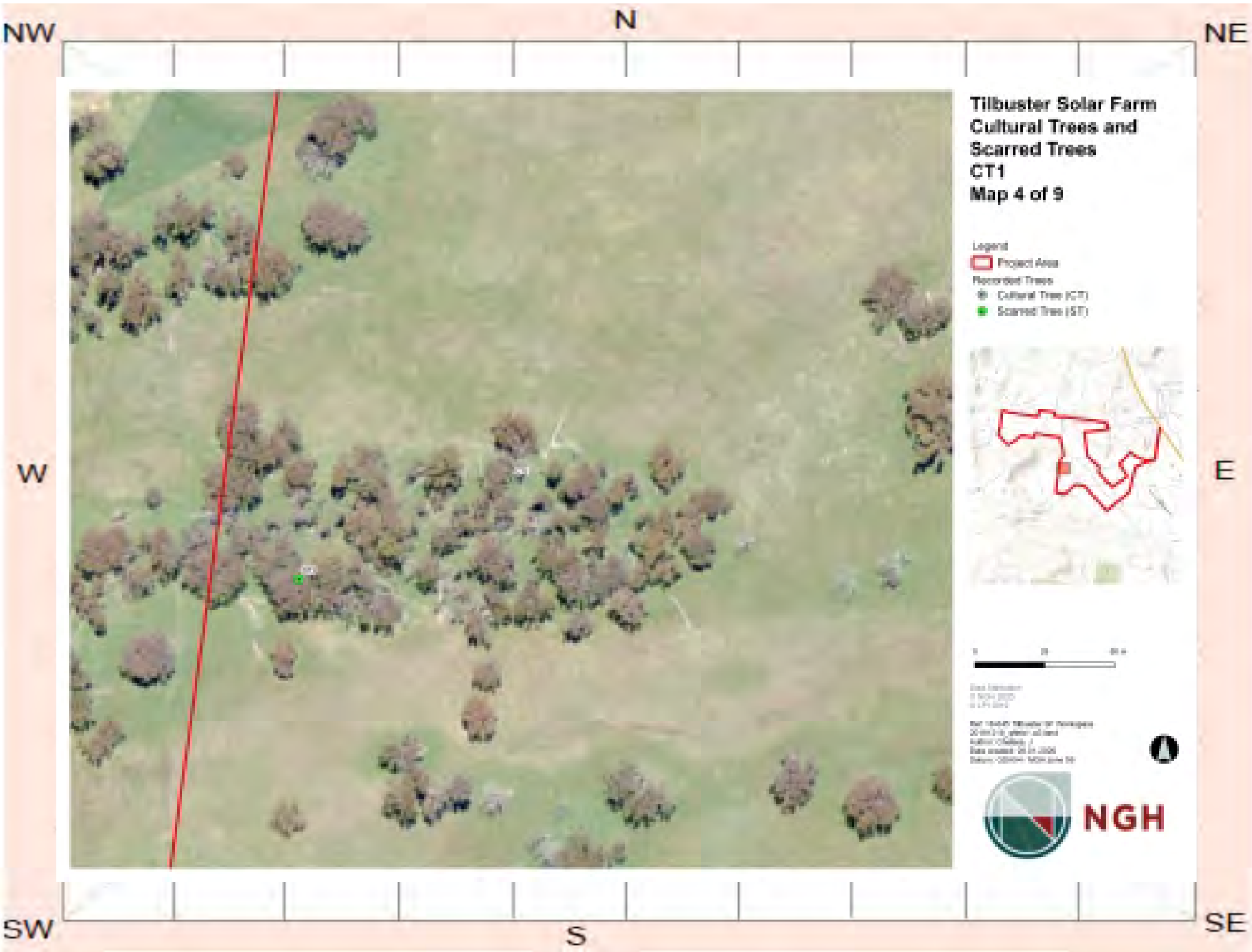
Distance to Water (m): 975

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km NW of house.

Other site information: The assessment concluded it not to be consistent with Aboriginal scarring morphology due to the amorphous shape and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was culturally significant.

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	00	00	00	00	Oval	Other

Description:

Despite the general oval shape, the scar splits towards the base of the tree and this in association with splitting and degradation towards the top of the trunk likely indicates the result of natural scarring rather than cultural scarring.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

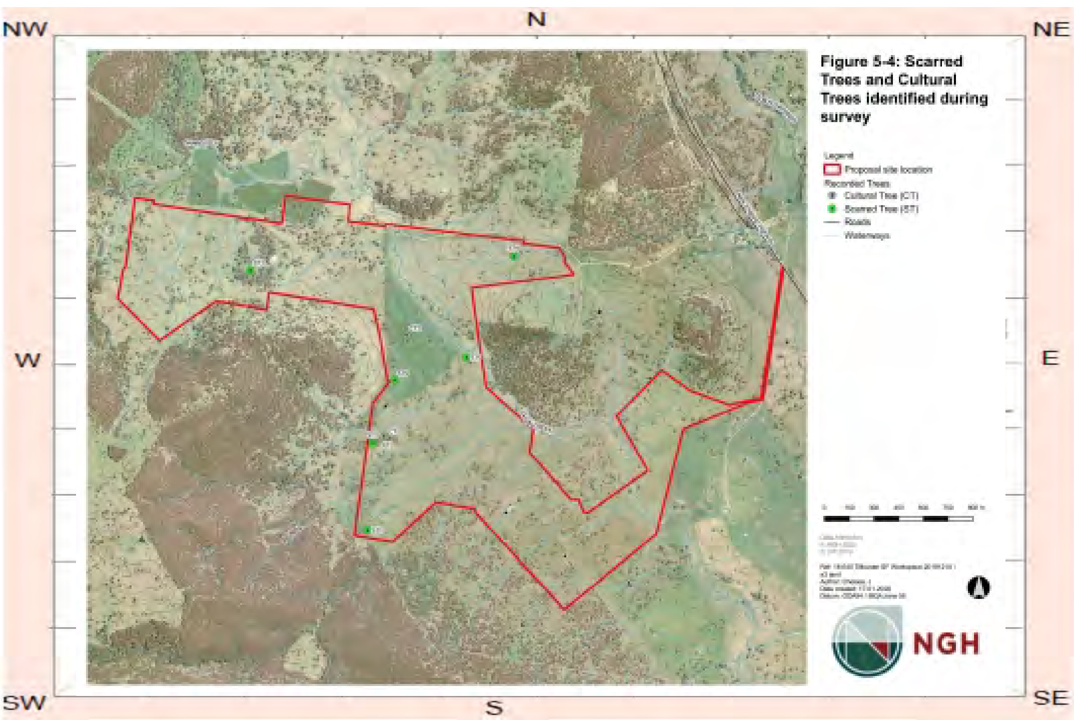
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The assessment concluded it not to be consistent with Aboriginal scarring morphology due to the amorphous shape and hollowed out interior through trauma damage. However, the Aboriginal community members present during the site survey indicated that this tree was culturally significant.

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm CT1.

Description: View north-west of Tilbuster Solar Farm CT1.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS site ID: 21-1-0341

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar CT3

Easting: 369882

Northing: 6638217

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Swamp

Vegetation: Isolated clumps of trees

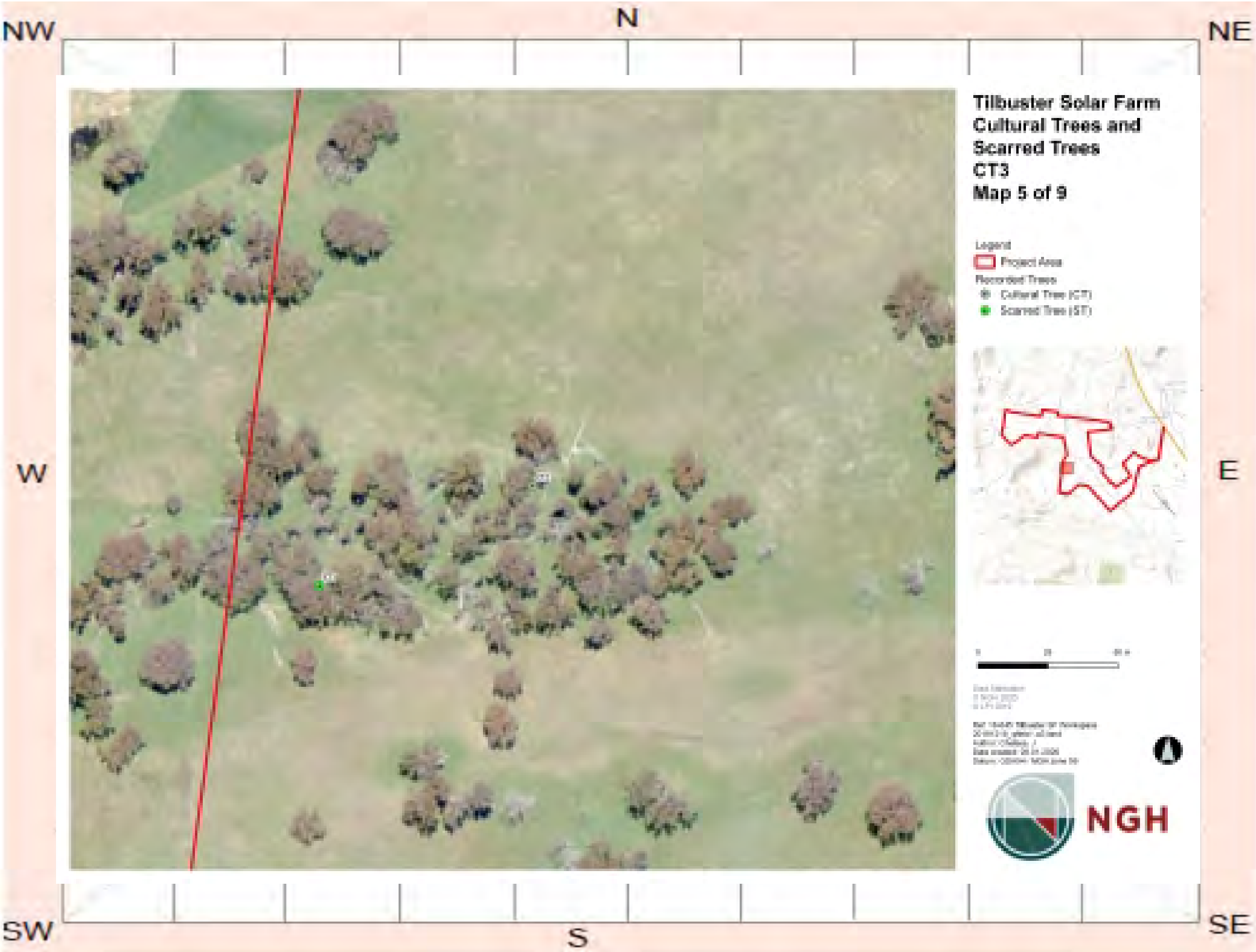
Distance to Water (m): 857

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km NW of house.

Other site information: Modern axe marks were evident at regular intervals either side of the scar and the amorphous shape of the scar is likely associated with breakage from the likely European tree felling process. However, the Aboriginal community members present during the site survey indicated that this tree was deter

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Modified Tree	1	00	00	00	00	Other	Other

Description:

The scar identified on this tree were determined to not be archaeological in nature and did not conform to the standard scarring morphology accepted for Aboriginal modification (cf. Long 2005). The morphological characteristics of the scarring are interpreted to conform with natural scarring

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.								

Description:

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.								

Description:

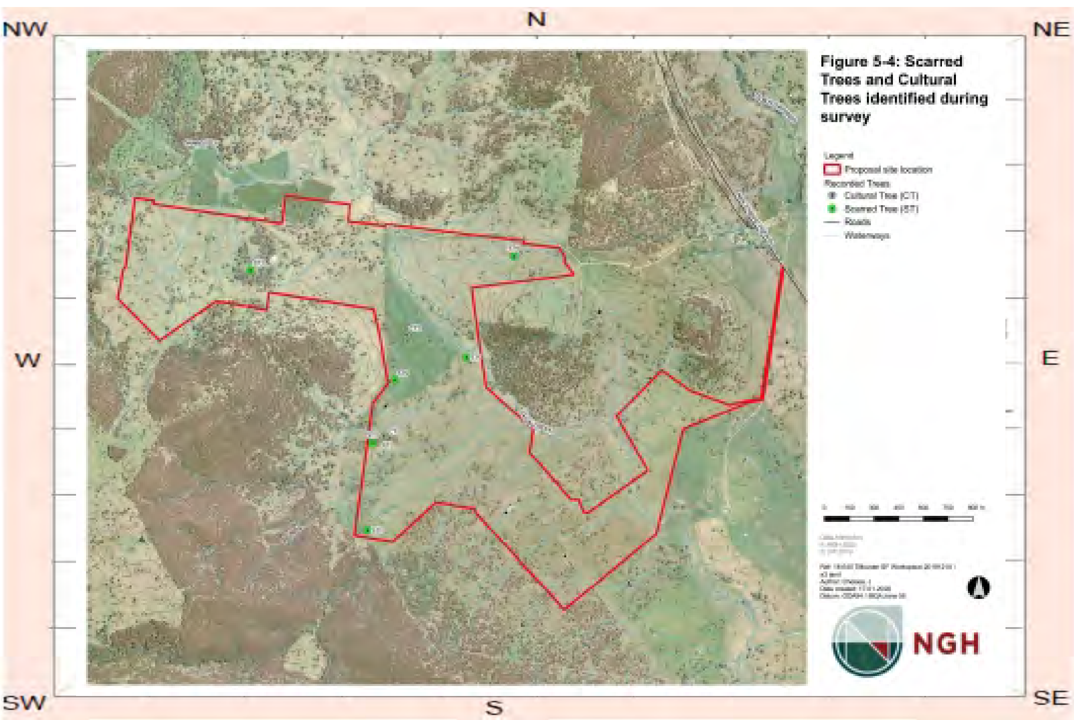
Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.								

Description:

Other Site Info: Modern axe marks were evident at regular intervals either side of the scar and the amorphous shape of the scar is likely associated with breakage from the likely European tree felling process. However, the Aboriginal community members present during the site survey indicated that this tree was deter

Site plan



Site photographs

Description: Close up of scar at Tilbuster Solar Farm CT3.

Description: View north-west of Tilbuster Solar Farm CT3.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0342

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS19

Easting: 370500

Northing: 6637765

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

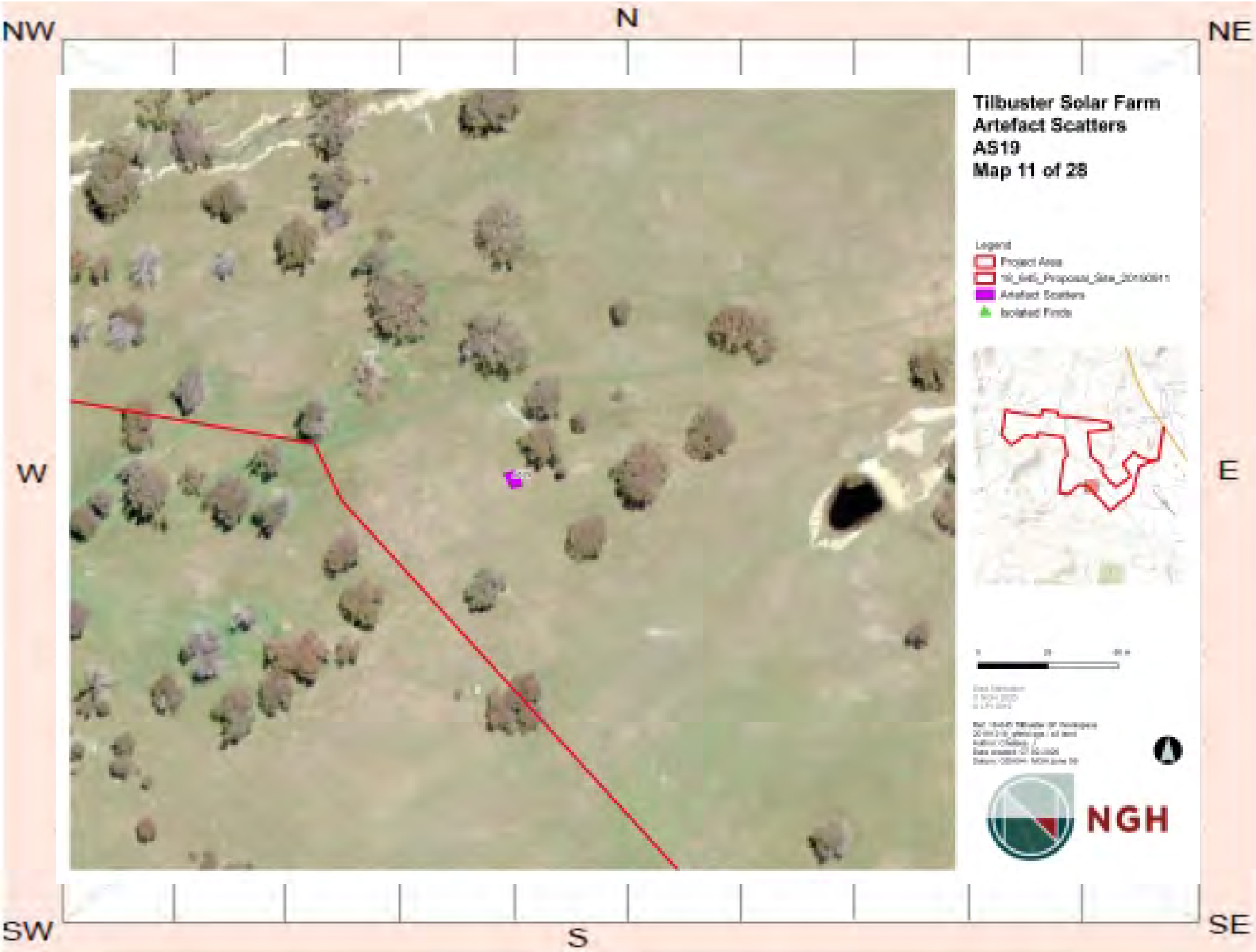
Distance to Water (m): 122

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.4km W of house.

Other site information: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought, and visibility was approximately 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	6	4				

Description:

The scatter included a silcrete flake (n=1) and a chert core (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

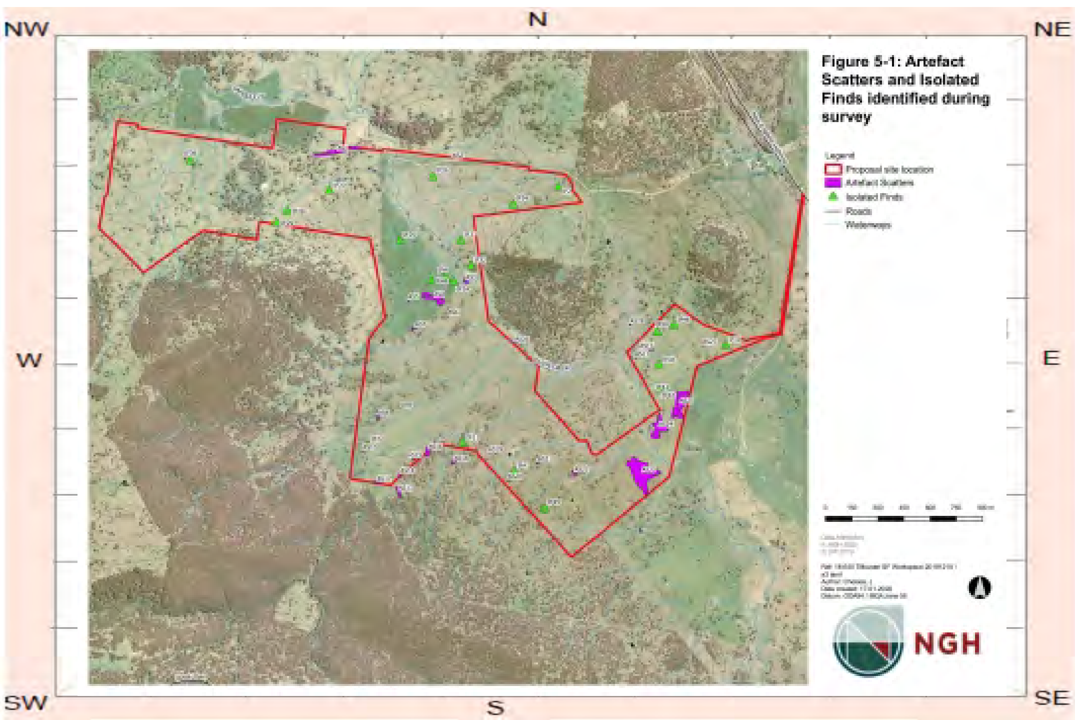
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought, and visibility was approximately 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS19.

Description: Close up of chert core, part of Tilbuster Solar Farm AS19.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0343

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS18

Easting: 370302 **Northing:** 6637712 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

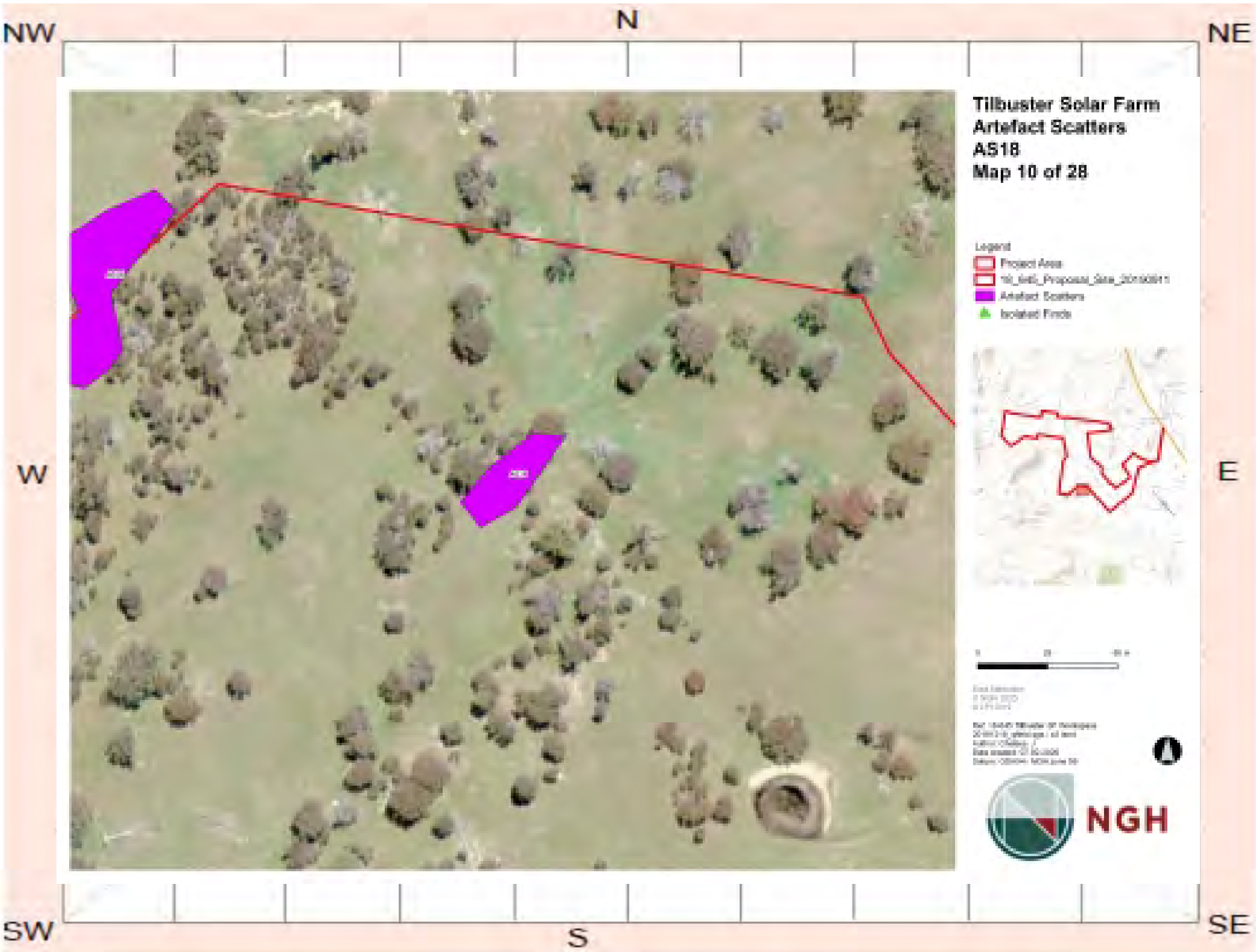
Distance to Water (m): 1115

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.7km W of house.

Other site information: The majority of artefacts showed evidence of tertiary stage reduction and also demonstrated evidence of vehicle damage. The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Vehicle damage

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	12	40	16				

Description:

Lithic types were mainly characterised by flakes (n=5), distal fragments (n=2), a broken flake (n=1), a core (n=1), a medial fragment (n=1) and a split flake (n=1). Additionally, one formal type, a silcrete scraper, was also identified (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

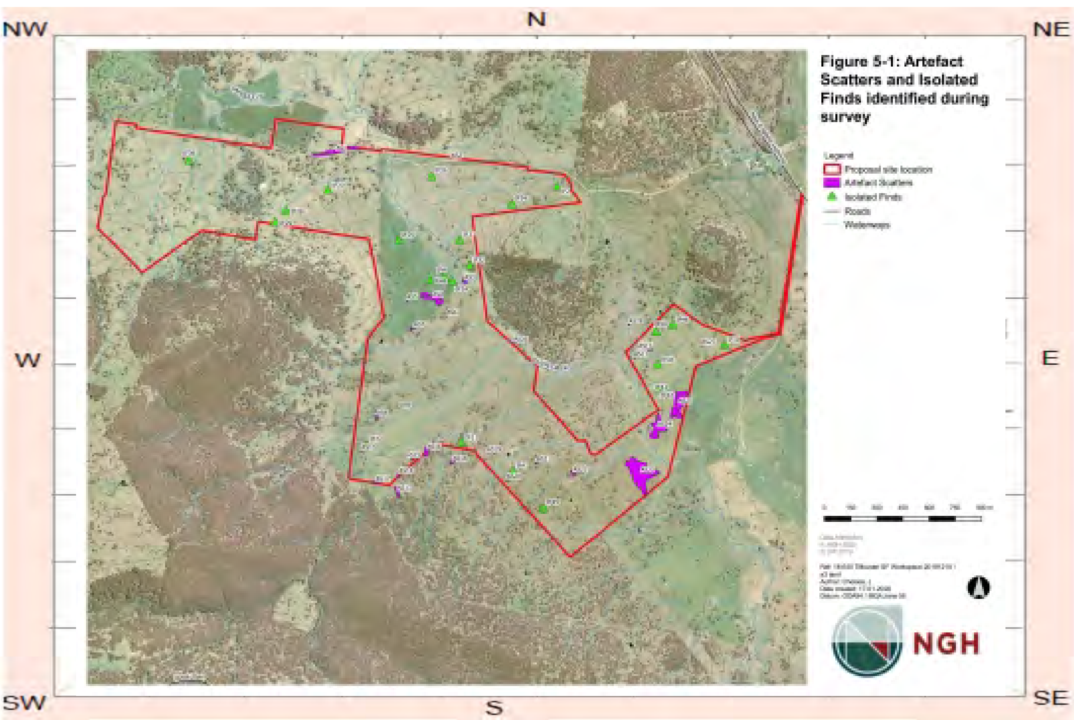
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The majority of artefacts showed evidence of tertiary stage reduction and also demonstrated evidence of vehicle damage. The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 80%.

Site plan



Site photographs

Description: Close up of silcrete scraper, part of Tilbuster Solar Farm AS18.

Description: Two silcrete flakes located at Tilbuster Solar Farm AS18.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

NSW GOVERNMENT | Office of Environment & Heritage

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0344

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS17

Easting: 371436

Northing: 6638357

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

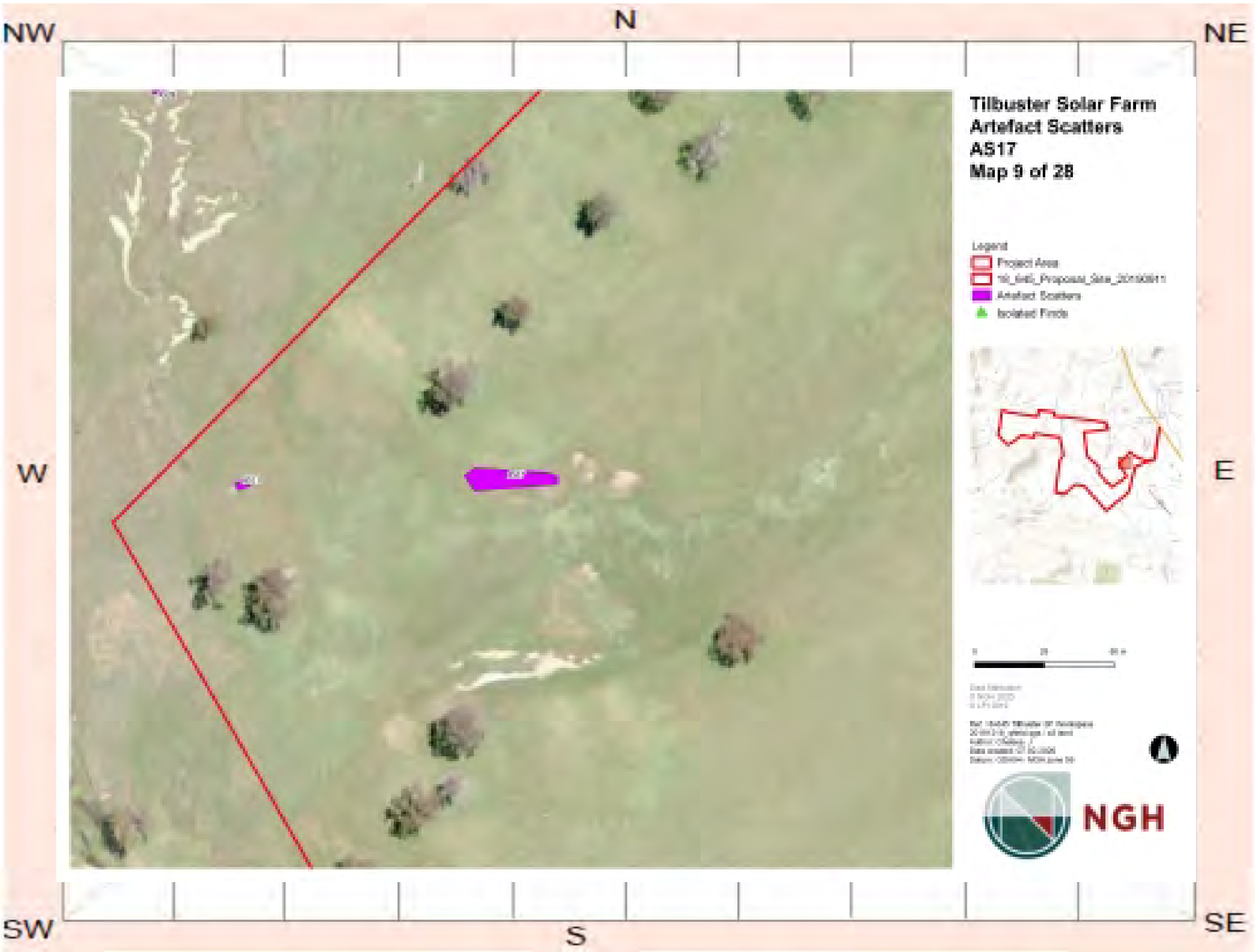
Distance to Water (m): 190

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 800m NNW of house.

Other site information: The artefacts were located on a shallow grey-brown sandy loam deposit and visibility was approximately 90%.

Site location map



Site contents information

open/closed site: Open **Site condition:** Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	3	30	5				

Description:

The scatter included a retouched silcrete flake (n=1), a broken silcrete flake (n=1) and a silcrete manuport (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

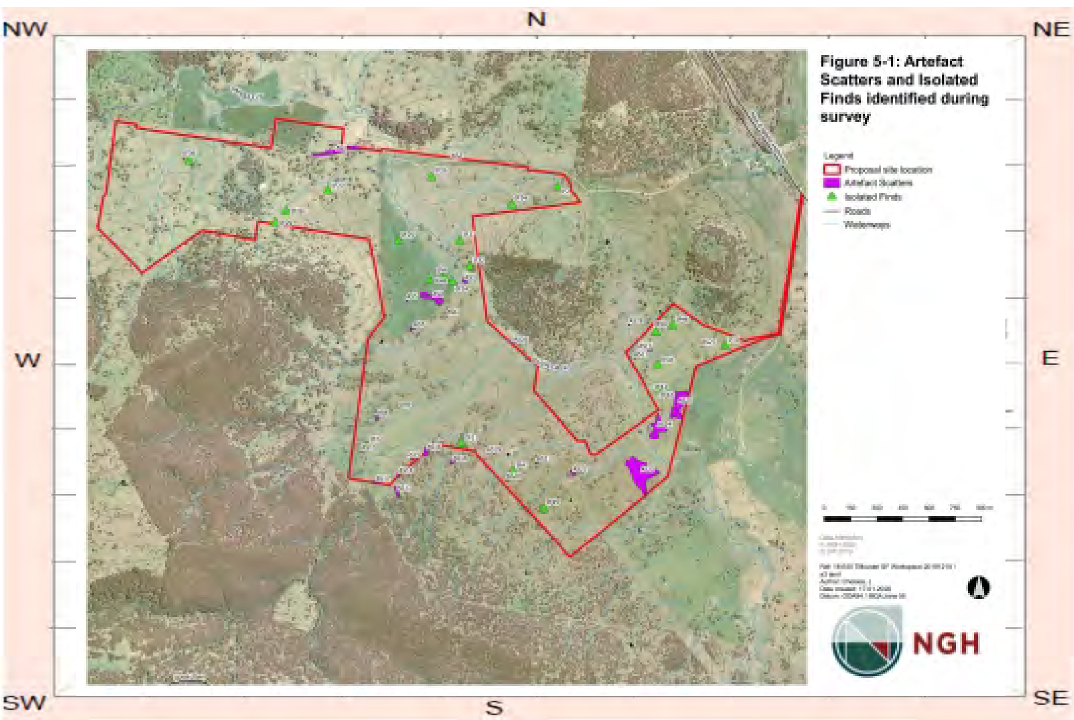
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a shallow grey-brown sandy loam deposit and visibility was approximately 90%.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS17.

Description: Location of Tilbuster Solar Farm AS17.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender | General | Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0345

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS16

Easting: 370156

Northing: 6637781

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

Distance to Water (m): 1255

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

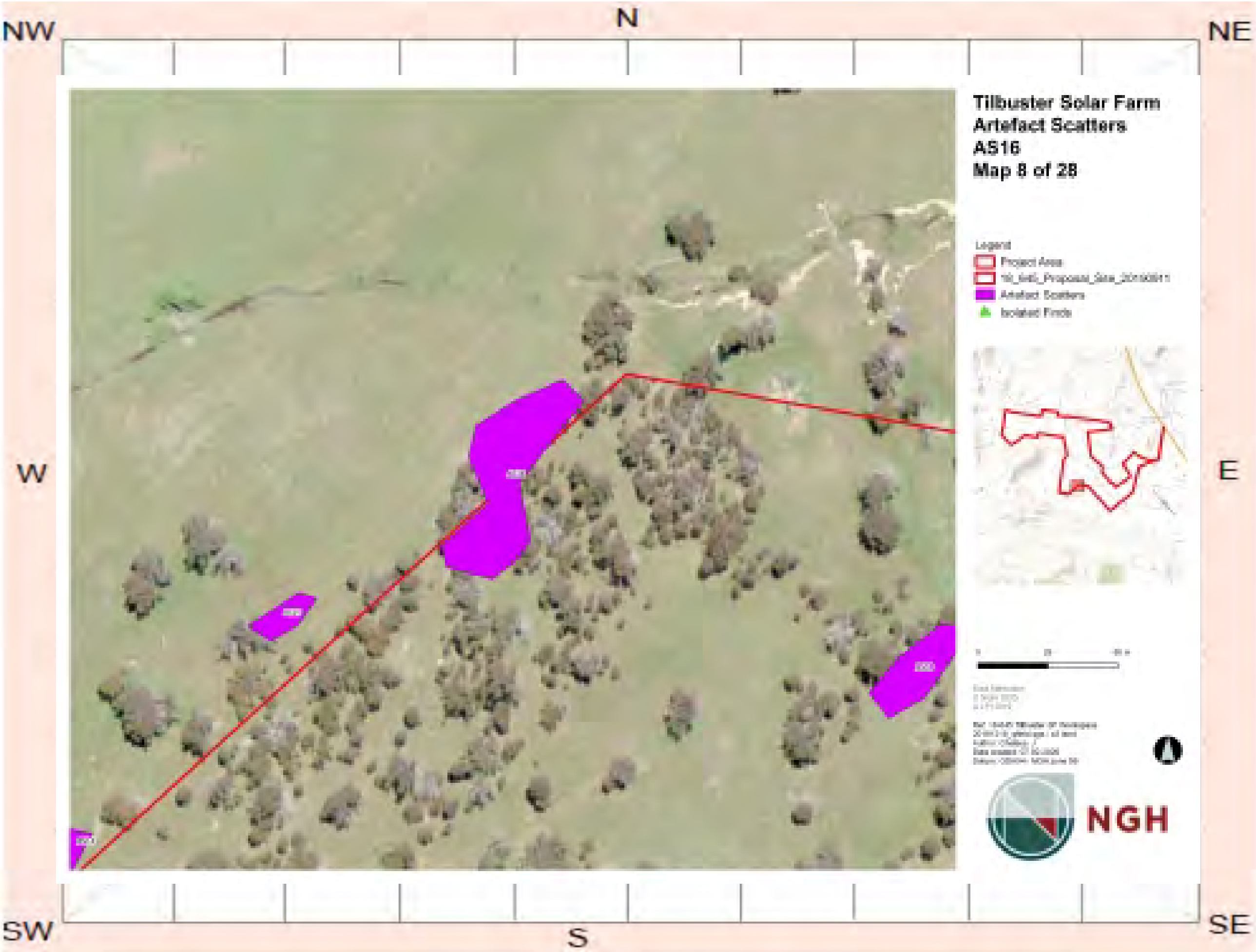
How to get to the site:

From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.8km W of house.

Other site information:

The majority of artefacts showed evidence of tertiary stage reduction. The artefacts were located on a heavily eroded grey-brown sandy loam and visibility was approximately 80%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated fro

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	36	71	18				

Description:

Lithic types were mainly characterised by flakes (including one backed) (n=22), proximal fragments (n=3), flaked pieces (n=3), distal fragments (n=2), cores (n=2), broken flakes (n=2), a medial fragment (n=1) and a split flake (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
3.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
4.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

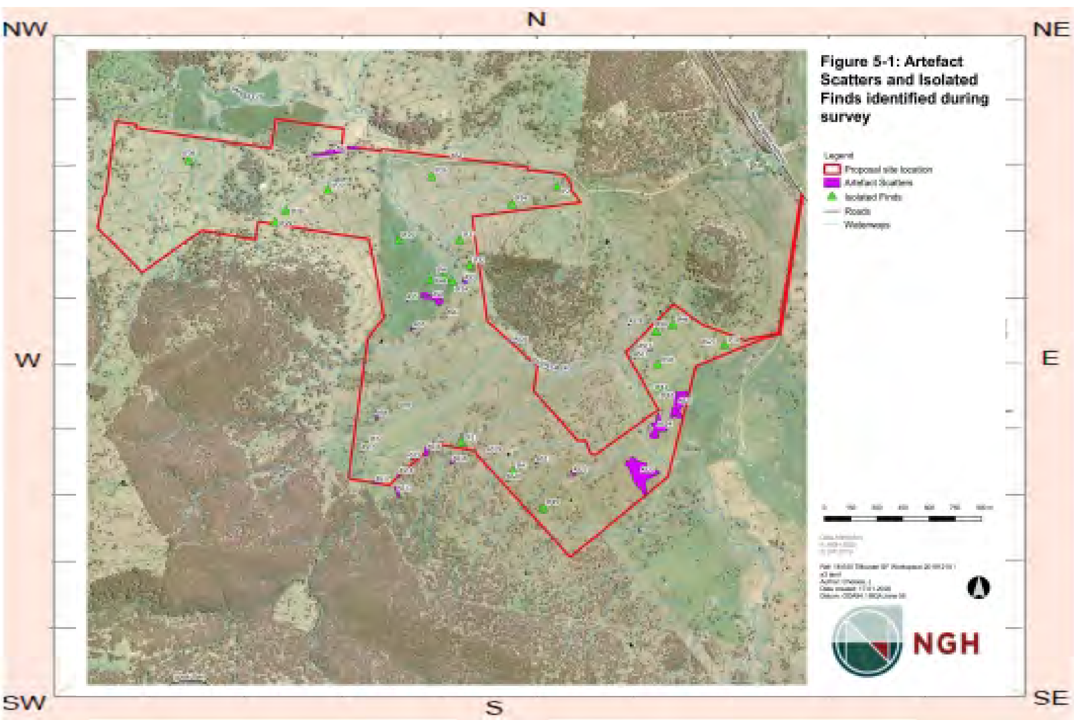
	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
5.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Other Site Info: The majority of artefacts showed evidence of tertiary stage reduction. The artefacts were located on a heavily eroded grey-brown sandy loam and visibility was approximately 80%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated fro

Site plan



Site photographs

Description: Close up of two silcrete flakes, the one on the left being backed, part of Tilbuster Solar Farm AS16

Description: Location, facing west, of Tilbuster Solar Farm AS16.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0346 **Date recorded:** 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS15

Easting: 370076 **Northing:** 6637731 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain **Land Use:** Pastoral/Grazing

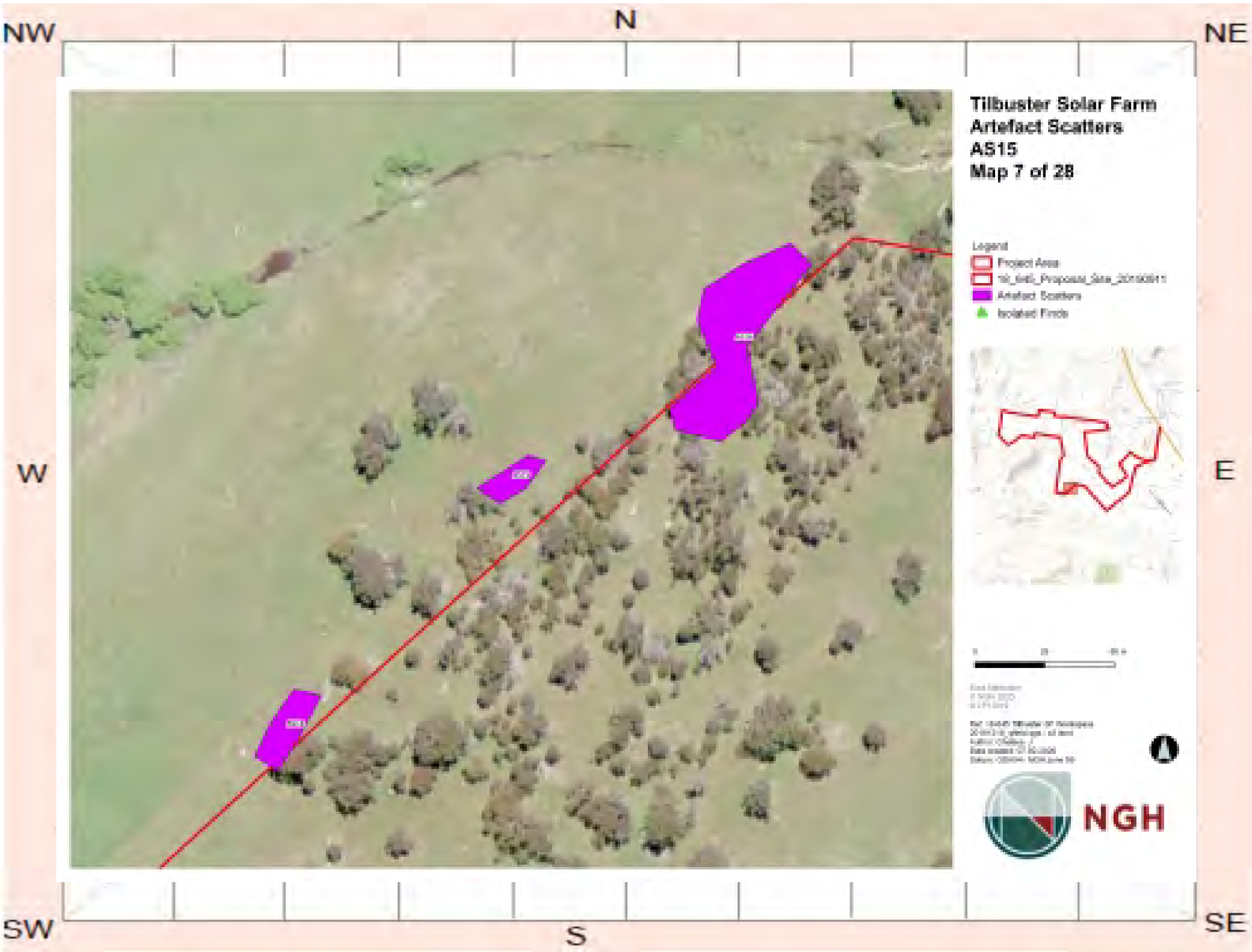
Land Form Unit: Slope **Vegetation:** Isolated clumps of trees

Distance to Water (m): 1302 **Primary Report:** Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.9km W of house.

Other site information: The artefacts were located on an eroded redeposited grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	19	10				

Description:

The scatter included one silcrete flake (n=1) and one silcrete proximal fragment (n=1).

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees

Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

3.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees

Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

4.

Description:

Features:

Number of features | Length of feature(s) extent (m) | Width of feature (s) extent (m)

Scarred Trees

Scar Depth (cm) | Regrowth (cm) | Scar shape | Tree Species

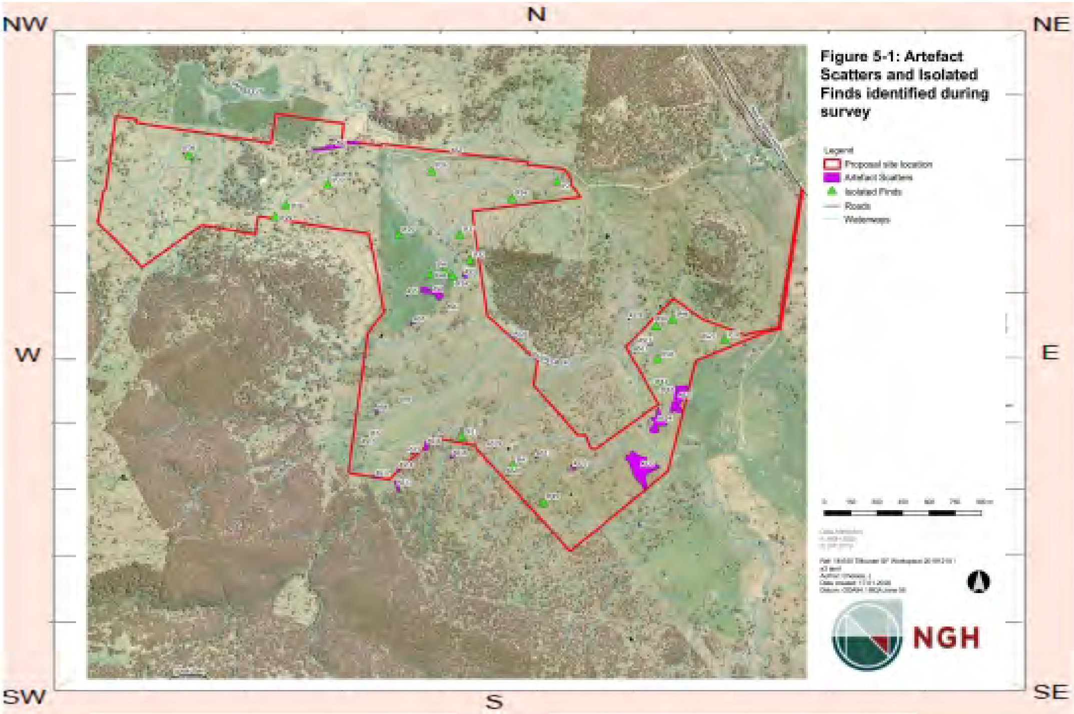
5.

Description:

Other Site Info:

The artefacts were located on an eroded redeposited grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site plan



Site photographs

Description: Close up of silcrete proximal fragment, part of Tilbuster Solar Farm A15.

Description: Close up of silcrete flake, part of Tilbuster Solar Farm A15.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0347

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS14

Easting: 369995

Northing: 6637642

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

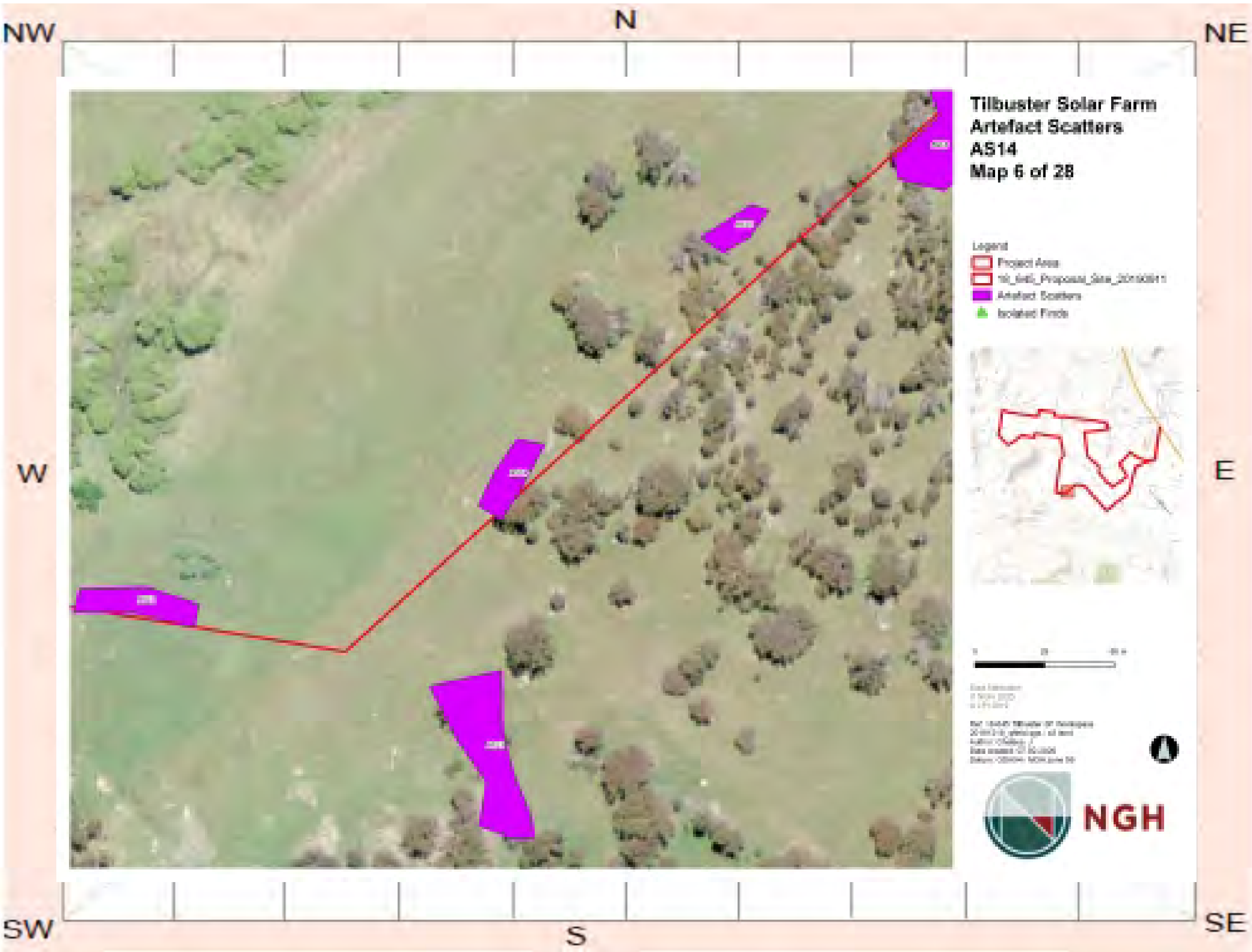
Distance to Water (m): 1480

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km W of house.

Other site information: The artefacts were located on an eroded grey-brown sandy loam and visibility was approximately 80%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	6	32	12				

Description:

The scatter included equal quantities of silcrete, quartz and chert materials. Tool types included cores (n=2), flakes (n=2), a distal fragment (n=1) and a proximal fragment (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

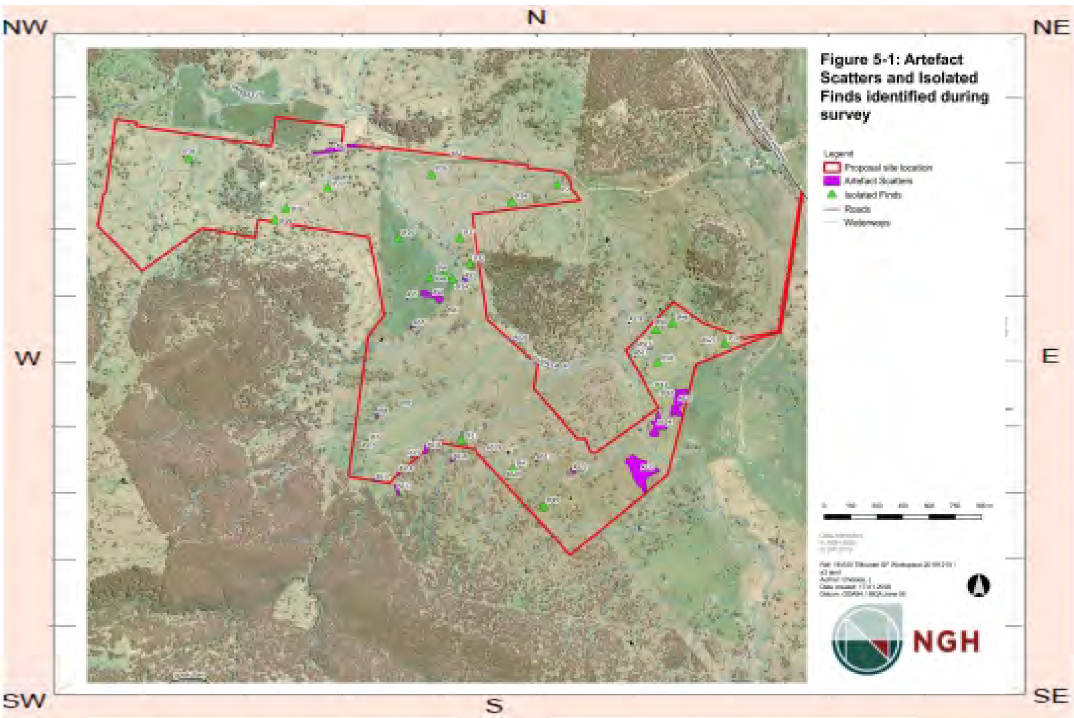
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on an eroded grey-brown sandy loam and visibility was approximately 80%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS14.

Description: Chert core, part of Tilbuster Solar Farm AS14.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0348

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS13

Easting: 369986 **Northing:** 6637544 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

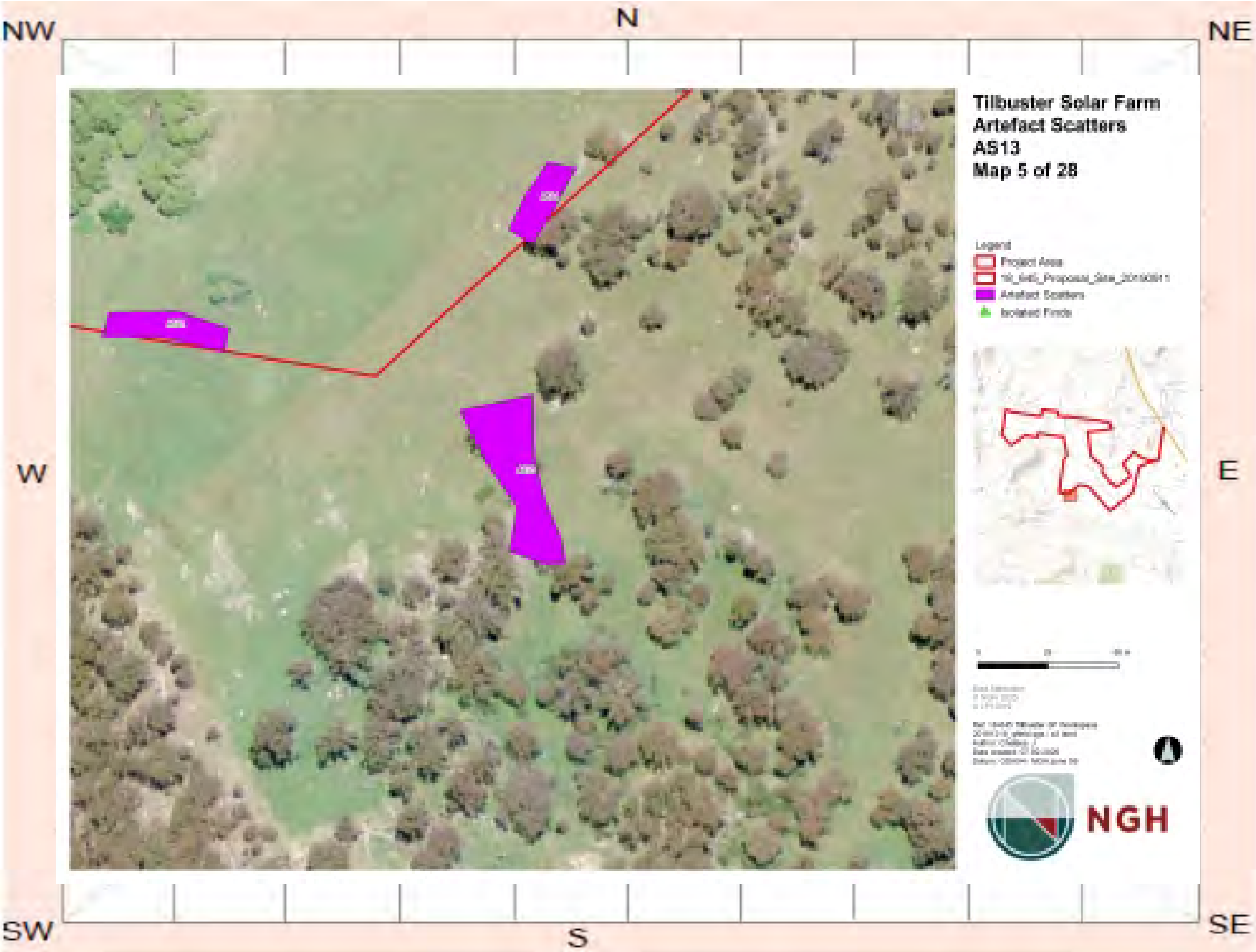
Distance to Water (m): 1444

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.0km W of house.

Other site information: The artefacts were located on a grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	10	62	13				

Description:

Artefact types included flakes (n=3), manuports (n=3), broken flakes (n=2), a proximal fragment (n=1) and a distal fragment (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

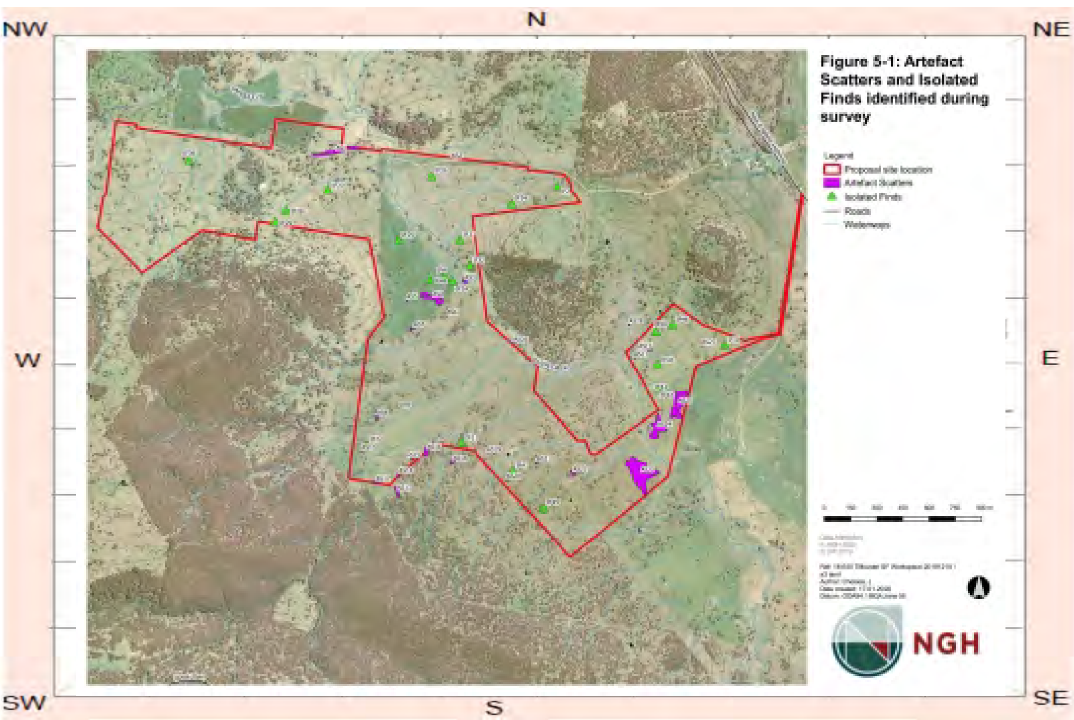
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam and visibility was approximately 70%. Scatters AS13, AS14, AS15 and AS16, as well as nearby isolated finds, are likely to be related and may have originated from one location prior to disturbances.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS13.

Description: Location, facing west, of Tilbuster Solar Farm AS13.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	Surname	First name

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0349

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS12

Easting: 369861 **Northing:** 6637596 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

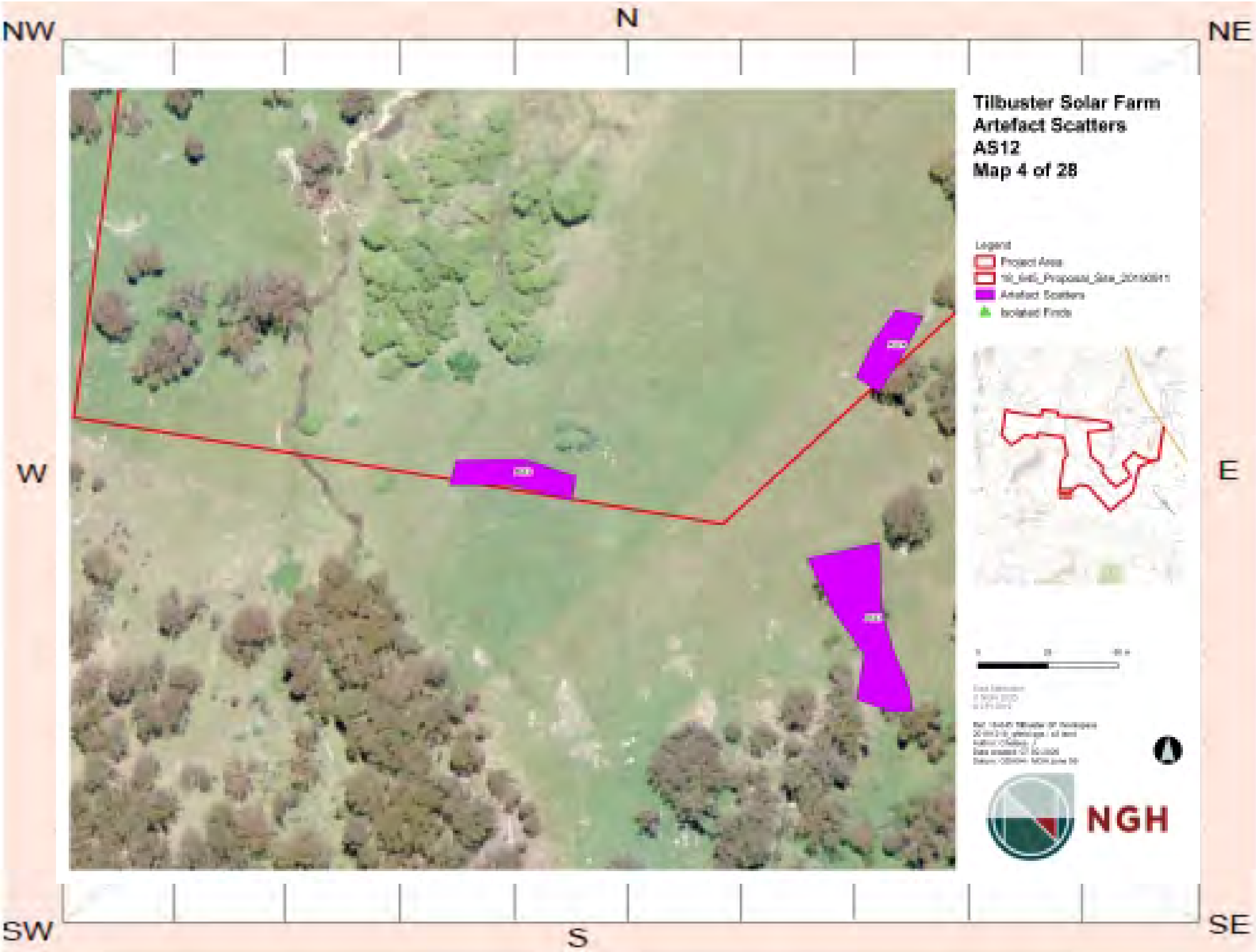
Distance to Water (m): 1574

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 2.1km W of house.

Other site information: The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 70%.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	43	8				

Description:

The scatter included one silcrete flake (n=1) and one volcanic flake (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

					Scarred Trees			
Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)		Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.								

Description:

					Scarred Trees			
Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)		Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.								

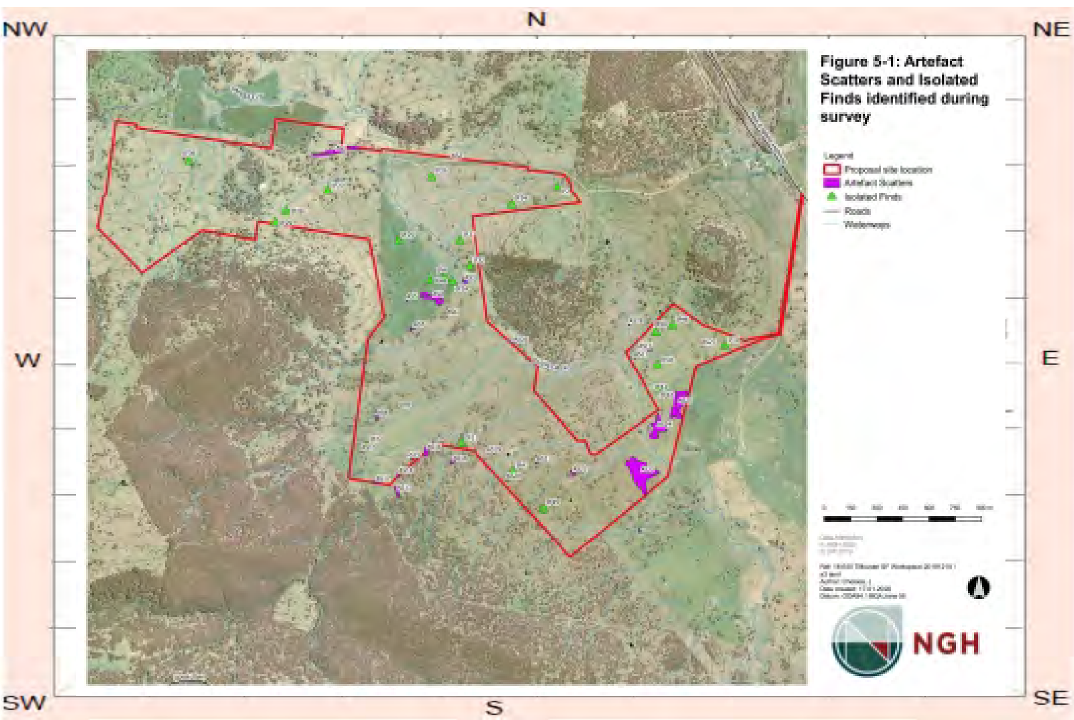
Description:

					Scarred Trees			
Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)		Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.								

Description:

Other Site Info: The artefacts were located on a shallow grey-brown sandy loam and visibility was approximately 70%.

Site plan



Site photographs

Description: Close up of volcanic flake, part of Tilbuster Solar Farm AS12.

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS12.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone:

E-mail:

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0350

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS28

Easting: 371312 **Northing:** 6638502 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

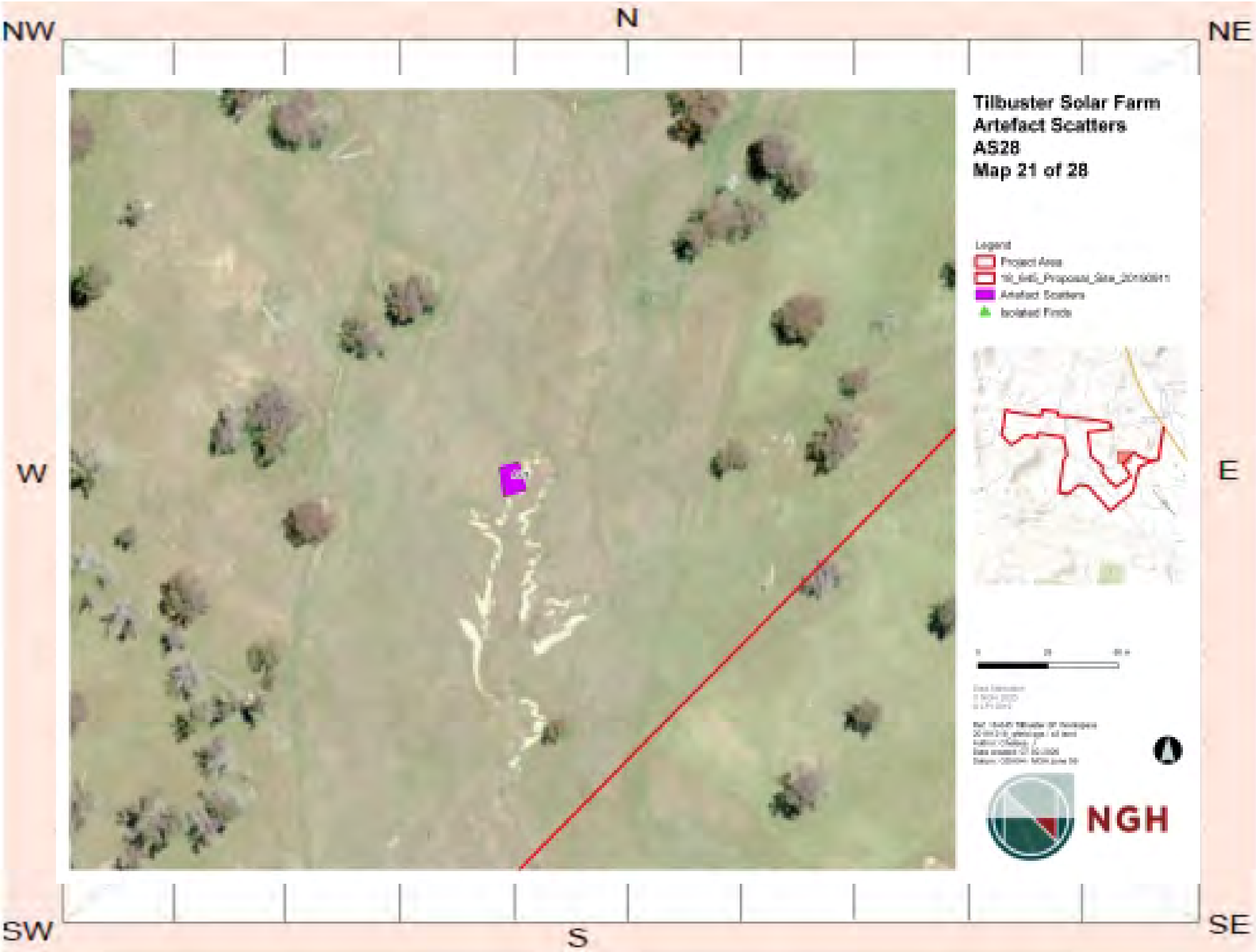
Distance to Water (m): 208

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 991m NNW of house.

Other site information: These may have been eroding out of the banks of the creek but equally may have been washed into the creek bed and then imbedded as a result of sedimentation. The deeply incised banks of Duval Creek suggest that movement of water can be rapid at times of flood or heavy rain.
Visibility 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Stock Damage

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	3	11	7				

Description:

The scatter comprised two broken silcrete flakes and one broken greywacke flake (n=3).

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

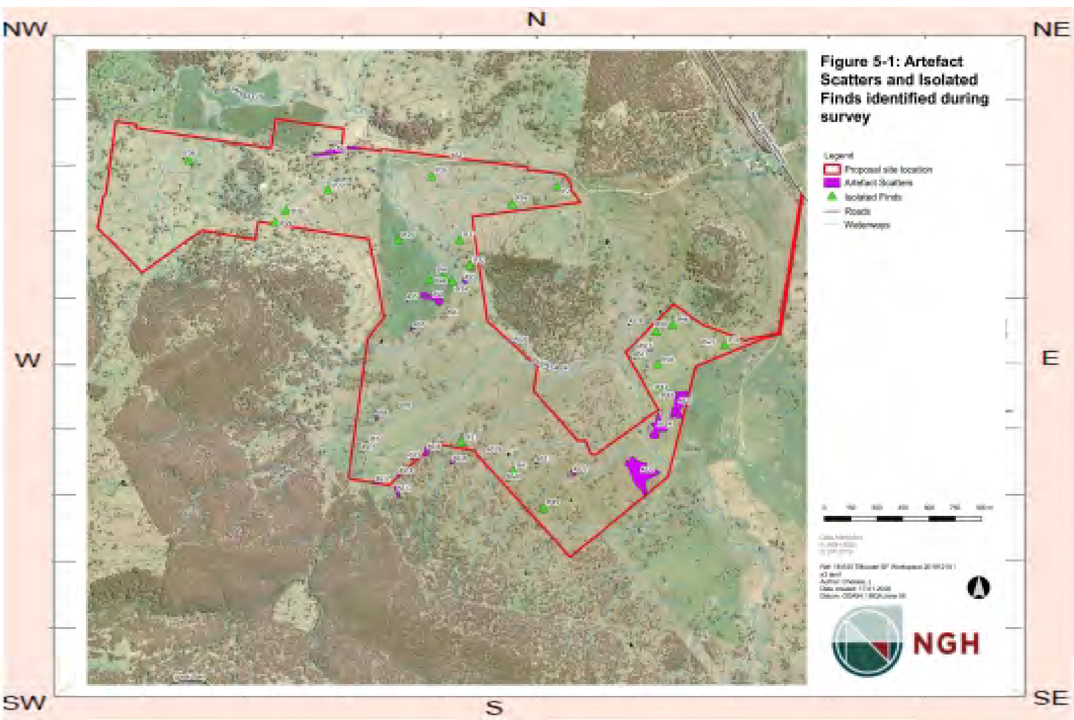
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

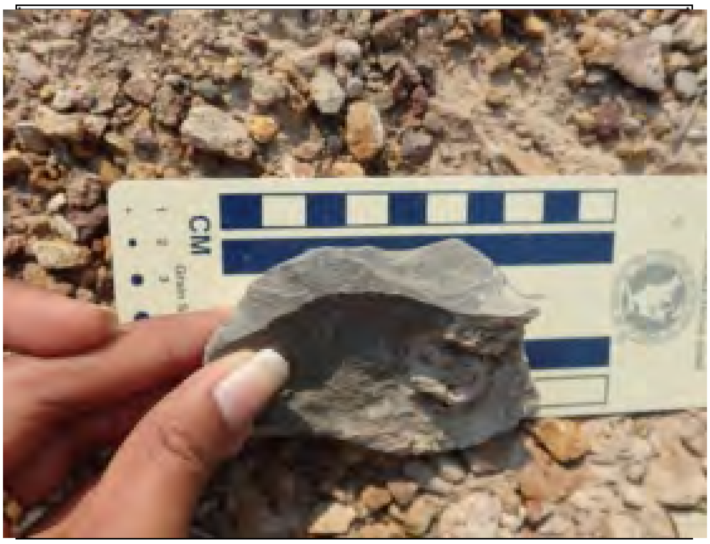
Other Site Info: These may have been eroding out of the banks of the creek but equally may have been washed into the creek bed and then imbedded as a result of sedimentation. The deeply incised banks of Duval Creek suggest that movement of water can be rapid at times of flood or heavy rain. Visibility 80%.

Site plan



Site photographs

Description: Close up of broken silcrete flake, part of Tilbuster Solar Farm AS27.



Description: Close up of greywacke flake, part of Tilbuster Solar Farm AS27.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0351 **Date recorded:** 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS27

Easting: 371729 **Northing:** 6638382 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

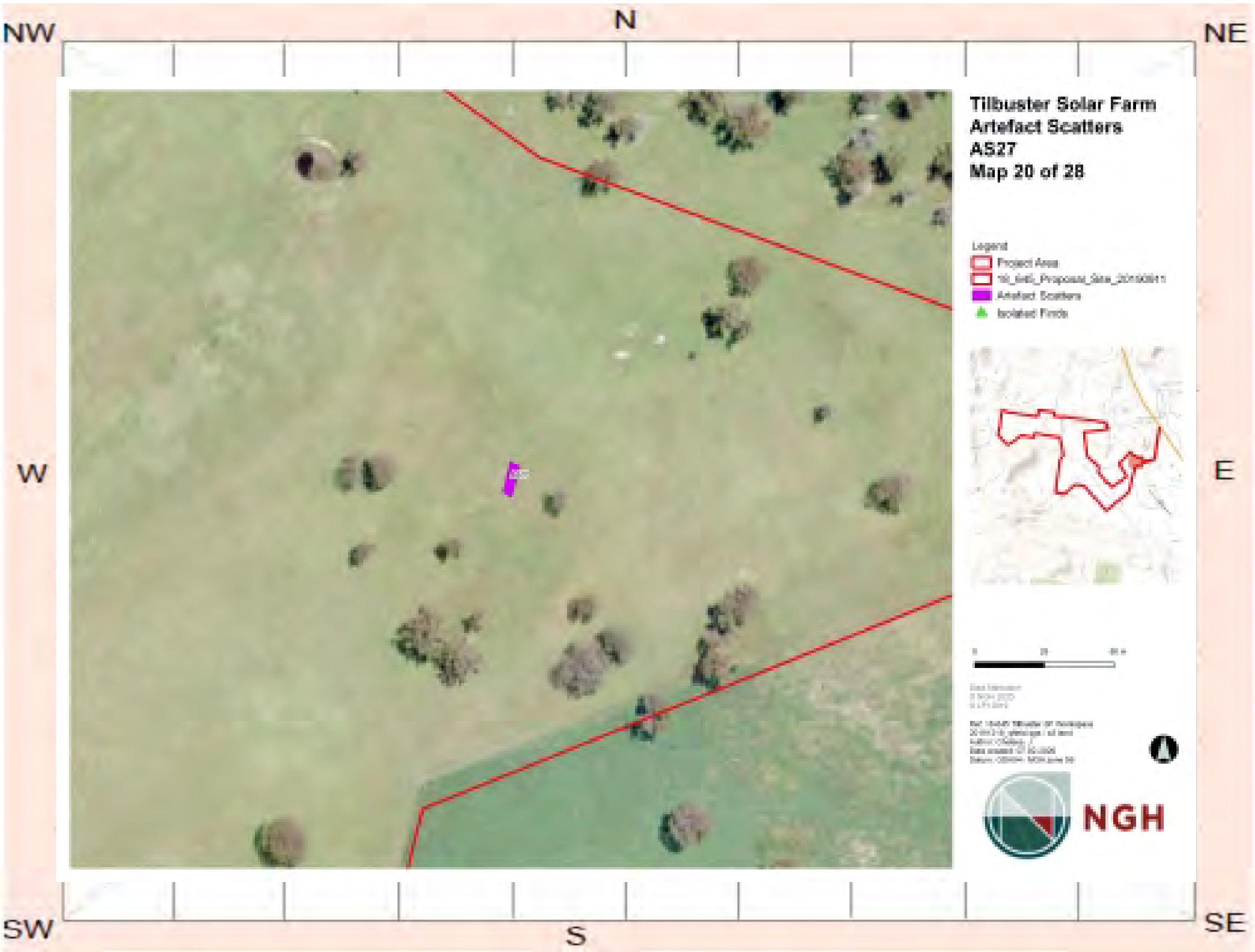
Distance to Water (m): 460

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 670m N of house.

Other site information: The artefacts were located on the banks of Duval Creek atop an eroded sandy silt redeposited A horizon layer.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	10	3				

Description:

The artefacts were located on a grey-brown sandy loam deposit and visibility was approximately 80%. Two greywacke flakes.

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

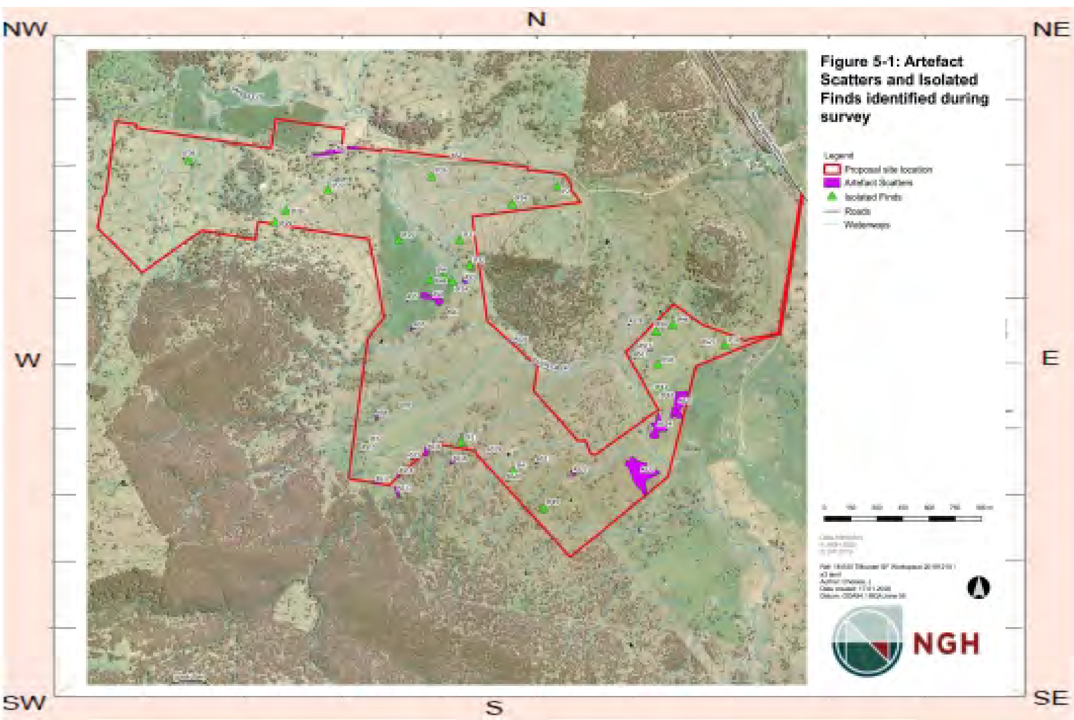
Description:

Features:	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

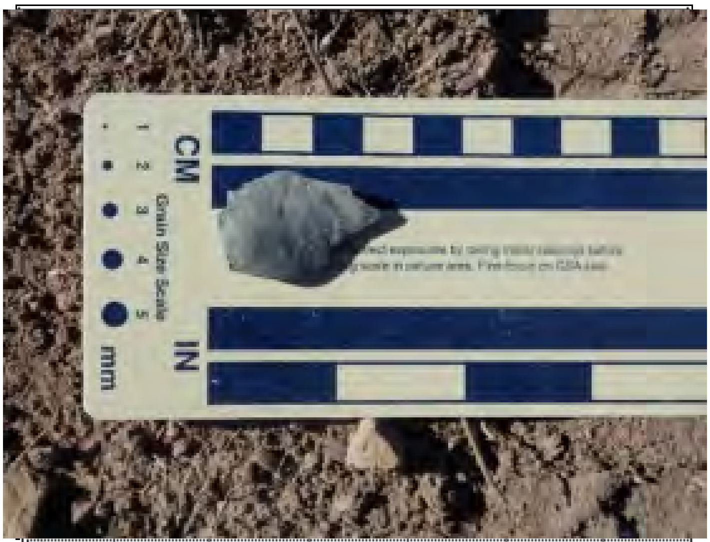
Description:

Other Site Info: The artefacts were located on the banks of Duval Creek atop an eroded sandy silt redeposited A horizon layer.

Site plan



Site photographs



Description: Close up of greywacke flake, part of Tilbuster Solar Farm AS27.

Description: Location of Tilbuster Solar Farm AS27, facing south east.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0352

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS26

Easting: 370652

Northing: 6638397

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

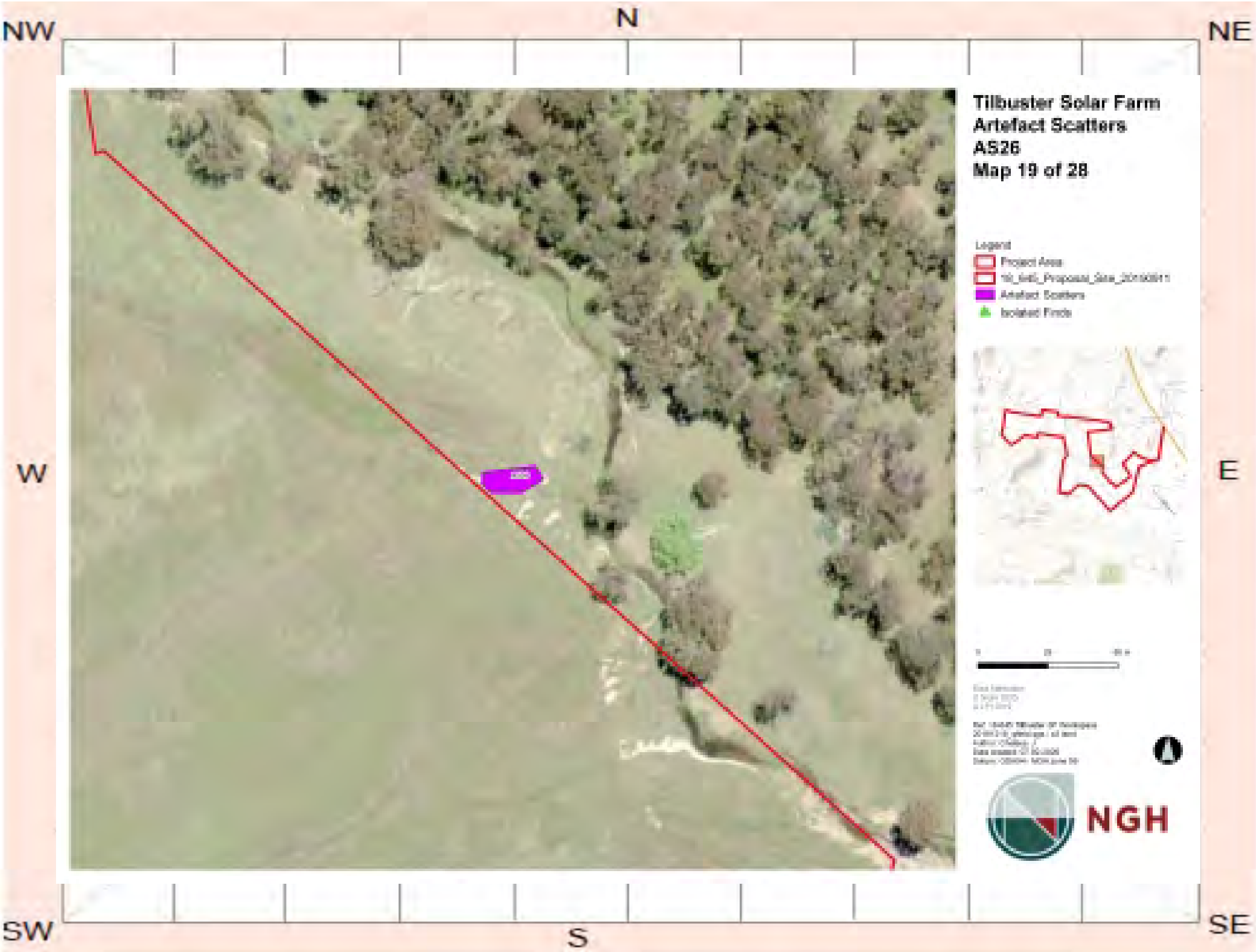
Distance to Water (m): 20

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.4km NW of house.

Other site information: The artefacts were located on the banks of Duval Creek atop an eroded sandy silt redeposited A horizon layer.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	21	8				

Description:

The site consisted of a low-density artefact scatter comprising two artefacts, a quartz core (n=1) and a quartz flake (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)

Scarred Trees

Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

3.

Description:

Features:

Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)

Scarred Trees

Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

4.

Description:

Features:

Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)

Scarred Trees

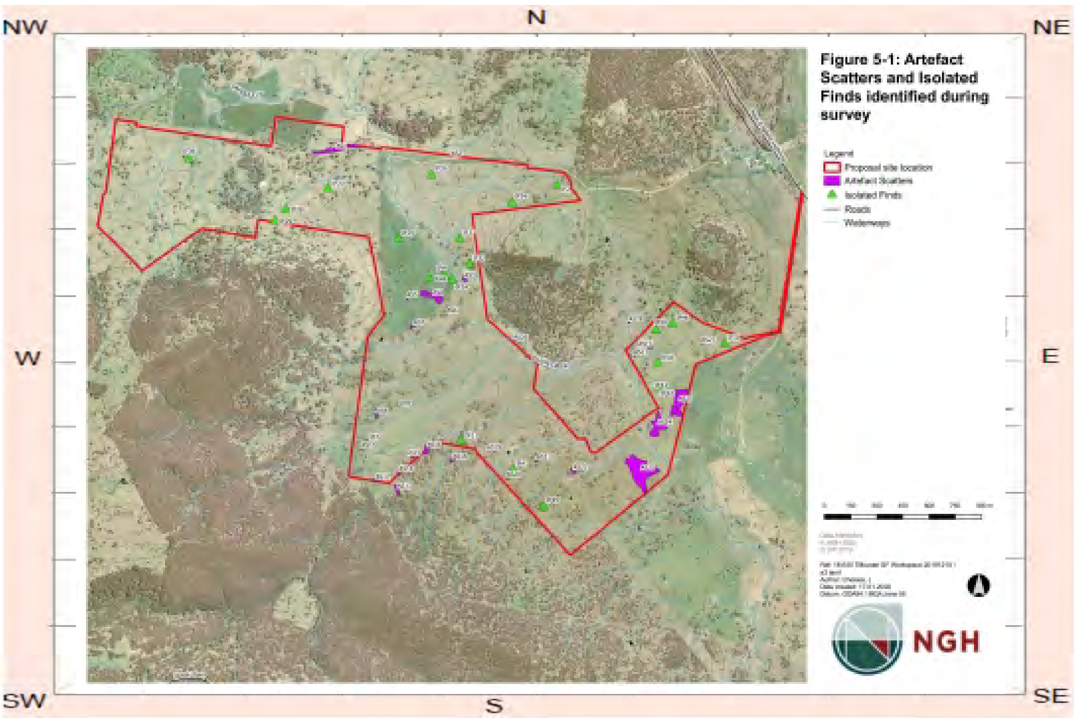
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

5.

Description:

Other Site Info: The artefacts were located on the banks of Duval Creek atop an eroded sandy silt redeposited A horizon layer.

Site plan



Site photographs

Description: Close up of quartz core, part of Tilbuster Solar Farm AS26.

Description: Quartz flake at Tilbuster Solar Farm AS26.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title **Surname** **First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0353

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS25

Easting: 371598

Northing: 6638045

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

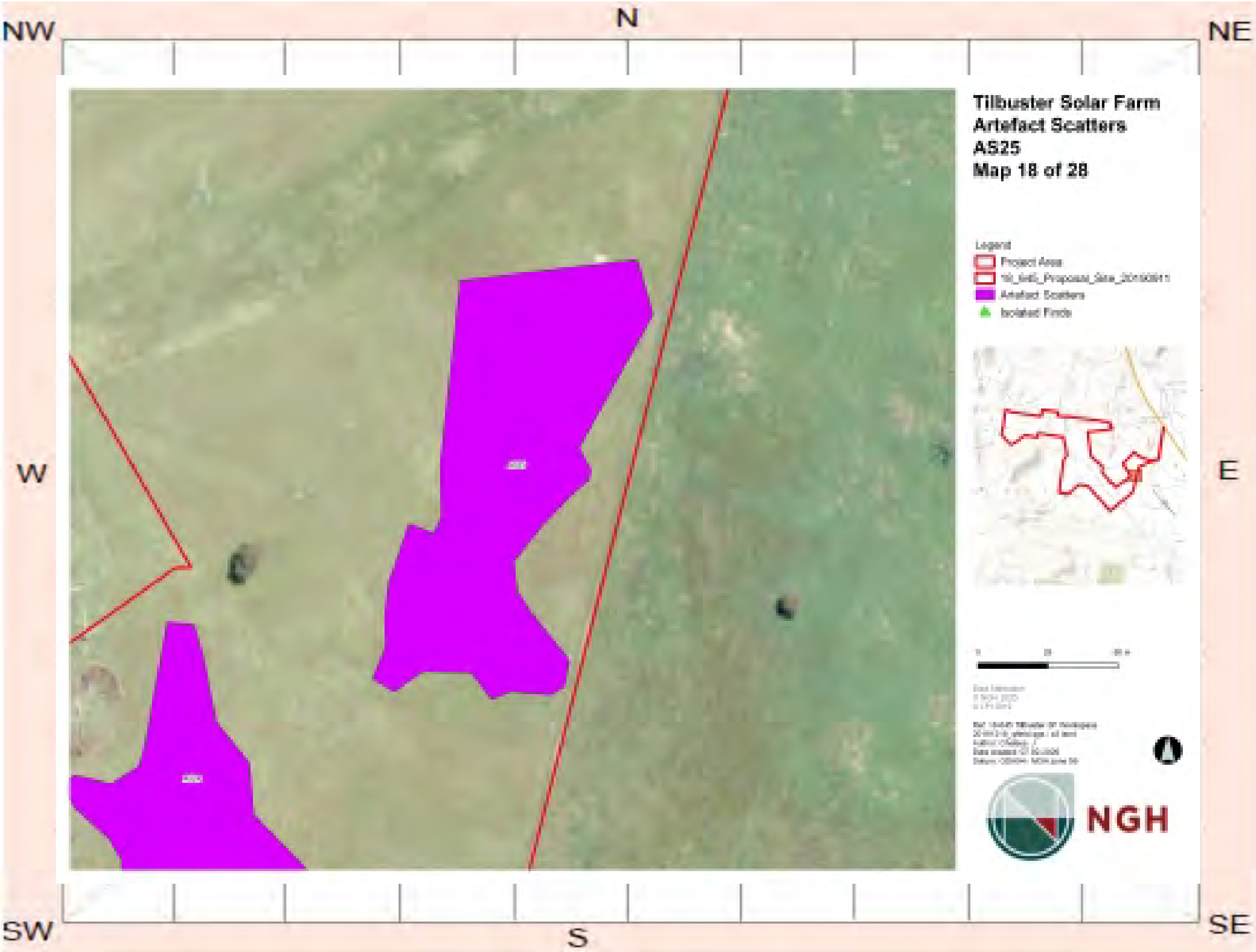
Distance to Water (m): 246

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 439m N of house.

Other site information: The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. AS25 is closely related to AS24. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site, though such impacts were still evident.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	36	145	50				

Description:

Silcrete, quartz, chert, basalt and greywacke material. Flakes (12), angular fragments (7), broken flakes (6), manuports (3), proximal flakes (2), a retouched flake (1), a core (1) and a split flake (1), two axes (2) and a scraper (1) .

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

Features:

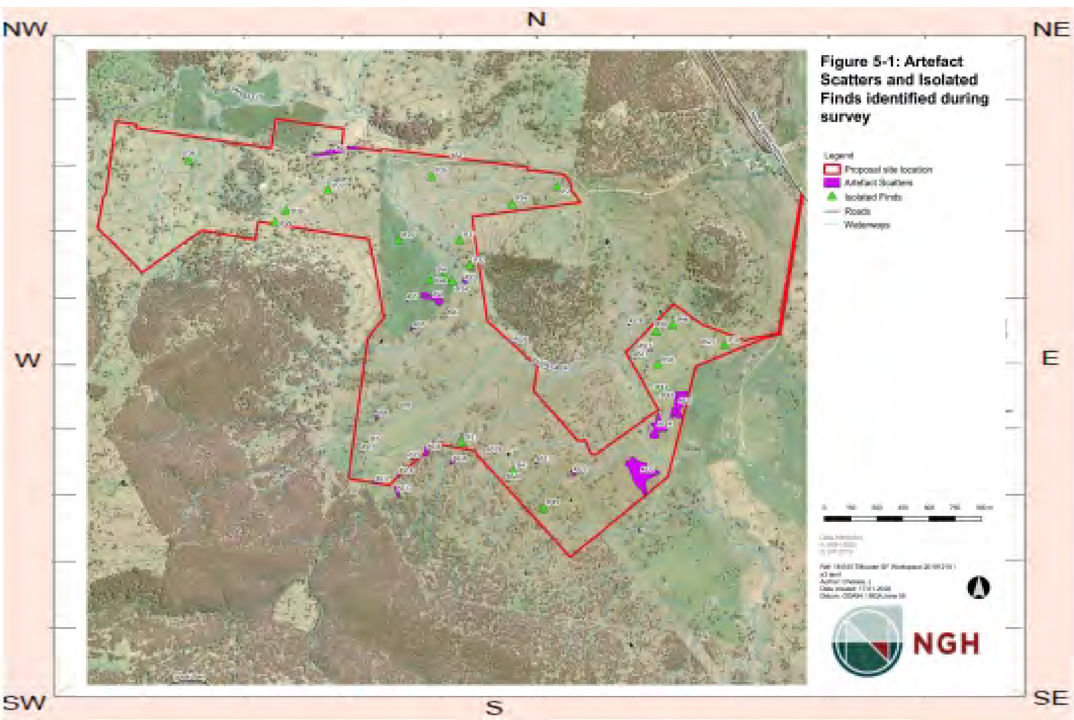
Scarred Trees

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. AS25 is closely related to AS24. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site, though such impacts were still evident.

Site plan



Site photographs

Description: Close up of axe, part of Tilbuster Solar Farm AS25.

Description: Close up of chert flake, part of Tilbuster Solar Farm AS25.

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS25.

Description: Context of Tilbuster Solar Farm AS25, facing north.

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0354

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS24

Easting: 371477 **Northing:** 6637909 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

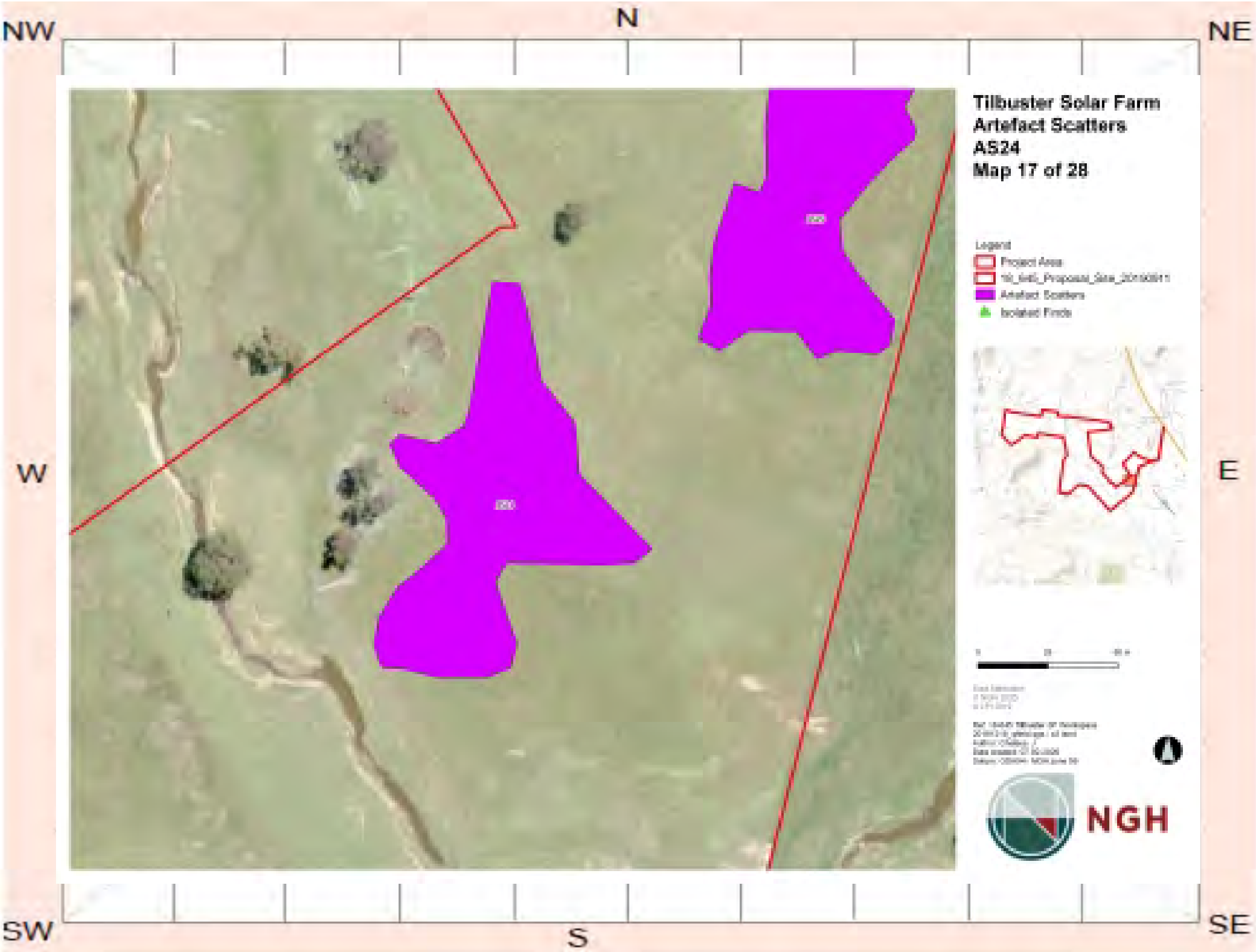
Distance to Water (m): 83

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 482m NW of house.

Other site information: The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site. AS24 is likely to be closely related to AS25.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	47	141	99				

Description:

Silcrete, quartz and chert materials with some instances of basalt and greywacke. Flakes (18), broken flakes (6), cores (6), proximal fragments (5), angular fragments (3), medial fragments (2), retouched flakes (2), one axe (1), a hammerstone (1), scraper (1), a flake tool (1) + a distal fragment.

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

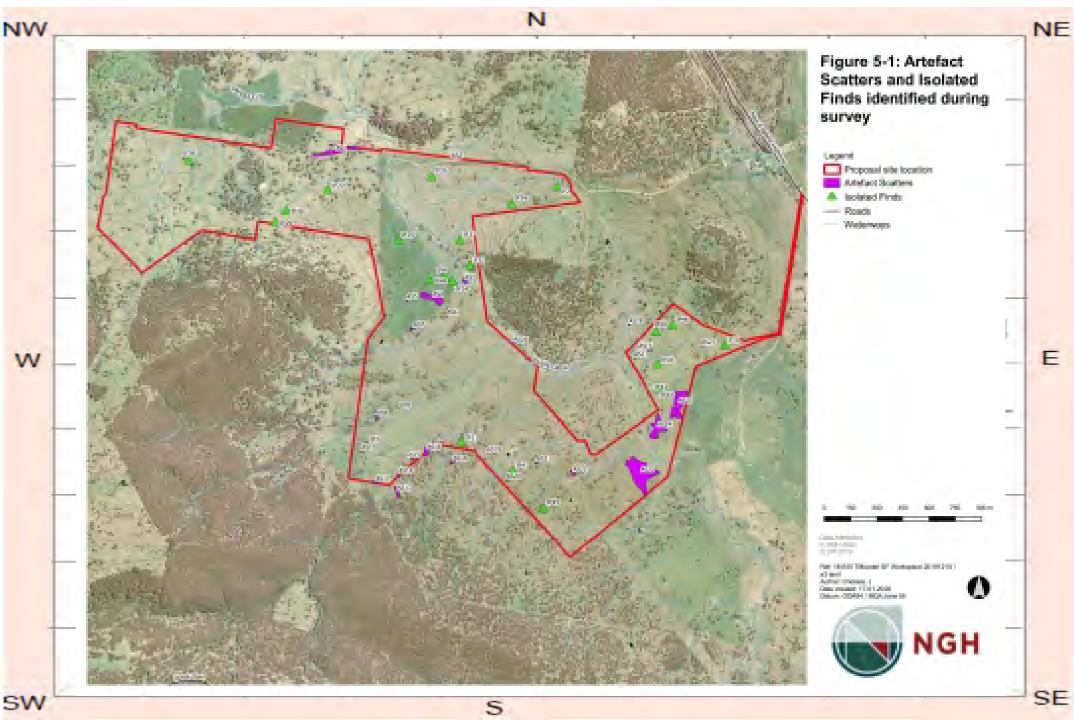
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a grey-brown sandy loam and visibility was approximately 80%. This location did not exhibit the effects of erosion and sheep grazing to the same extent as the rest of the proposal site. AS24 is likely to be closely related to AS25.

Site plan



Site photographs

Description: Close up of basalt axe, part of Tilbuster Solar Farm AS24.

Description: Hammerstone identified at AS24.

Description: Detail of backing on silcrete flake, part of AS24.

Description: Location of Tilbuster Solar Farm AS24, facing south west to edge of spur overlooking Duval Creek.

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender | General | Location

Why is this site restricted?:

Further information contact

Title | **Surname** | **First name**

Organisation:

Address:

Phone: | **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW GOVERNMENT

AHIMS site ID: 21-1-0355

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS23

Easting: 371381

Northing: 6637647

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

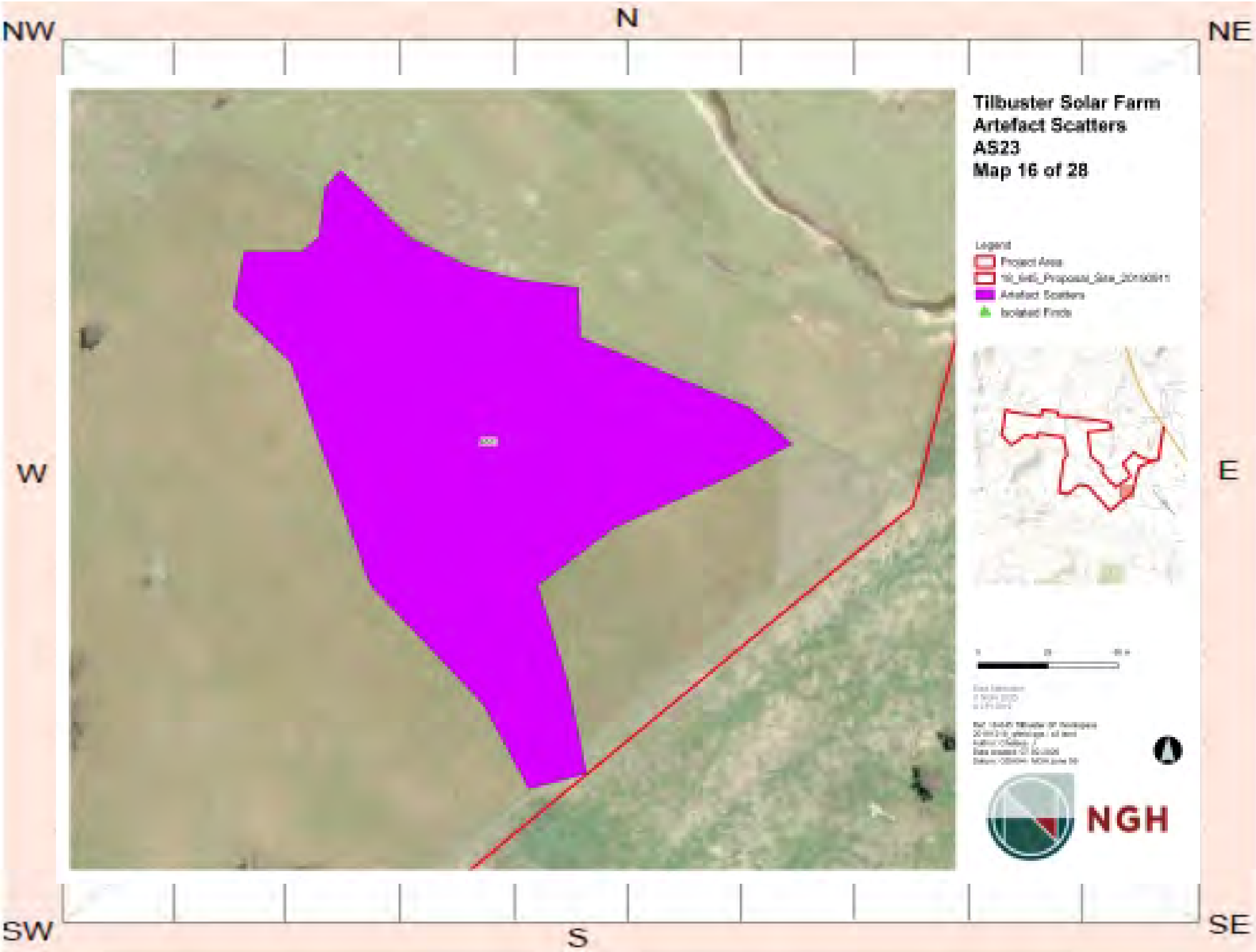
Distance to Water (m): 26

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 572m W of house.

Other site information: There were also four manuports recorded (n=4). The artefacts were located on shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	39	219	100				

Description:

Silcrete, greywacke, chert and basalt materials. Flakes (10) and cores (8), proximal fragments (3), broken flakes (3), distal fragments (2), medial fragments (2), retouched flakes (2), a split flake (n=1), angular fragment (1), geometric microlith (1), hammerstone(1) and core tool scraper (1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
4.							

Description:

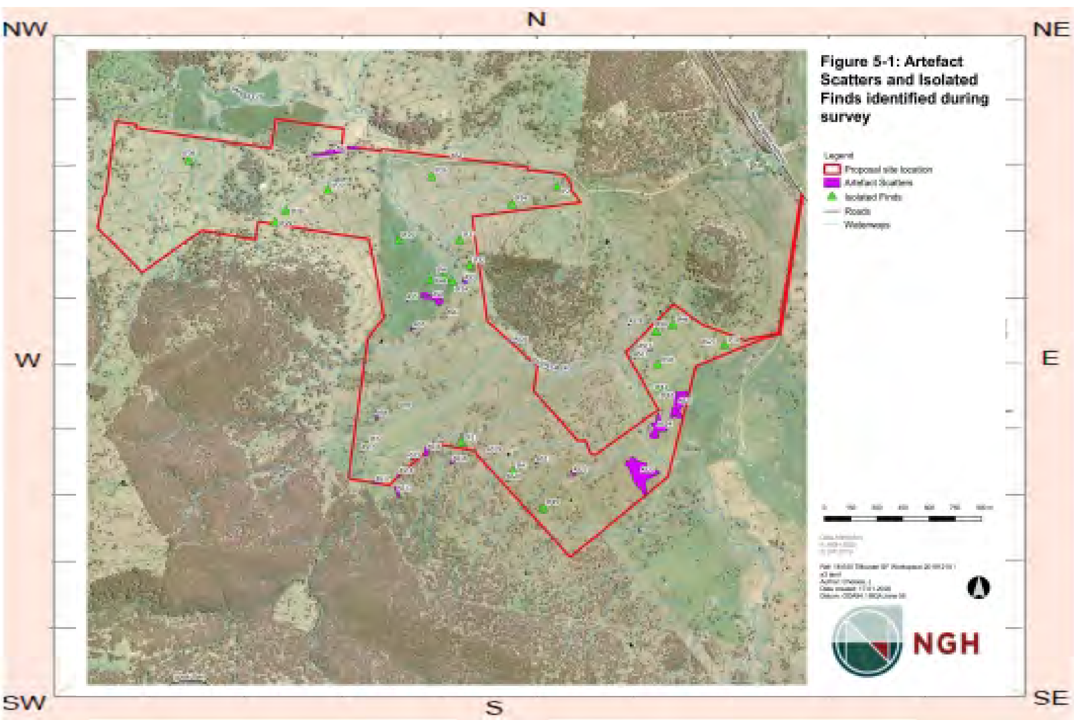
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
5.							

Description:

Other Site Info: There were also four manuports recorded (n=4). The artefacts were located on shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Site plan



Site photographs

Description: Detail of silcrete flake scraper, part of Tilbuster Solar Farm AS23.

Description: Blade core, part of Tilbuster Solar Farm AS23.

Description: Hammerstone at AS23

Description: Location of Tilbuster Solar Farm AS23 (mid-ground) facing north east.

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone:

E-mail:

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0356

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS22

Easting: 370994 **Northing:** 6637650 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

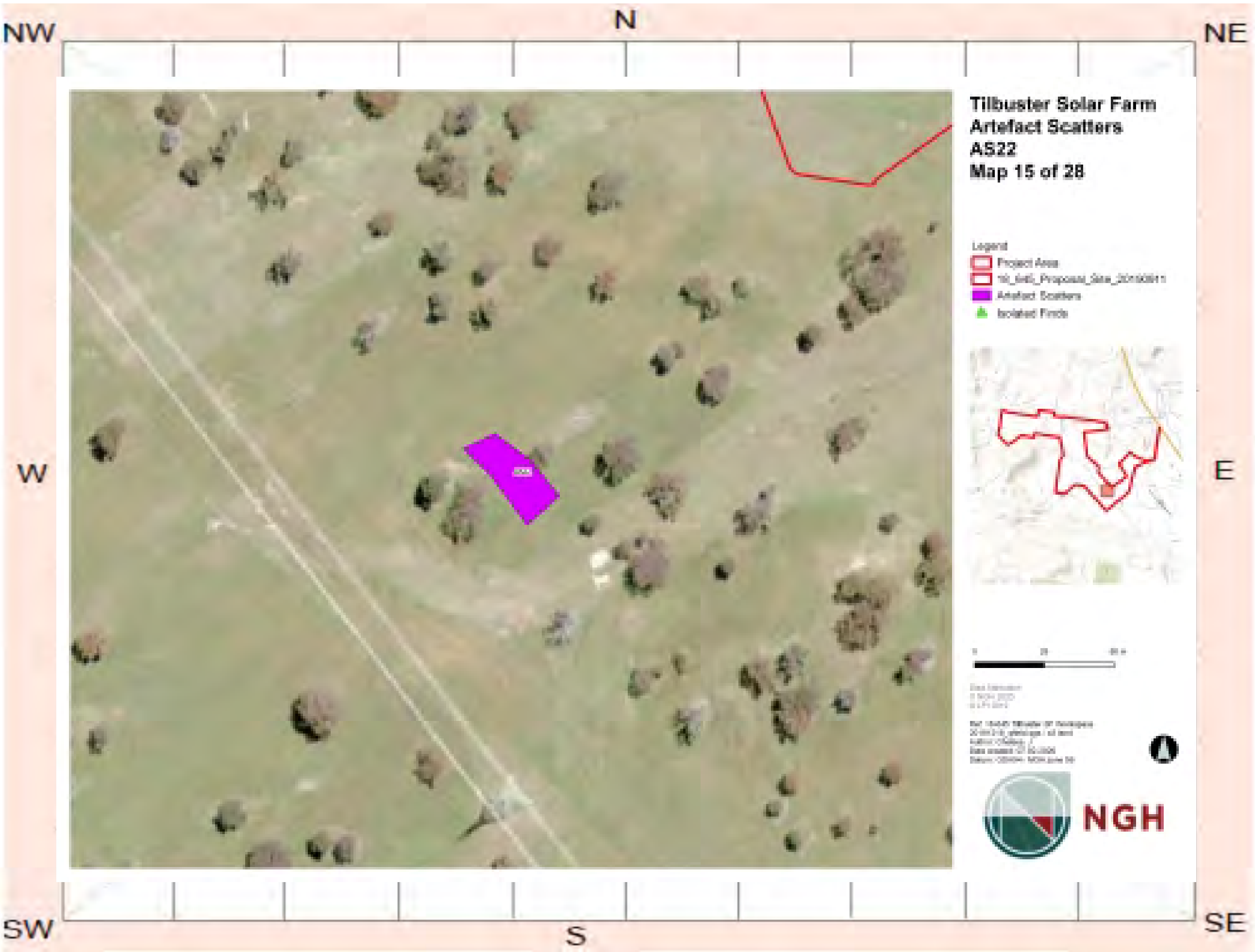
Distance to Water (m): 518

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 978m W of house.

Other site information: The artefacts were located shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Site location map



Site contents information

open/closed site: Open

Site condition: Poor

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	38	14				

Description:

The scatter included a chert flake (n=1) and a quartz core (n=1).

Features:

	Feature	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

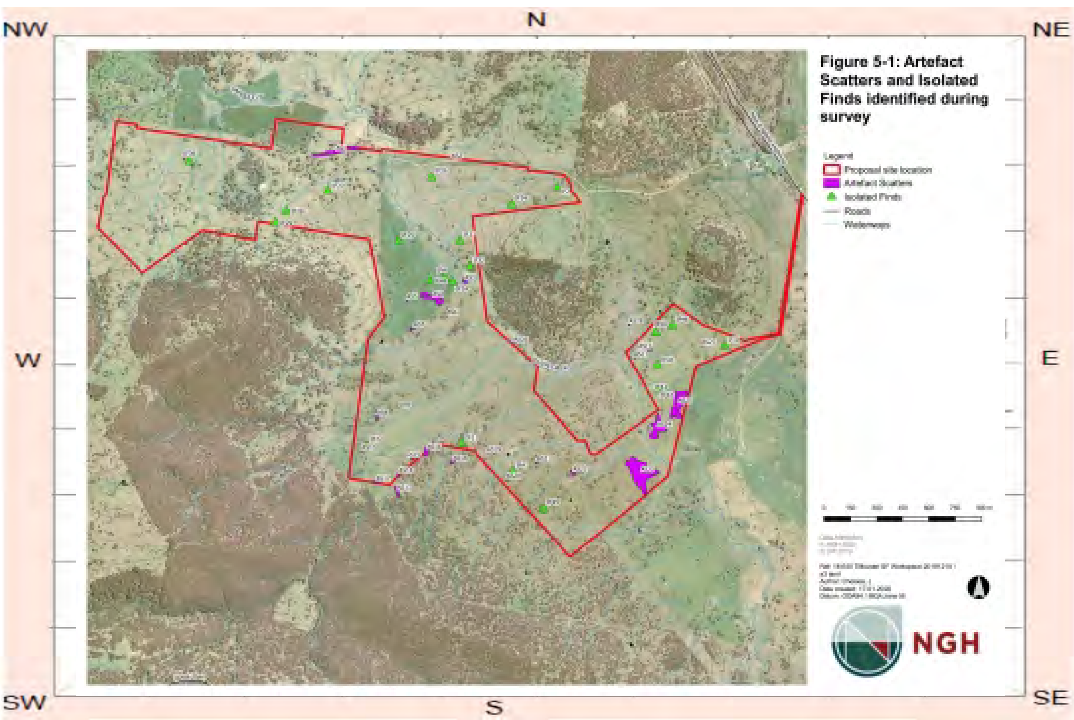
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%.

Site plan



Site photographs

Description: Close up of silcrete flake, part of Tilbuster Solar Farm AS22.

Description: Close up of chert flake, part of Tilbuster Solar Farm AS22.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

Office of Environment & Heritage — NSW Government

AHIMS site ID: 21-1-0357

Date recorded: 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS20

Easting: 370611

Northing: 6637609

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 5

Zone: 56

Location method: Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018

E-mail: matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

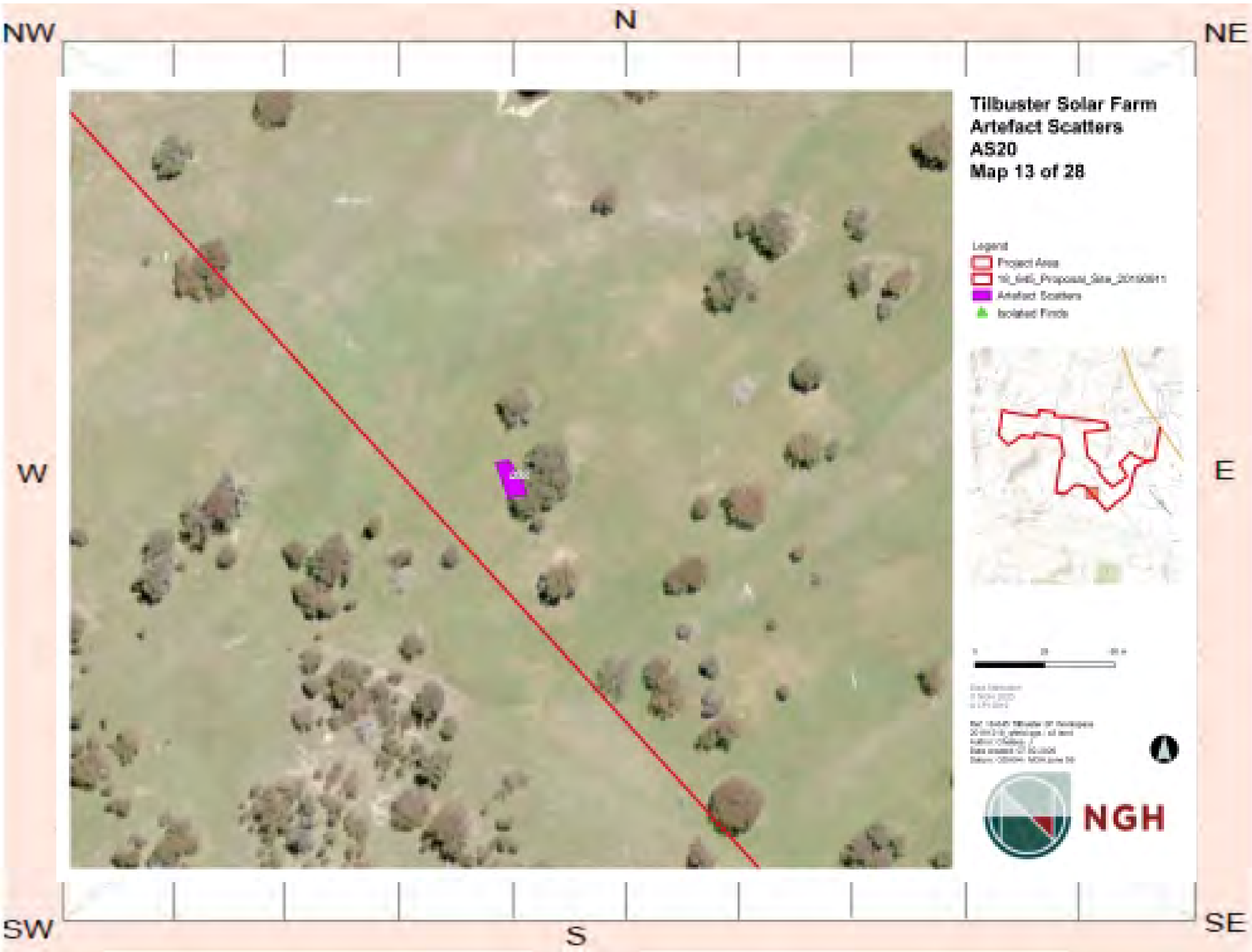
Distance to Water (m): 907

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.3km W of house.

Other site information: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS21 and IF47.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
1.	Artefact	2	14	6				

Description:

The scatter included a chert flake (n=1) and a quartz core (n=1).

Features:

		Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Scarred Trees: Regrowth (cm)	Scarred Trees: Scar shape	Scarred Trees: Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

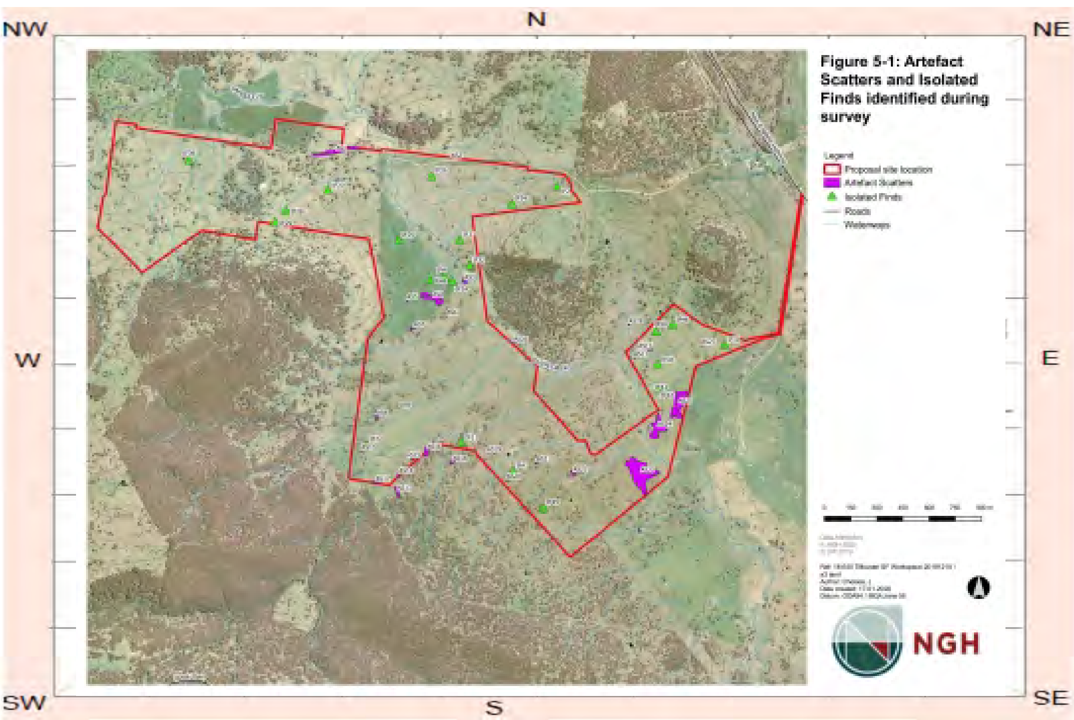
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

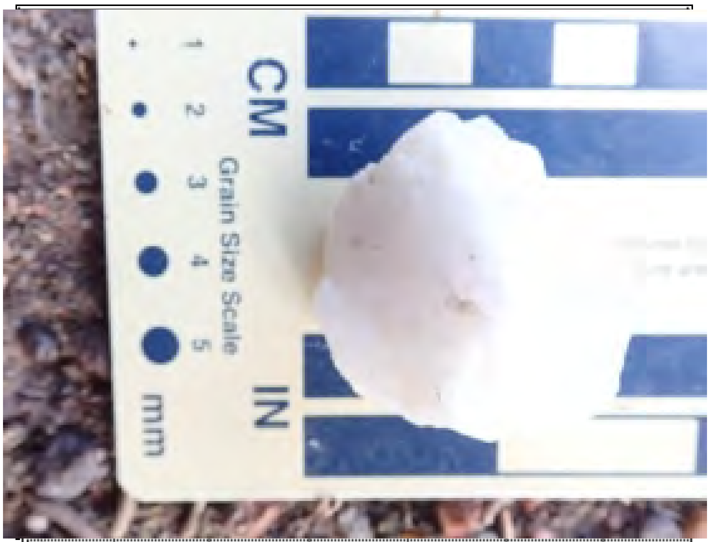
Description:

Other Site Info: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS21 and IF47.

Site plan



Site photographs



Description: Close up of quartz core, part of Tilbuster Solar Farm AS20.

Description: Location of Tilbuster Solar Farm AS20.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville 2220 NSW

AHIMS site ID: 21-1-0358 **Date recorded:** 26-05-2020

Site Location Information

Site name: Tilbuster Solar AS21

Easting: 370783 **Northing:** 6637708 **Coordinates must be in GDA (MGA)**

Horizontal Accuracy (m): 5

Zone: 56 **Location method:** Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title	Surname	First name
Mr.	Barber	Matthew

Organisation: 75

Address: Po Box 62 Fyshwick ACT 2609

Phone: 0407485018 **E-mail:** matthew.b@nghenvironmental.com.au

Site Context Information

Land Form Pattern: Undulating Plain

Land Use: Pastoral/Grazing

Land Form Unit: Slope

Vegetation: Isolated clumps of trees

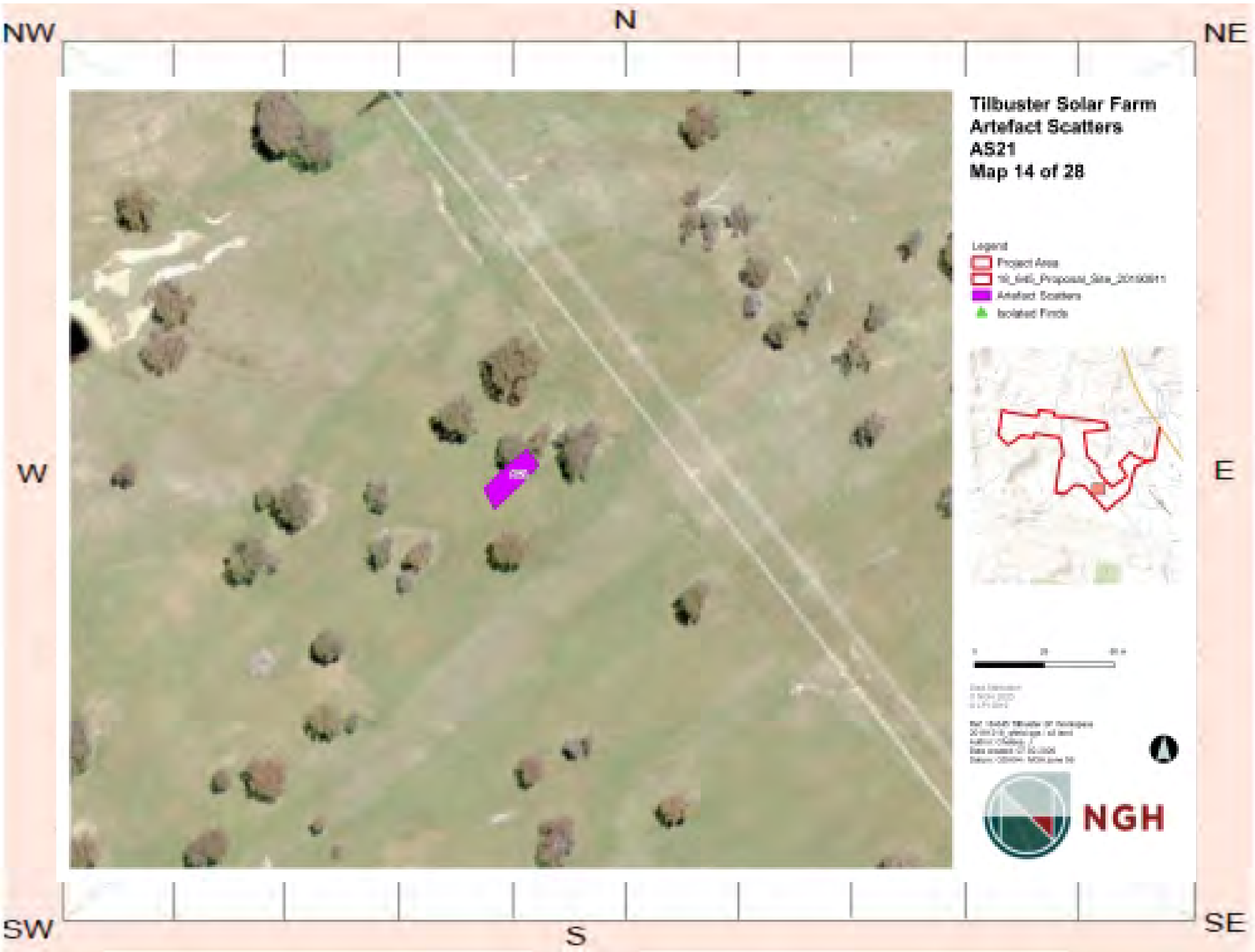
Distance to Water (m): 615

Primary Report: Tilbuster Solar Farm ACHA (NGH 2020)

How to get to the site: From Armidale head E on Erskine St towards Campion Parade (74m), turn left onto Campion (450m), turn left Glen Innes Rd (1km), at roundabout take 3rd exit New England Hwy/A15 (15.4km), sharp left into 11915 New Eng Hwy and travel 1.1km W of house.

Other site information: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS20 and IF47.

Site location map



Site contents information

open/closed site: Open

Site condition: Erosion

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
1.	Artefact	2	21	7				

Description:

The scatter included silcrete proximal fragment (n=1) and a chert retouched flake (n=1).

Features:

	Features	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
2.								

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
3.							

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
4.							

Description:

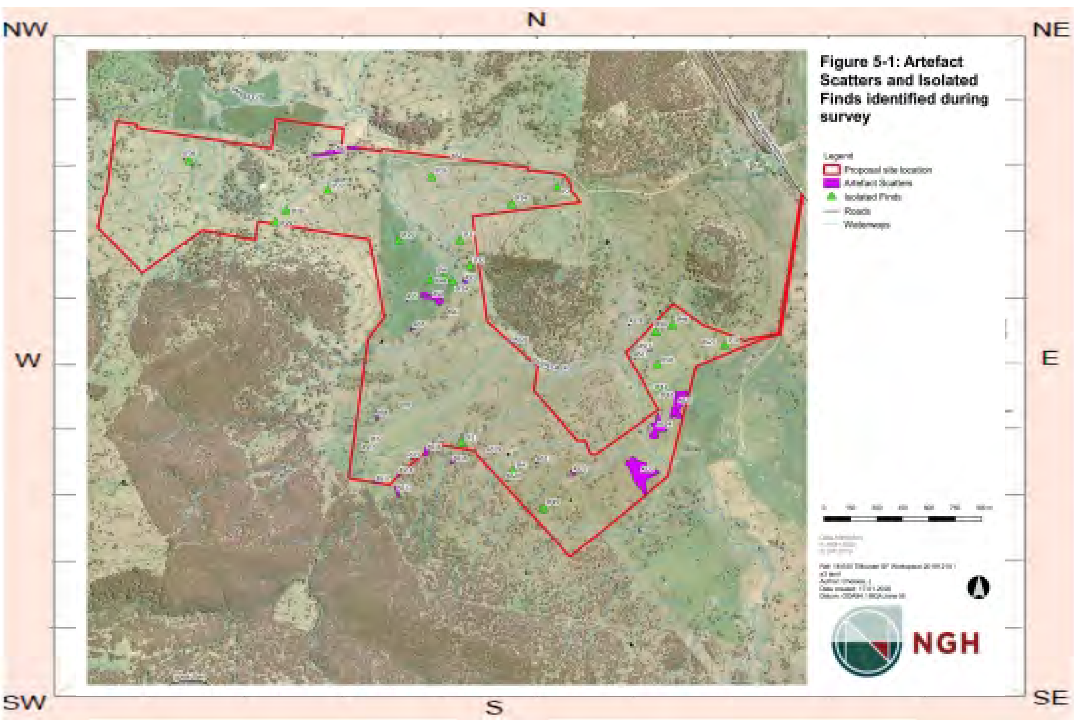
Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)	Scarred Trees: Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species
5.							

Description:

Other Site Info: The artefacts were located on a shallow grey-brown sandy loam significantly eroded by sheep grazing and drought. Visibility was approximately 80%. This site is likely associated with AS20 and IF47.

Site plan



Site photographs

Description: Close up of silcrete proximal fragment, part of Tilbuster Solar Farm AS21.

Description: Close up of chert retouched flake, part of Tilbuster Solar Farm AS21.

Description:

Description:

Site restrictions

Do you want to Restrict this site?:

Restriction type: Gender General Location

Why is this site restricted?:

Further information contact

Title	**Surname**	**First name**

Organisation:

Address:

Phone: **E-mail:**

APPENDIX G HYDROLOGICAL AND HYDRAULIC ANALYSIS

footprint.
sustainable engineering.

Proposed Solar Farm, Tilbuster, New South Wales

Hydrological and Hydraulic Analysis

Project No. 1908
Date: 21 April 2020

Prepared for: ngh consulting

Footprint (NSW) Pty Ltd
15 Meehan Drive
Kiama Downs, NSW 2533, Australia
ACN 131 571 929   ABN 44 131 571 929
Phone: 02 4237 6770
Mobile: 0430 421 661
Email: ashley@footprinteng.com.au

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Ashley Bond								
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			Louiza Romane (ngh)					
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2	FINAL	21/04/20	PDF					

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TABLE OF CONTENTS

APPENDICES

APPENDIX A

Catchment Plan

APPENDIX B

ARR Hub Data

APPENDIX C

Rainfall Depths

APPENDIX D

Pre-burst Rainfall Depths

APPENDIX E

PMP Calculations

APPENDIX F

Adopted Manning's Values

APPENDIX G

Floood Mapping

APPENDIX H

RFFE Method Results

APPENDIX I

Stream Order

1.0 INTRODUCTION

Footprint (NSW) Pty. Ltd. (*Footprint*) has been engaged by NGH Consulting to undertake a hydrological and hydraulic analysis in support of a proposed solar farm located approximately 15km north of Armidale.

The purpose of the analysis is to define the flood behaviour, including depth of inundation and flood velocity over that part of Duval Creek within the proposal area and the numerous ephemeral watercourses/overland flow paths that traverse the proposal area. The result of the analysis will be used to guide the design with respect to the extent and elevation of proposed solar array infrastructure and to determine the potential impact of this infrastructure on the existing flood behaviour.

1.1. Scope of Works

The scope of works for the project includes:

1. Review available background information including LiDAR data, topographic maps, proposed development plans.
2. Undertake hydrologic calculations to determine critical storm durations for the 5% AEP, 1% AEP and PMF events.
3. Undertake two-dimensional hydraulic modelling (using HEC-RAS) to determine the depth and extent of flooding over the proposal area for each of the above rainfall events for both the pre and post development scenarios.
4. Preparation of a hydrological and hydraulic report, including flood mapping, defining the methodology and results of the above investigations, and providing any recommendations with respect to floodplain management.

2.0 PROPOSAL AREA

The Tilbuster Solar Farm proposal is to be located on a property of approximately 8800ha located approximately 15km north of Armidale.

The proposal area occupies an area of approximately 310 hectares includes parts of Lot 1 DP585523, Lot1 DP225170 and Lot 3 DP800611, of which approximately 165 hectares would be developed for the solar farm and associated infrastructure (Development Footprint)

The location and extent of the proposal area in relation to Armidale is shown in Figure 1.

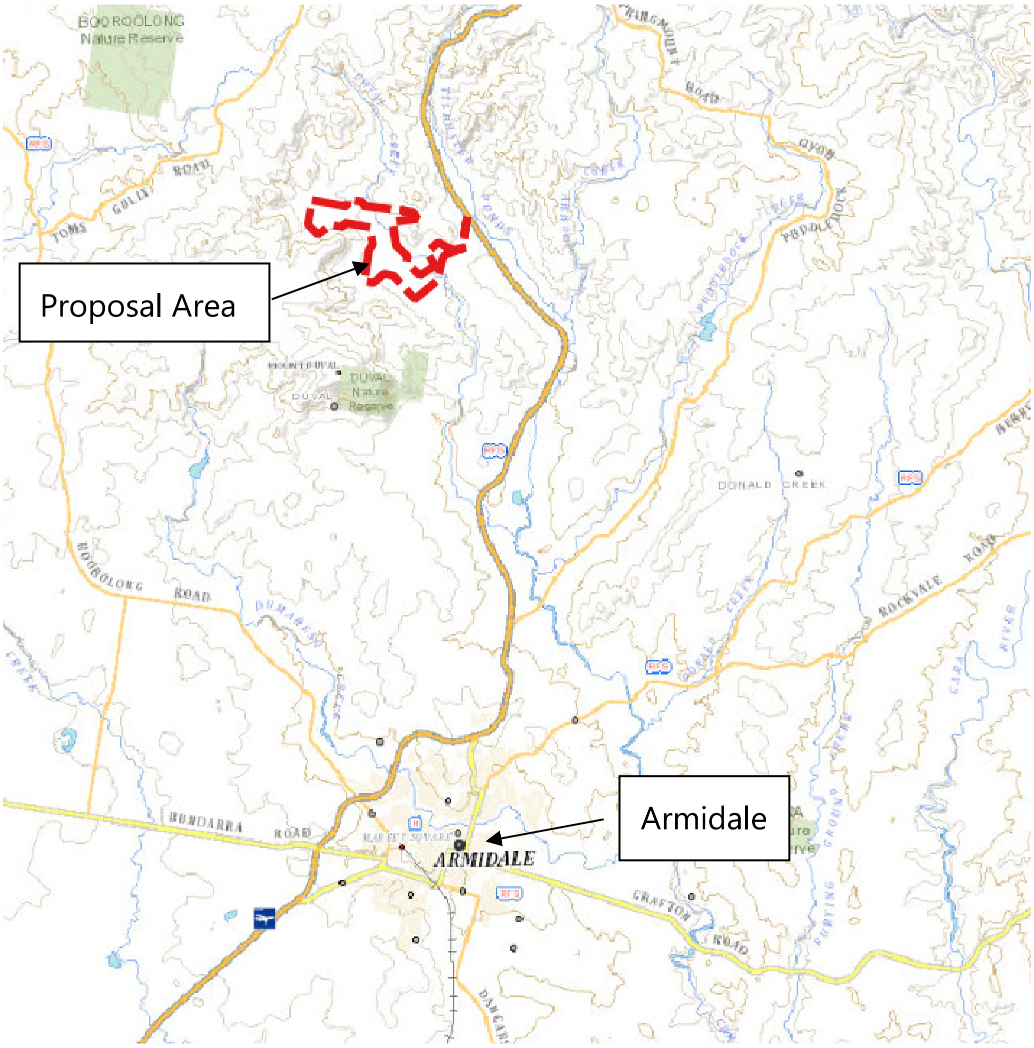


Figure 1: Location and Extent of Proposal Area

The proposal area is traversed by Duval Creek, largely along its western flank, and contains numerous other minor un-named tributaries of Duval Creek, most of which are first, second or third order watercourses.

All watercourses within the proposal area would be described as ephemeral and would only contain flowing water during and shortly after rainfall events.

There are 4 small farm dams within the proposal area that are currently used for stock water.

It is understood that the proposal area has been used for agricultural cultivations, including grazing and occasional cropping, and is predominately cleared of understorey vegetation (refer to Figure 2).

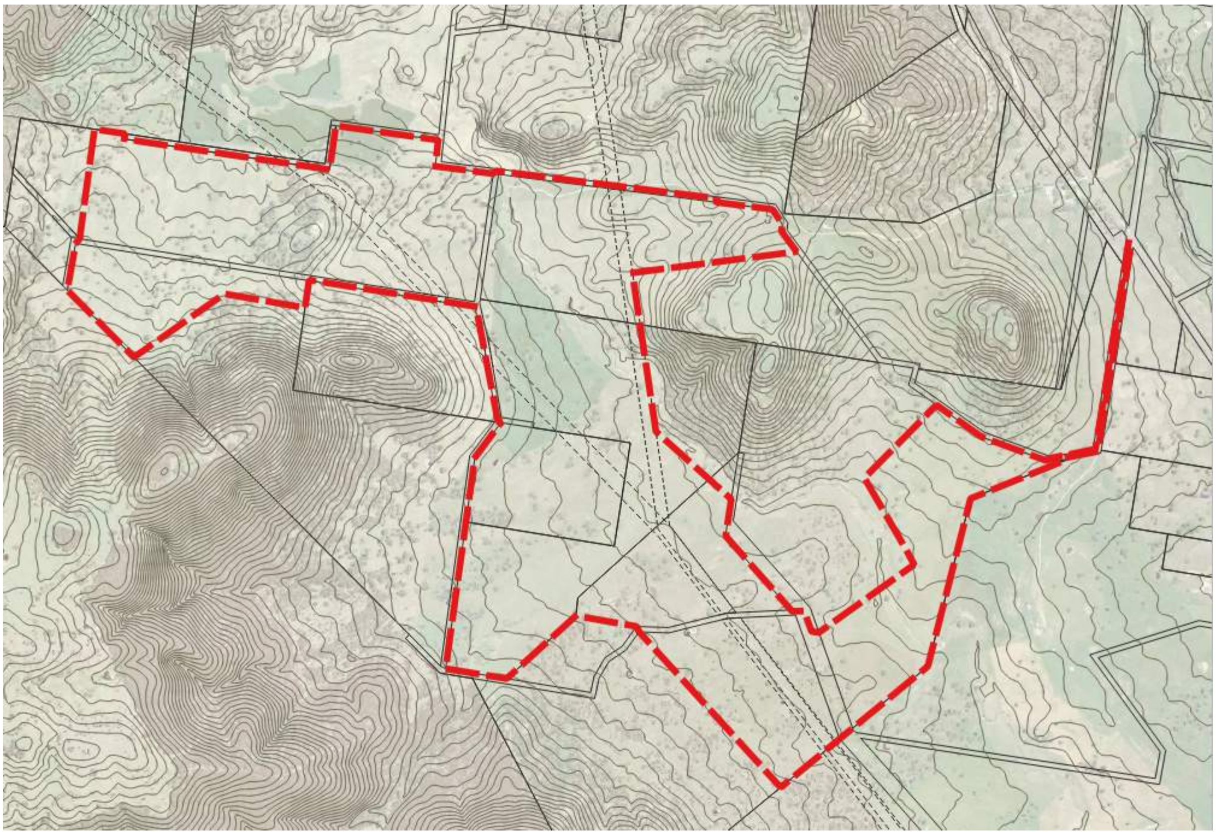


Figure 2: View of Proposal Area (outlined in red)

The proposal area typically falls from north-west to south-east with elevation ranging from about 1150m AHD to 1050m AHD. On its northern and western flanks, the proposal area is bound by relatively steep terrain which rises to an elevation of about 1300m AHD.

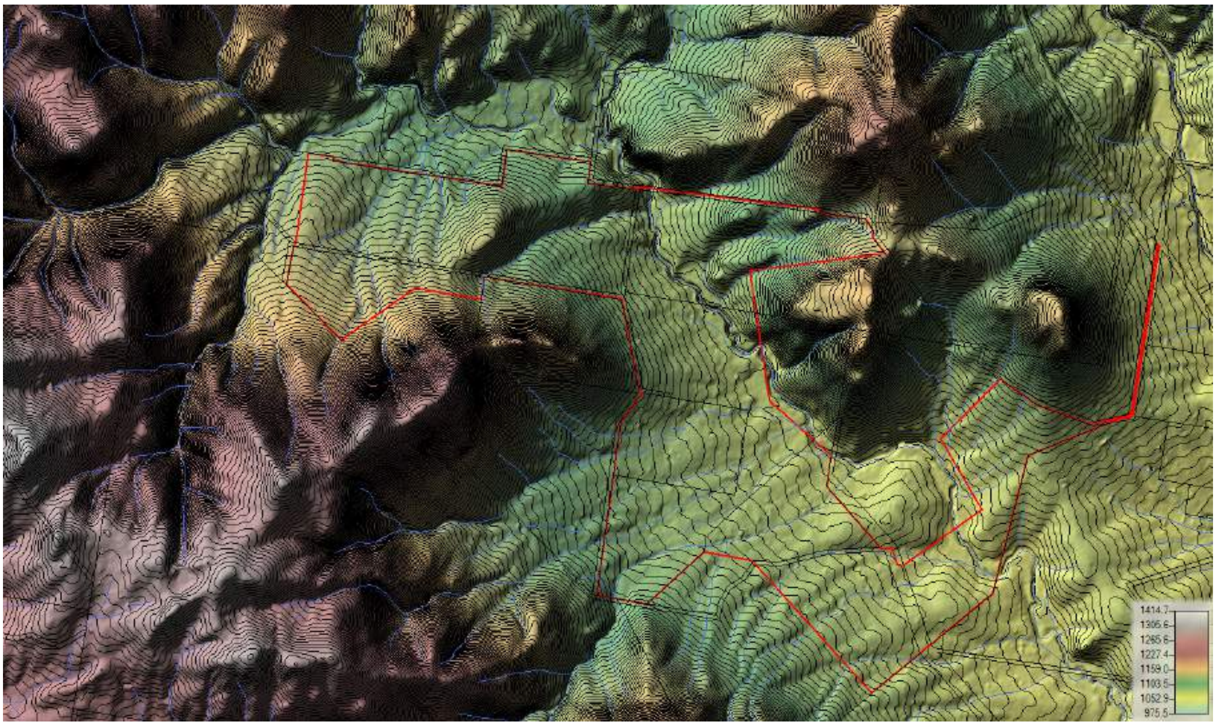


Figure 3: Terrain Analysis over Proposal Area (2m contour interval)

3.0 HYDROLOGICAL MODELLING

3.1. Purpose

Hydrological modelling was conducted to inform the HEC-RAS two-dimensional direct rainfall hydraulic model. The primary purposes of the hydrological model were to:

i. determine the critical storm duration for the subject site, and
ii. determine the median storm within the ensemble of modelled storms such that the hydraulic modelling could be limited to only one storm for each storm event.

3.2. Model Adoption

Hydrological modelling was conducted in DRAINS using a RAFTS storage routing model.

Storage routing models can model larger catchments using a lumped approach by assuming heterogeneity within the sub-catchment to account for the storage and retardence of flows that occurs within the sub-catchment. Such models account for slope and roughness and use a loss model to produce a hydrograph at the sub-catchment outlet.

The RAFTS hydrological model was chosen because it is widely used and accepted across Australia within the industry and has been shown to be insensitive to initial conditions.

3.3. Catchment Areas

The total catchment area contributing Duval Creek at the southern boundary of the proposal area was estimated to be approximately 2765 hectares (27.65km^2) and was determined using 5m Digital Elevation Models (DEM) covering the areas which were obtained through the Australian Foundation Spatial Data web portal.

The overall catchment was dissected into 25 sub-catchments using hydrologic analysis software package Catchment SIM and ranged in size from 3.30 to 211.31 hectares, with an average size of approximately 100 hectares. Sub-catchment slopes were derived by CatchmentSIM using the above terrain data.

A catchment plan and summary of the sub-catchments is shown in Figure 1.1 in Appendix A.

3.4. Modelling Input Parameters

The parameters adopted for hydrological modelling are shown in Table 1.

Table 1: Hydrological Parameters Adopted

Parameter	**Value Adopted**	**Justification/Source**
Pervious Area Initial Loss (mm)	15	Value for South East Coast (NSW) obtained through ARR data hub (refer Appendix B)
Pervious Area Continuing Loss (mm/h)	1.7	40% of the value for East Coast (NSW) obtained through ARR data hub (refer Appendix B) in accordance with recommended NSW loss hierarchy (level 5)
BX	1	RAFTS Default
Sub-catchment Area (ha)	Varies	As per Figure 1.1 in Appendix A
Impervious Area (%)	0	Based on aerial photography
Sub-catchment Slope (%)	Varies	Varies based on site topography.
Manning's n	Varies 0.025 – 0.08	Based on aerial photography and varies from 0.025 for rural pasture lands to 0.08 for heavily wooded areas. Refer to Figure 1.1 in Appendix A.

3.5. Rainfall Data

3.5.1. Design Rainfall

IFD design rainfall depth data and temporal patterns were derived in accordance with Australian Rainfall and Runoff (2019) using the Bureau of Meteorology's 2019 Rainfall IFD on-line Data System.

The temporal patterns for the East Coast South (ECsouth) region was used as these cover the subject site (latitude -30.377, longitude 151.656).

A copy of the rainfall depths for the range of storm durations used can be found in Appendix C. Storm probabilities in ARR2019 are now classified in two ways: Very Frequent storms, quantified as 'Exceedances per Year' (EY), and both Frequent and Infrequent storms given as Annual Exceedance Probability (AEP). The 'very frequent' storms have only been used for the 1EY, 0.5EY and the 0.2EY as these are equivalent to the former classifications of 1 in 1 year, 1 in 2 year and 1 in 5 year storms respectively (ARR 2016 state that the 50% AEP and the 20% AEP do not correspond statistically to the 1 in 2 year and 1 in 5 year storms, but rather are equivalent to the 1 in 1.44 year and 1 in 4.48 year storms respectively).

3.5.2. Pre-Burst Rainfall

NSW transformation pre-burst rainfall depths derived from ARR 2019 data hub (refer Appendix D) were adopted in the model.

3.5.3. Probable Maximum Precipitation

The PMF is the response of the catchment to the probable maximum precipitation (PMP) and is the largest flood event that can reasonably be expected to occur at a location.

Estimates of PMP were made using the Generalised Short Duration Method (GSDM) presented in Bureau of Meteorology (2003) and are provided in Table 2. This method is appropriate for estimating extreme rainfall depths for catchments up to 1000km^2 in area and storm durations up to 6 hours and is therefore considered appropriate for the subject catchment. For the subject catchment PMP rainfall depths were limited to a maximum 3 hour duration.

Table 2: Estimate of PMP

Duration (Hours)	PMP Estimate (mm)
0.25	150
0.50	220
0.75	280
1.0	330
1.5	430
2.0	500
3.0	600

Due to the inability of DRAINS (and HEC-RAS) to model spatially variable rainfall no adjustment to the point values above where made.

The hydrological results obtained through modelling point PMP values in lieu of spatially variable PMP values would therefore be slightly higher than actual flows and therefore conservative.

The PMP Calculation spreadsheet is included in Appendix E

3.6. Flow Routing

The routing of flows through the catchment was undertaken by extracting a representative cross section from the LiDAR DEM over the watercourse linking each sub-catchment area. Manning's n values were applied to the full width of the cross section based on an assessment of aerial photography.

Flows were routed along each link within DRAINS which applies the full S.t Venant equations of unsteady flow to overland flow routes. This allows water levels along these routes to be determined accurately, allowing for varied water surface flow profiles, including subcritical and supercritical flows.

3.7. Results

The DRAINS model was run in 'standard' mode for storm durations ranging from 10 minutes to 6 hours for the 5% and 1% AEP events and 15 minutes to 3 hours for the PMF event.

The critical duration and median storm from the ensemble, where applicable, for the range of events modelled are shown in Table 3.

Table 3: Summary of Critical Durations and Storms

Event	Critical Duration	Median Storm from Ensemble	Peak Flow at Outlet (m^3/s)
5% AEP	1.5 hours	Storm 9	209
1% AEP	1 hour	Storm 7	345
PMF	1.5 hours	N/A	2483

4.0 HYDRAULIC MODELLING

Hydraulic modelling was conducted using an unsteady direct rainfall two-dimensional HEC-RAS model (Version 5.0.7) which covered the entire catchment draining to the subject site.

4.1. Two-Dimensional Domain

A digital elevation model (DEM) of the entire catchment areas draining to the subject site was established using a series of 5m gridded digital elevation models (Guyra2011.asc) sourced from www.elevation.fsdf.org.au.

A two-dimensional flow area (i.e. active cells) was defined over the entire catchment to simulate the rainfall-runoff process. The extent of the two-dimensional flow area is shown in Figure 4.

The 5m DEM grid was imported into HEC-RAS and used as the basis for development of a 10m x 10m terrain model. The DEM grid was further refined where required by applying breaklines to enforce abrupt changes in geometry, such as along existing watercourses.

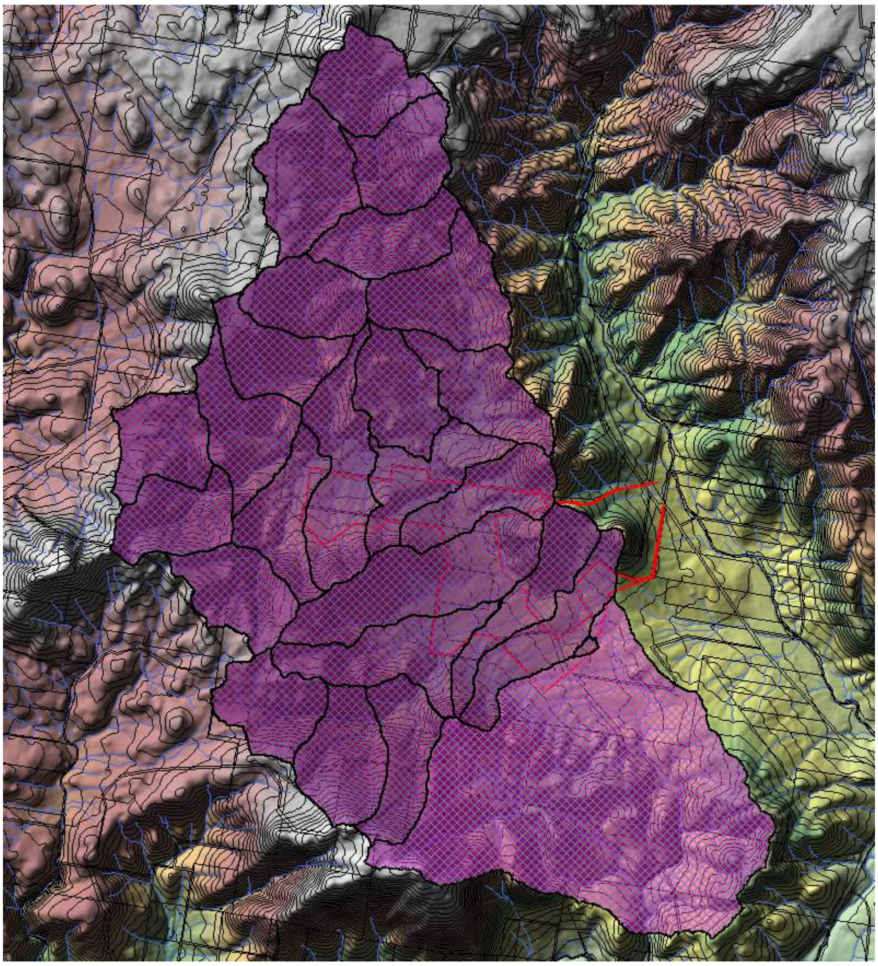


Figure 4: Two-Dimensional Flow Area

4.2. Manning's Roughness

HEC-RAS 5.0.7 is currently limited to modelling constant roughness which does not consider changes to roughness with changes in flow depth. As direct rainfall models frequently experience shallow flow conditions over large areas of the catchment this approach can magnify the impact of depth-variation in roughness for shallow flows and lead to under-estimation of over-estimation of effective roughness depending on surface type, hence resulting in faster or slower routing of catchment runoff.

An iterative approach was therefore adopted by adjusting the surface roughness over the catchment until the hydrographs at the outlet of sub-Catchment 1.11 at the southern boundary of the subject site closely aligned with those produced by the DRAINS hydrological model.

Final Manning's roughness values adopted for design event modelling are shown in Figure 2.1 in Appendix F

4.3. Direct Rainfall Boundary Condition

The direct rainfall boundary condition applies precipitation directly to the surface of the grid to perform two-dimensional hydraulic calculations.

The current limitation of HEC-RAS means that precipitation can only be used to apply rainfall excess (rainfall minus losses due to interception/infiltration) directly to the two-dimensional grid.

Rainfall excess hyetographs for each of the critical duration median storm events shown in Table 3 were generated in Microsoft Excel by subtracting initial losses plus pre-burst rainfall (where applicable) from the design rainfall data starting from the beginning of the data set. An example of this for the 1% AEP, 1-hour storm event is shown in Figure 5: 1% AEP Hyetograph.

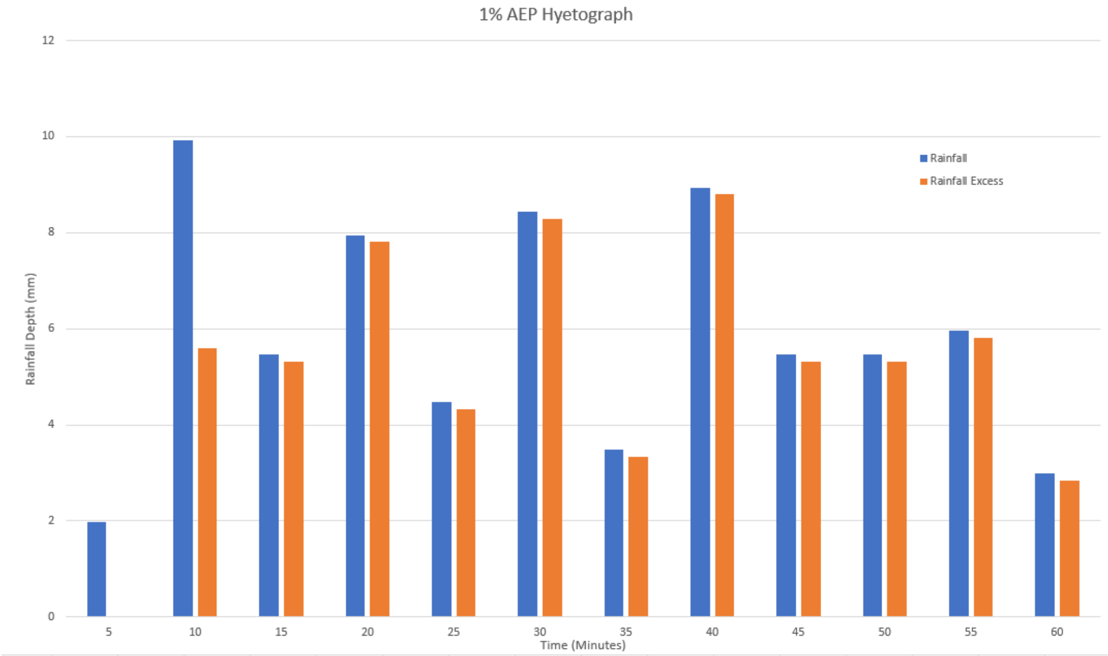


Figure 5: 1% AEP Hyetograph

4.3.1. Downstream Boundary Condition

Flows leaving the two-dimensional area were defined with a normal depth downstream boundary condition with a friction slope approximating the gradient of the land at the location of the boundary. The friction slope method uses the Manning's equation to compute a normal depth for each given flow, based on the cross section underneath the two-dimensional boundary condition line and is computed on a per cell basis.

4.4. Results

The HEC-RAS model was run in unsteady mode with variable timestep controlled by Courant conditions using the diffusion wave computational method. The results are provided in Appendix G and include the mapping shown in Table 4.

The results include the mapping of flood hazard vulnerability in accordance with Book 6, Chapter 7 of Australian Rainfall and Runoff (2019).

Table 4: Summary of Results

Figure	Description
Figure 3.1	Maximum Flood Levels and Depths – 5% AEP
Figure 3.2	Maximum Flood Velocities – 5% AEP
Figure 3.3	Maximum Flood Hazard – 5% AEP
Figure 4.1	Maximum Flood Levels and Depths – 1% AEP
Figure 4.2	Maximum Flood Velocities – 1% AEP
Figure 4.3	Maximum Flood Hazard – 1% AEP
Figure 5.1	Maximum Flood Levels and Depths – PMF
Figure 5.2	Maximum Flood Velocities – PMF
Figure 5.3	Maximum Flood Hazard – PMF

4.4.1. Comparison to Hydrological Model Results

As described in Section 4.2 an iterative process was undertaken by adjusting the surface roughness over the catchment until the hydrographs produced by the hydraulic model approximated those produced by the hydrological model.

The comparison of hydrographs generated for the hydrological and hydraulic models on Duval Creek immediately downstream of the subject site (sub-catchment outlet 1.11) are provided in Figure 6 for the 5% AEP and 1% AEP events and Figure 7 for the PMF event.

The comparison shows reasonable correlation between both the peak and the shape of the hydrographs, with the hydraulic model typically taking longer to generate runoff and peaking slightly later and a little higher than the hydrological model for both the 5% and 1% AEP events. In the PMF event the hydraulic model is shown to be shedding runoff slightly faster and generating a slightly earlier and higher peak than the hydrological model.

A comparison of peak flows and hydrograph volumes is provided in Table 5 and again shows reasonable correlation between the results, with peak flows being typically 10-16% higher for the hydraulic model. Runoff volumes were also comparable with variations of -2 to +8%.

Table 5: Comparison of Peak Flows and Runoff Volumes

Event	PEAK FLOW (m^3/s)			VOLUME (m^3x10^3)		
	DRAINS	HEC-RAS	%	DRAINS	HEC-RAS	%
5%AEP	209	232	11.0%	1025	940	8.3%
1% AEP	345	402	16.5%	1514	1451	4.2%
PMF	2483	2738	10.3%	11168	10928	-2.1%

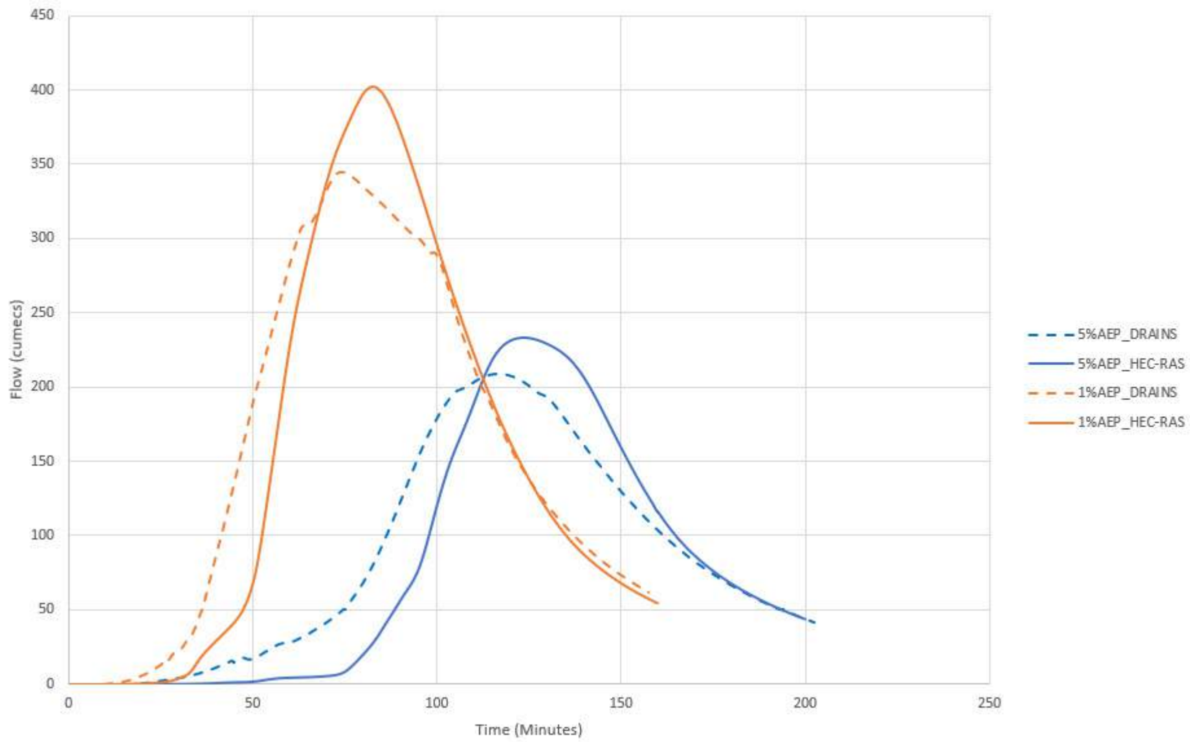


Figure 6: Comparison of Hydrographs at Sub-Catchment 1.11 outlet - 5% and 1% AEP

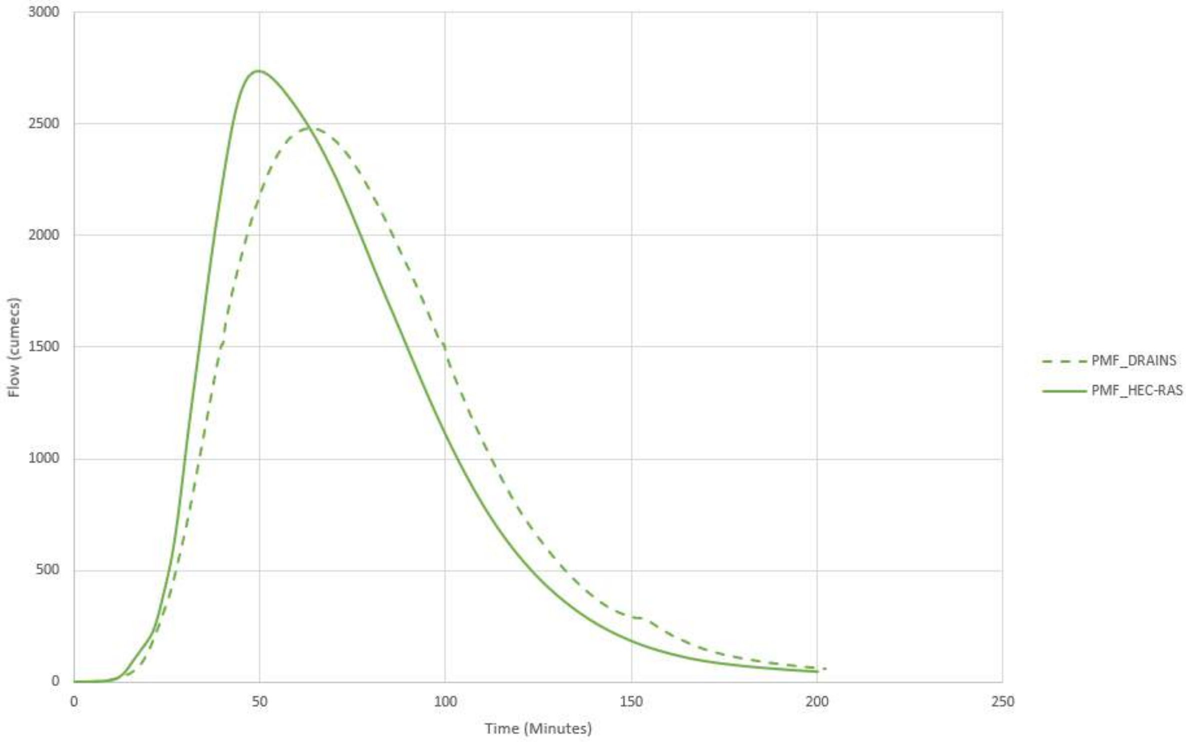


Figure 7: Comparison of Hydrographs at Sub-Catchment 1.11 Outlet - PMF

4.4.2. Comparison to Regional Flood Frequency Model

A comparison of peak flows for the 5% and 1% AEP events from both DRAINS and HEC-RAS were compared to the peak flows obtained through the Regional Flood Frequency Estimation (RFFE) Model and the results are shown in Table 6, with a copy of the RFFE Model report contained in Appendix H.

The comparison shows that peak flows derived by both the DRAINS hydrological and HEC-RAS Hydraulic model are significantly higher than those estimated by the RFFE Model.

Comparing the results to Catchment 2 from the RFFE model which is located approximately 10km north of the subject site (see Figure 8) in what appears to be a similar topographical area shows that this 14km^2 catchment generates a peak flow of about 150-200 cumecs. Extrapolating this out to the subject catchment which is approximately twice the size peak flows should be in the order of 300-400 cumecs, which better aligns with the DRAINS and HEC-RAS results achieved.

Table 6: Comparison to RFFE Model

AEP	Peak Flow Rate (cumecs)				
	DRAINS	HEC-RAS	Regional Flood Frequency Estimation Model		
			Discharge	Lower (5%)	Upper (95%)
5%	209	232	25.8	11.2	59.7
1%	345	402	51.4	20	131

Figure 8: Outlet and Centroid of Tilbuster Solar Catchment in Comparison to nearby catchments from RFFE

4.4.3. Comparison to Probabilistic Rational Method

Considering the discrepancy of the RFFE Model results a check was undertaken using the Probabilistic Rational Method and the results are provided in Table 7. The comparison shows that the results of the hydrological and hydraulic models, whilst slightly lower, are much more consistent with the Probabilistic Rational Method results than the RFFE model results and therefore the RFFE Model results are not considered reliable and should not be used as a basis for comparison.

Table 7: Comparison of Results to Probabilistic Rational Method (PRM)

Event	Peak Flows (cumecs)		
	DRAINS	HEC-RAS	PRM
5%	209	232	285
1%	345	402	492

4.5. Hazard Vulnerability

The flood hazard vulnerability over the subject site was mapped in accordance with Table 6.7.4 of Australian Rainfall and Runoff (2019) and is shown in Figures 3.3, 4.3 and 5.3 in Appendix G for the 5%AEP, 1%AEP and PMF events respectively.

The mapping shows that flooding within the proposal area is primarily classified as a H1 hazard vulnerability in the 5% AEP and 1% AEP events, except for flooding within Duval Creek which reached H6 classification and the third order watercourse that discharges into Duval Creek through the south-western corner of the proposal area, which reaches H5 classification in parts. As expected, hazard increases over the proposal area in the PMF event.

Table 6.7.3 of Australian Rainfall and Runoff (below) describes the hazard thresholds for community interaction with floodwaters.

Table 6.7.3. Combined Hazard Curves - Vulnerability Thresholds (Smith et al, 2014)

Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles. children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

5.0 IMPACT OF PROPOSED WORKS

5.1. Proposal Description

The proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would generate approximately 152 Megawatts (AC) to be supplied directly to the national electricity grid. The Proposal would provide enough clean, renewable energy for about 48,000 average NSW homes while displacing approximately 250,000 metric tons of carbon dioxide annually. The proposal site is approximately 310 hectares of which approximately 165 hectares would be developed for the solar farm and associated infrastructure (Development Footprint). Two existing TransGrid transmission lines transect the site, a 132 kilovolts eastern line and a 330 kilovolts central line. The 330 kilovolts transmission line would be used to connect the solar farm to the national electricity grid.

The primary access point during construction and operation for light and heavy vehicles would be off New England Highway, east of the site.

Key development and infrastructure components would include:

- Installation of approximately 400,878 PV solar modules mounted on either fixed or horizontal single-axis tracking system
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8km in length
- Perimeter security fencing
- Security camera poles
- Construction of creek crossing as required
- Native vegetative screening as required

In total, the construction phase of the proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. Up to five fulltime equivalent operations and maintenance staff and service contractors would operate the facility. At the end of its operational life, the facility would be decommissioned. All below ground components to a depth of 500 mm would be removed and returned to its existing agricultural land capability.

The Proposal would require subdivision of Deposited Plan Lots within the proposal site for lease and purchase agreement purposes with the involved landowner.

5.2. Hydraulic Modelling

An assessment of the impact of the proposed permanent infrastructure on flooding was undertaken by increasing the surface roughness over the proposed development footprint to account for solar array infrastructure and buildings.

Typical solar array modules consist of a frame supported by piers at a typical grid spacing of 5-6m. The addition of the solar arrays and their associated infrastructure will result in an increase in surface roughness over the site, from grazed/cropped pasture to a regular grid of steel piers.

The change in floodplain roughness associated with the proposed solar arrays was assessed using the Modified Cowan Method for Floodplain Roughness and is shown in Table 8. It should be noted that only n_3 (effect of obstructions) has been modified to represent the change in roughness associated with the solar array piers, all other variables remain at pre-development values which are variable across the site and hence have remained at n_b, n_1 etc.

It demonstrates that the roughness is anticipated to slightly increase because of the proposed development.

Table 8: Modified Cowan Method for Estimation of Floodplain Roughness

Roughness Component	Existing (Grazed Pasture)	Proposed (Solar Array)
Floodplain Material (n_b)	n_b	n_b
Degree of Irregularity (n_1)	n_1	n_1
Variation in Floodplain Cross Section (n_2)	n_2	n_2
Effect of Obstructions (n_3)	0.000	0.003[1]
Amount of Vegetation (n_4)	n_4	n_4
Change in Roughness (n)	0.000	0.003

[1] Based on an obstruction of 2.5% of the available flow area (i.e. 150mm piers at 5-6m intervals)

The increase in roughness was applied to the pre-development roughness values shown in Figure 2.1 in Appendix F over the extent of the proposed solar array footprint.

The area nominated for the proposed substation, battery storage and O&M facilities, including parking areas was assigned a Manning's n value of 3 to reflect the impact of the proposed buildings and structures in these areas.

It should be noted that the proposed development would include a network of access roads and these would be constructed from gravel and within the floodplain itself would be constructed at the existing surface level so as not to result in adverse impact on flood behaviour.

In accordance with the Modified Cowan Method of Floodplain Roughness gravel has a similar floodplain roughness to that of the surrounding pre-development floodplain roughness. On this basis, and considering the fact these tracks are likely to be less than 10m in width and therefore not well represented by the model, the marginal increase in floodplain roughness associated with the proposed road network has not been included in the post development model.

Furthermore, watercourse crossings have not been included in the model as fords or bridges, which minimise any hydraulic impact, have been recommended (see Section 6.4).

The post development hydraulic model is therefore considered to be representative of the development as proposed and therefore reflective of the hydraulic impacts associated with the development.

The hydraulic model was re-run to assess the impact of an increase in surface roughness on flood behaviour for the 1% AEP event and the results in included in Figures 6.1, 6.2 and 6.3 in Appendix G.

The results in Figures 6.1, 6.2 and 6.3 demonstrate that there is not predicted to be a significant impact on flood behaviour within the floodplain as a result of the proposed works, with flood levels, depths, velocities and hazards remaining relatively unchanged.

This is better demonstrated in Figures 7.1 and 7.2 (Appendix G) which show the change in maximum flood level and peak flood velocity resulting from the proposed development. These figures show that peak flood levels and velocities over most of the proposal area are anticipated to remain unchanged, due primarily to the infrastructure being located outside of areas subject to flooding. Some minor increases in flood levels and corresponding decreases in velocity are shown to occur within the proposed substation and operation and maintenance precinct, however these changes are very localised and not anticipated to adversely affect adjoining properties.

6.0 FLOOD MANAGEMENT RECOMMENDATIONS

6.1. Buildings and Structures

All buildings and structures (including solar arrays) associated with the proposal should be located outside high hazard areas (H5 and above) where they may be vulnerable to structural damage and have significant impact on flood behaviour.

The finished floor level of all buildings should be a minimum of 500mm above the 1% AEP flood level, except where required as an emergency flood refuge (see Section 6.2) where the floor level should eb a minimum of 500mm above the PMF flood level.

At the substation site slight raising of the adjacent roadway (or similar type bunding) is recommended in order to divert upslope runoff around this critical piece of infrastructure.

6.2. Flood Management

Access to a significant portion of the site (including operation and maintenance buildings) will require the crossing of Duval Creek. If the proposed crossing structures over Duval Creek will be rendered impassable during significant flood events it is recommended that:

i. Flood warning signs and flood level indicators should be placed on each approach to the proposed crossings.
ii. A flood refuge building or structure be provided within the proposal area on the eastern side of Duval Creek, such that in the event the proposed Duval Creek crossings are not trafficable any staff on-site have access to a weatherproof, flood free structure to seek temporary refuge. Such refuge area should be located a minimum of 500mm above the PMF level.
iii. A Business Floodsafe Plan be prepared for the development to ensure the safety of employees during flood events in general accordance with the NSW SES "Business Floodsafe Toolkit and Plan"

6.3. Solar Array Field

For fixed solar panel modules, the mounting height of the module frames should be designed such that the lower edge of the frame is clear of the predicted 1% AEP flood level plus 500mm freeboard so as not to impact on existing flood behaviour and to prevent the infrastructure from being damaged from flooding.

For solar tracking modules, the tracking axis should be located above the 1%AEP flood level plus 500mm freeboard, and the modules rotated to the horizontal during significant flood events to provide maximum clearance to the predicted flood level.

Where located in the floodplain the solar array mounting piers should be designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event, giving regard to the depth and velocity of floodwaters. Post development 1% AEP flood levels and velocities are included in Figures 6.1 and 6.2 respectively in Appendix G.

6.4. Electrical Infrastructure

All electrical infrastructure, including power conversions stations and the proposed substation, should be located above the 1% AEP flood level plus appropriate freeboard (min 500mm).

Where electrical cabling is required to be constructed below the 1% AEP flood level it should be capable of continuous submergence in water.

6.5. Perimeter Fencing

Wherever possible security fencing within the floodplain should be avoided or minimised. Where required security fencing should be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater.

Fencing across Duval Creek should be avoided in preference to creating two separate fenced compounds on either side of the creek.

6.6. Watercourse Crossings

Watercourses on the subject site have been classified by the Strahler System in accordance with the Guidelines for Riparian Corridors on Waterfront Land (DPI Water, 2012) and are shown in Figure 8.1 in Appendix I. Any road crossings on watercourses within the subject site should be of the type defined in Table 2 of this same document (see extract below).

Table 2. Riparian corridor matrix

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

Any proposed crossings (vehicular or service) of existing watercourses on the subject site should be designed in accordance with the following guidelines, and, in the case of vehicular crossings should preferably consist of bed level crossings constructed flush with the bed of the watercourse on first and second order watercourses to minimise any hydraulic impact:

i. Guidelines for Watercourse Crossings on Waterfront land (NSW DPI, 2012)
ii. Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land (NSW DPI, 2012)

6.7. Access Roads

Within the floodplain access roads should be constructed as close to natural ground levels as possible so as not to form an obstruction to floodwaters.

The surface treatment of roads should be designed giving regard to the velocity of floodwaters to minimise potential for scouring during flood events.

6.8. Erosion Management

Any areas of existing erosion within the proposed development footprint should be appropriately treated prior to the erection of solar array modules to ensure their ongoing stability.

For further information refer to Saving Soil: A Landowners Guide to Preventing and Repairing Soil Erosion, NSW DPI (2009) available at https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/270881/saving-soil-complete.pdf

7.0 SEAR'S COMPLIANCE

The Department of Planning and Environment issued environmental assessment requirements (SEARs) for the preparation of an Environmental Impact Assessment (EIS) for the proposed development on 12 October 2018, which included requirements from the Office of Environmental and Heritage (OEH) pertaining to flooding. Table 9 below demonstrates how this report addresses the OEH SEAR's requirements with respect to flooding.

Table 9: Assessment of Compliance with SEAR's

OEH Requirement	**Response**
12. The EA must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005), including:	
a. Flood Prone Land.	Flood Prone Land for the 5% AEP, 1% AEP and PMF have been defined over the proposal area as defined in Section 4.4 of this report.
b. Flood Planning Area, the area below the flood planning level.	Whilst an important tool in the management of flood risk the delineation of a flood planning areas is not considered relevant for the proposed development as the development does not comprise filling or habitable structures within the floodplain. Notwithstanding, Section 6.3 recommends setting proposal solar array panels a minimum of 500mm above the 1% AEP flood level.
c. Hydraulic Categorisation (floodways and flood storage areas).	Hydraulic categorisation is not considered relevant for the proposed development as they are a tool to assist in the preparation of appropriate floodplain risk management plans. The Floodplain Development Manual (2005) states that "they are not to be used for assessment of development proposals on an isolated or individual basis".

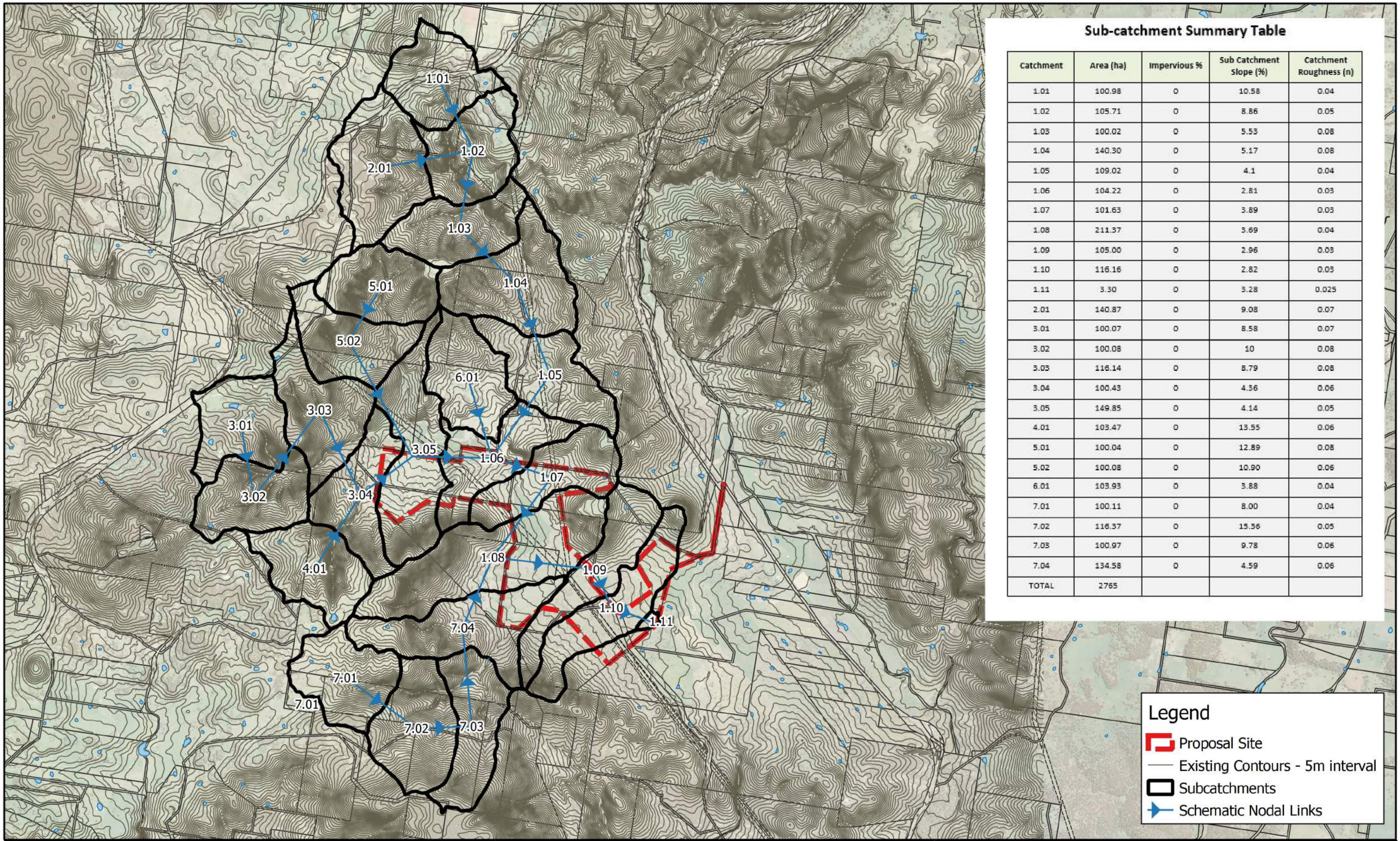
d. Flood Hazard.	Flood Hazard Categorisation for all design storm events modelled was undertaken in accordance with Table 6.7.4 of Australian Rainfall and Runoff (2016) and is included in Section 4.5 of this report.
e. The EA must describe the flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% AEP, 1% AEP flood levels and the PMF, or equivalent extreme event.	The methodology and modelling undertaken in determining flood levels and velocities is described in details in Sections 3.0 and 4.0 of this report.
f. The EA must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:	
g. Current flood behaviour for a range of design events as identified in 15 above. This includes the 0.5% and 0.2% year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	The impact of the proposed development on flood behaviour is described in detail in Section 5.2 of this report. Modelling for 1% AEP only was undertaken and shows minimal impact on existing flood behaviour. It is not considered necessary to model the 0.5% and 0.2% AEP events as proxies for assessing the sensitivity to an increase in rainfall intensity as the proposed development is relatively insensitive to flooding and will incorporate measures (such a solar array panels being a minimum of 500mm above the 1% AEP flood level) to minimise flood damages to proposed infrastructure.
13. Modelling in the EA must consider and document:	
14. Existing Council flood studies in the area and examine consistency to the flood behaviour documented in these studies.	No existing studies are known to exist within proximity of the proposal area.
15. The impact on existing flood behaviour for a full range of flood events including up to the probably maximum flood, or equivalent extreme flood.	The impact of existing flood behaviour up to the PMF event has been included in this assessment

16. Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories	Section 5.2 of this report demonstrates that the impacts of the proposed development are very minor change in flood level and velocity within the proposal area. Importantly the modelling demonstrates that changes in peak flood levels are limited to within the proposal area and are therefore not anticipated to adversely affect adjoining properties
17. Relevant provision of the NSW Floodplain Development Manual 2005	This report is considered to address the relevant provisions of the NSW Floodplain Development Manual.
18. The EA must assess the impact on the proposed development on flood behaviour including:	
a. Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.	The post development modelling presented in Section 5.2 shows that the proposed development will have negligible impact on existing flood behaviour, and no change in flood behaviour of other properties, assets or infrastructure.
b. Consistency with Council Floodplain Risk Management Plans	No known Floodplain Risk Management Plan exists for the proposal area.
c. Consistency with any Rural Floodplain Management Plan	No known Rural Floodplain Management Plans exist for the proposal area.
d. Compatibility with the flood hazard of the land	The development is compatible with the flood hazard of the site as infrastructure proposed as part of the development is typically located on low flood hazard land.
e. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	The layout proposed infrastructure has been undertaken in consideration of flood risk with development located outside land subject to mainstream flooding and where located within the floodplain typically located on land with low associated flood risk.
f. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.	The proposed development will not result in any change to the current flooding regime on the proposal area and beneficial inundation of the floodplain environment will continue to occur.

<table>
<tr><td>g. 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.</td><td>Section 5.2 indicates that changes in peak velocity resulting from the proposed development are expected to be in the range of plus or minus 0.25m/s which will ensure the stability of the bed and banks of existing watercourses and minimise further erosion potential. Further Section 6.8 recommends that any areas of existing erosion within the proposed development footprint should be appropriately treated prior to the erection of solar array modules to ensure their ongoing stability</td></tr>
<tr><td>h. Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.</td><td>No known community emergency management arrangement exists in proximity of the proposal area.</td></tr>
<tr><td>i. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.</td><td rowspan="2">Recommendations regarding specific measures to manage the risk to life from flooding and evacuation are provided in Section 6.2 and include flood warning signs, a flood refuge structure and preparation of a Business Floodsafe Plan. Whilst not discussed with the NSW SES or Council they are considered standard flood management measures.</td></tr>
<tr><td>j. Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.</td></tr>
<tr><td>k. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.</td><td>The proposed development is not anticipated to have any adverse impact on the social and economic costs to the community as a result of flooding.</td></tr>
</table>

APPENDIX A

Catchment Plan



Sub-catchment Summary Table

Catchment	Area (ha)	Impervious %	Sub Catchment Slope (%)	Catchment Roughness (n)
1.01	100.98	0	10.58	0.04
1.02	105.71	0	8.86	0.05
1.03	100.02	0	5.53	0.08
1.04	140.30	0	5.17	0.08
1.05	109.02	0	4.1	0.04
1.06	104.22	0	2.81	0.03
1.07	101.63	0	3.89	0.03
1.08	211.37	0	3.69	0.04
1.09	105.00	0	2.96	0.03
1.10	116.16	0	2.82	0.03
1.11	3.30	0	3.28	0.025
2.01	140.87	0	9.08	0.07
3.01	100.07	0	8.58	0.07
3.02	100.08	0	10	0.08
3.03	116.14	0	8.79	0.08
3.04	100.43	0	4.36	0.06
3.05	149.85	0	4.14	0.05
4.01	103.47	0	13.55	0.06
5.01	100.04	0	12.89	0.08
5.02	100.08	0	10.90	0.06
6.01	103.93	0	3.88	0.04
7.01	100.11	0	8.00	0.04
7.02	116.37	0	15.36	0.05
7.03	100.97	0	9.78	0.06
7.04	134.58	0	4.59	0.06
TOTAL	2765			

footprint.
sustainable engineering.
15 meehan drive, kiama downs,
nsw 2533 p: (02) 4237 6770

500 0 500 1000 m

Scale 1:40,000 at A3

TILBUSTER SOLAR FARM

FIGURE 1.1
CATCHMENT PLAN

Rev 2 - 21 April 2020

APPENDIX B

ARR Hub Data

ATTENTION: This site was updated recently, changing some of the functionality. Please see the changelog (./changelog) for further information

Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	151.656
Latitude	-30.377
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Interim Climate Change Factors	show
Probability Neutral Burst Initial Loss (./nsw_specific)	show

Data

River Region

Division	South East Coast (NSW)
River Number	6
River Name	Macleay River

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2016_v1

ARF Parameters

$$ARF = Min\left\{1, \left[1 - a\left(Area^{b} - c\log_{10}Duration\right)Duration^{-d} + eArea^{f}Duration^{g}\left(0.3 + \log_{10}AEP\right) + h10^{iArea\frac{Duration}{1440}}\left(0.3 + \log_{10}AEP\right)\right]\right\}$$

Zone	a	b	c	d	e	f	g	h	i
East Coast North	0.327	0.241	0.448	0.36	0.00096	0.48	-0.21	0.012	-0.0013

Short Duration ARF

$$ARF = Min\left[1, 1 - 0.287\left(Area^{0.265} - 0.439\log_{10}(Duration)\right).Duration^{-0.36} + 2.26 \text{ x } 10^{-3} \text{ x } Area^{0.226}.Duration^{0.125}\left(0.3 + \log_{10}(AEP)\right) + 0.0141 \text{ x } Area^{0.213} \text{ x } 10^{-0.021\frac{(Duration-180)^{2}}{1440}}\left(0.3 + \log_{10}(AEP)\right)\right]$$

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

Note: As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (./nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. The continuing storm loss information from the ARR Datahub provided below should only be used where relevant under the loss hierarchy (level 5) and where used is to be multiplied by the factor of 0.4.

ID	23453.0
Storm Initial Losses (mm)	15.0
Storm Continuing Losses (mm/h)	4.2

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECsouth.zip)

code	ECsouth
Label	East Coast South

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2016_v2

Areal Temporal Patterns | Download (.zip) (./static/temporal_patterns/Areal/Areal_ECsouth.zip)

code	ECsouth
arealabel	East Coast South

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2016_v2

BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-30.377272&longitude=151.656333&sdmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	05 September 2019 12:23PM

Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.5 (0.020)	1.0 (0.027)	1.3 (0.030)	1.6 (0.032)	1.8 (0.029)	1.9 (0.027)
90 (1.5)	0.6 (0.019)	0.8 (0.019)	0.9 (0.018)	1.0 (0.018)	1.0 (0.014)	0.9 (0.012)
120 (2.0)	1.5 (0.048)	2.1 (0.047)	2.4 (0.046)	2.7 (0.045)	1.7 (0.024)	1.0 (0.012)
180 (3.0)	0.4 (0.012)	0.4 (0.009)	0.4 (0.007)	0.4 (0.006)	0.9 (0.011)	1.2 (0.014)
360 (6.0)	0.7 (0.017)	0.8 (0.015)	0.9 (0.014)	1.0 (0.013)	2.9 (0.032)	4.3 (0.042)
720 (12.0)	1.5 (0.029)	1.1 (0.016)	0.8 (0.010)	0.5 (0.006)	3.1 (0.029)	5.0 (0.042)
1080 (18.0)	0.0 (0.000)	0.2 (0.002)	0.3 (0.003)	0.4 (0.004)	3.5 (0.030)	5.8 (0.044)
1440 (24.0)	0.0 (0.000)	0.2 (0.002)	0.3 (0.004)	0.5 (0.004)	5.2 (0.041)	8.8 (0.062)
2160 (36.0)	0.0 (0.000)	0.1 (0.001)	0.2 (0.002)	0.3 (0.002)	1.8 (0.012)	2.9 (0.018)
2880 (48.0)	0.0 (0.000)	0.1 (0.001)	0.1 (0.001)	0.2 (0.001)	0.4 (0.002)	0.5 (0.003)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.1 (0.002)	0.2 (0.003)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	9.7 (0.361)	9.0 (0.240)	8.4 (0.189)	7.9 (0.152)	13.4 (0.215)	17.5 (0.249)
90 (1.5)	10.2 (0.339)	10.7 (0.258)	11.0 (0.223)	11.3 (0.196)	9.9 (0.144)	8.9 (0.114)
120 (2.0)	12.2 (0.375)	13.0 (0.294)	13.6 (0.258)	14.1 (0.230)	14.1 (0.192)	14.0 (0.169)
180 (3.0)	9.4 (0.262)	11.6 (0.240)	13.1 (0.228)	14.5 (0.218)	17.4 (0.219)	19.6 (0.218)
360 (6.0)	13.6 (0.322)	15.1 (0.269)	16.1 (0.244)	17.1 (0.224)	25.8 (0.284)	32.4 (0.316)
720 (12.0)	14.5 (0.285)	14.7 (0.220)	14.8 (0.190)	14.9 (0.166)	35.3 (0.333)	50.5 (0.424)
1080 (18.0)	3.0 (0.053)	6.9 (0.093)	9.4 (0.109)	11.9 (0.119)	28.4 (0.242)	40.8 (0.309)
1440 (24.0)	5.7 (0.093)	8.7 (0.108)	10.7 (0.113)	12.6 (0.116)	23.7 (0.186)	32.0 (0.224)
2160 (36.0)	0.0 (0.000)	4.5 (0.050)	7.5 (0.070)	10.3 (0.085)	15.3 (0.106)	18.9 (0.118)
2880 (48.0)	0.0 (0.000)	3.6 (0.036)	6.0 (0.052)	8.2 (0.062)	9.5 (0.061)	10.4 (0.060)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.7 (0.004)	1.2 (0.006)

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	34.7 (1.287)	30.4 (0.813)	27.5 (0.615)	24.7 (0.474)	66.1 (1.060)	97.2 (1.379)
90 (1.5)	29.6 (0.980)	27.7 (0.670)	26.5 (0.537)	25.4 (0.441)	36.0 (0.522)	43.9 (0.564)
120 (2.0)	42.6 (1.313)	48.2 (1.088)	51.8 (0.983)	55.4 (0.902)	56.2 (0.767)	56.9 (0.687)
180 (3.0)	24.5 (0.686)	32.5 (0.672)	37.8 (0.659)	42.9 (0.644)	58.9 (0.742)	70.9 (0.791)
360 (6.0)	39.5 (0.933)	47.2 (0.840)	52.4 (0.790)	57.3 (0.749)	79.5 (0.875)	96.2 (0.939)
720 (12.0)	30.6 (0.604)	41.2 (0.618)	48.1 (0.617)	54.8 (0.612)	72.6 (0.685)	85.9 (0.720)
1080 (18.0)	28.4 (0.500)	34.2 (0.460)	38.0 (0.438)	41.7 (0.419)	64.6 (0.549)	81.8 (0.619)
1440 (24.0)	29.3 (0.475)	31.3 (0.388)	32.6 (0.346)	33.8 (0.313)	57.9 (0.454)	75.9 (0.531)
2160 (36.0)	8.1 (0.117)	19.4 (0.214)	26.9 (0.254)	34.1 (0.281)	40.5 (0.282)	45.2 (0.282)
2880 (48.0)	4.8 (0.063)	10.9 (0.111)	15.0 (0.130)	18.9 (0.143)	30.3 (0.195)	38.9 (0.224)
4320 (72.0)	0.8 (0.010)	4.0 (0.036)	6.1 (0.047)	8.0 (0.054)	20.6 (0.119)	30.0 (0.156)

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Interim Climate Change Factors

	RCP 4.5	RCP6	RCP 8.5
2030	**0.869 (4.3%)**	0.783 (3.9%)	**0.983 (4.9%)**
2040	**1.057 (5.3%)**	1.014 (5.1%)	**1.349 (6.8%)**
2050	**1.272 (6.4%)**	1.236 (6.2%)	**1.773 (9.0%)**
2060	**1.488 (7.5%)**	1.458 (7.4%)	**2.237 (11.5%)**
2070	**1.676 (8.5%)**	1.691 (8.6%)	**2.722 (14.2%)**
2080	**1.810 (9.2%)**	1.944 (9.9%)	**3.209 (16.9%)**
2090	**1.862 (9.5%)**	2.227 (11.5%)	**3.679 (19.7%)**

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2019_v1
Note	ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.

Probability Neutral Burst Initial Loss

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	17.5	11.7	11.4	12.4	10.0	6.6
90 (1.5)	17.7	12.3	12.0	13.2	12.0	10.4
120 (2.0)	16.1	11.0	10.4	11.3	10.1	7.5
180 (3.0)	18.1	12.6	11.7	12.2	10.6	6.7
360 (6.0)	16.4	11.6	11.3	11.0	9.9	5.0
720 (12.0)	17.0	12.5	12.2	12.4	9.9	5.1
1080 (18.0)	19.5	14.3	14.5	14.7	11.1	5.5
1440 (24.0)	19.5	14.4	15.1	15.1	12.1	7.0
2160 (36.0)	23.6	17.6	17.2	16.5	15.3	7.9
2880 (48.0)	24.2	19.3	19.1	19.5	17.7	9.7
4320 (72.0)	25.7	21.5	22.8	24.9	20.7	14.3

Layer Info

Time Accessed	05 September 2019 12:23PM
Version	2018_v1

Note As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (./nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

Download TXT (downloads/60050869-5bcd-4409-b229-e28e23a25397.txt)

Download JSON (downloads/5220bb5d-8532-46af-b6c3-1c5de7537579.json)

Generating PDF... (downloads/2d65c5ae-f575-4bfe-bc85-fbe13597c7c5.pdf)

APPENDIX C

Rainfall Depths

Australian Government
Bureau of Meteorology

Location

Label: Tilbuster Solar Farm

Latitude: -30.3875 [Nearest grid cell: 30.3875 (S)]

Longitude: 151.6625 [Nearest grid cell: 151.6625 (E)]

IFD Design Rainfall Depth (mm)

Issued: 04 March 2020

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	2.00	2.27	3.17	3.79	4.42	5.26	5.93
2 min	3.41	3.87	5.35	6.40	7.47	8.90	9.99
3 min	4.73	5.37	7.42	8.88	10.3	12.3	13.8
4 min	5.92	6.72	9.31	11.1	13.0	15.4	17.3
5 min	6.99	7.94	11.0	13.2	15.3	18.3	20.5
10 min	11.0	12.6	17.6	21.0	24.5	29.2	32.9
15 min	13.8	15.7	22.0	26.4	30.7	36.6	41.3
20 min	15.8	18.1	25.3	30.3	35.3	42.2	47.6
25 min	17.4	19.9	27.8	33.4	38.9	46.5	52.5
30 min	18.8	21.4	29.9	35.8	41.8	50.0	56.4
45 min	21.7	24.7	34.3	41.1	48.0	57.4	64.9
1 hour	23.8	27.0	37.3	44.7	52.2	62.4	70.5
1.5 hour	26.7	30.2	41.4	49.5	57.7	68.9	77.8
2 hour	28.8	32.4	44.3	52.7	61.4	73.3	82.8
3 hour	32.0	35.8	48.4	57.4	66.6	79.4	89.6
4.5 hour	35.4	39.5	52.8	62.3	72.1	85.8	96.8
6 hour	38.1	42.3	56.3	66.3	76.5	90.8	102
9 hour	42.4	47.0	61.9	72.6	83.6	99.0	112
12 hour	45.9	50.7	66.6	78.0	89.6	106	119
18 hour	51.4	56.8	74.3	86.8	99.6	118	132
24 hour	55.8	61.6	80.6	94.2	108	127	143
30 hour	59.5	65.7	86.1	101	115	136	152
36 hour	62.7	69.3	90.8	106	122	143	160
48 hour	68.0	75.2	98.7	115	132	156	174
72 hour	75.8	84.0	110	129	148	174	193
96 hour	81.3	90.2	118	138	158	185	205
120 hour	85.6	94.8	124	144	165	191	211

144 hour	88.9	98.3	128	148	168	194	214
168 hour	91.5	101	131	151	170	195	215

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

This page was created at **17:11 on Wednesday 04 March 2020 (AEDT)**

APPENDIX D

Pre-burst Rainfall Depths

Table E1: NSW Transformation Pre-Burst Rainfall Depths

Storm Duration		Pre-Burst Rainfall Depth (mm)	
		AEP (%)	
min	hrs	5	1
60	1	2.8	8.7
90	1.5	2.1	4.8
120	2	3.9	7.8
180	3	3.1	8.6
360	6	4.3	10.3

APPENDIX E

PMP Calculations

GSDM Calculation Sheet

Location Information				
Catchment	Tilbuster Solar	Area (km2)	27.65	
State	NSW	Duration Limit (hrs)	3	
Latitude	-30.37951	Longitude	151.65415	
Proportion of Area Considered:				
Smooth S= (0.0 - 1.0)	0	Rough R= (0.0-1.0)	1	

Elevation Adjustment Factor (EAF)		
Mean Elevation (m AHD)	1200	
Adjustment for Eelvation (-0.05 per 300m above 1500m)	0	
EAF = (0.85-1.00)	1	

Moisture Adjustment Factor (MAF)		
MAF = (0.40 - 1.00)	0.77	

PMP Values

Duarion (hrs)	Initial Depth - Smooth	Initial Depth - Rough	PMP Estimate	Rounded PMP Estimate (nearest 10mm)
0.25	195	195	150	150
0.50	285	285	219	220
0.75	365	365	281	280
1.0	435	435	335	330
1.5	495	555	427	430
2.0	555	645	497	500
2.5	590	715	551	550
3.0	625	780	601	600
4.0	0	0	0	0
5.0	0	0	0	0
6.0	0	0	0	0

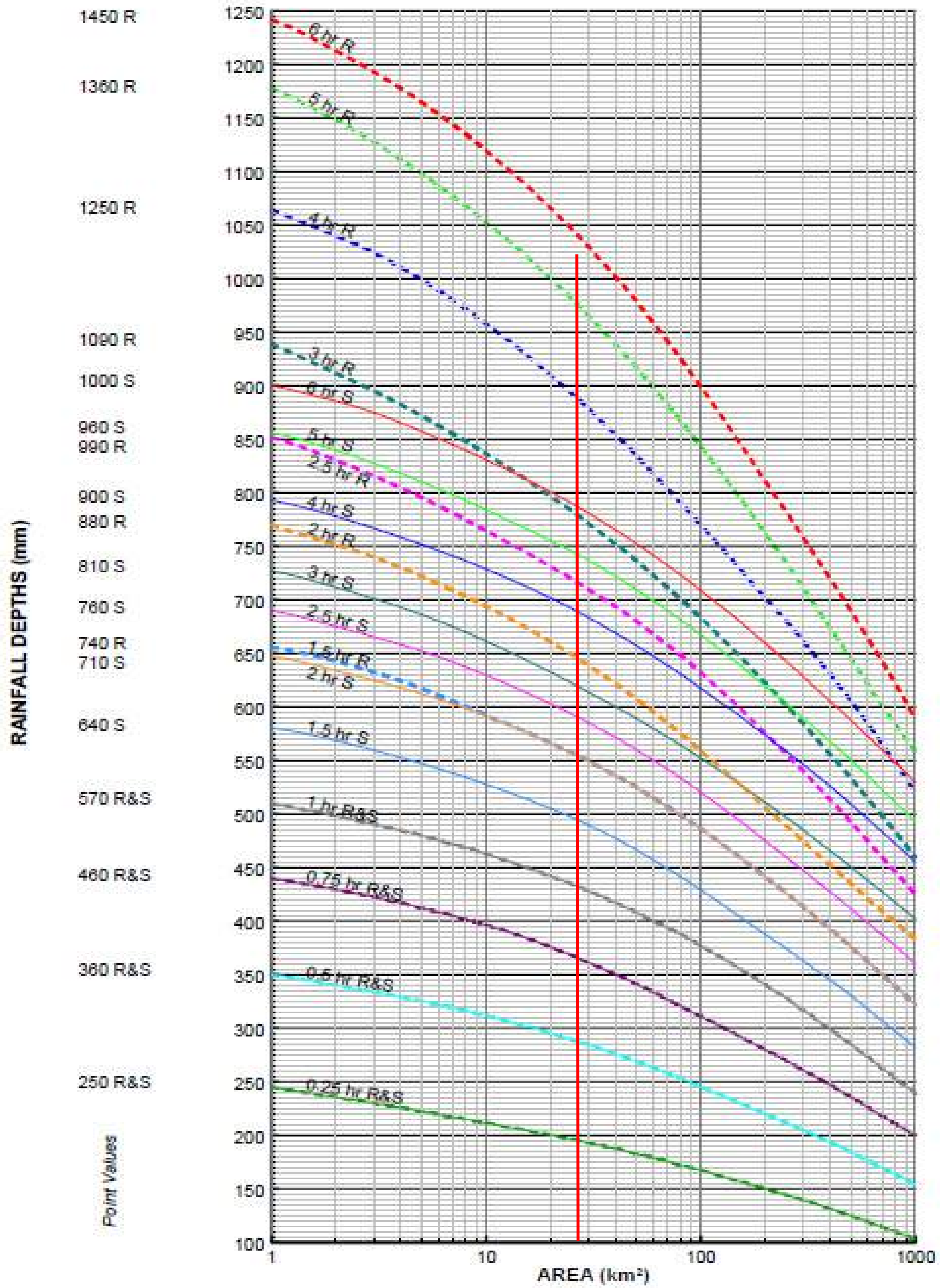
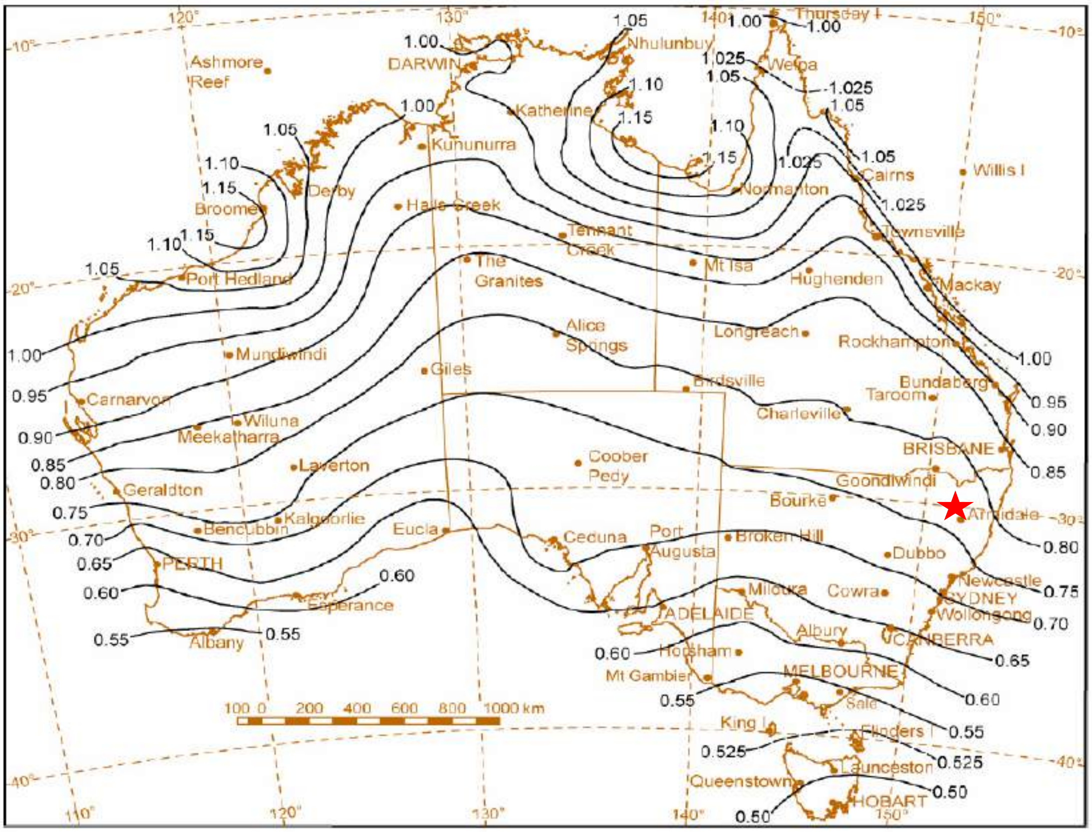
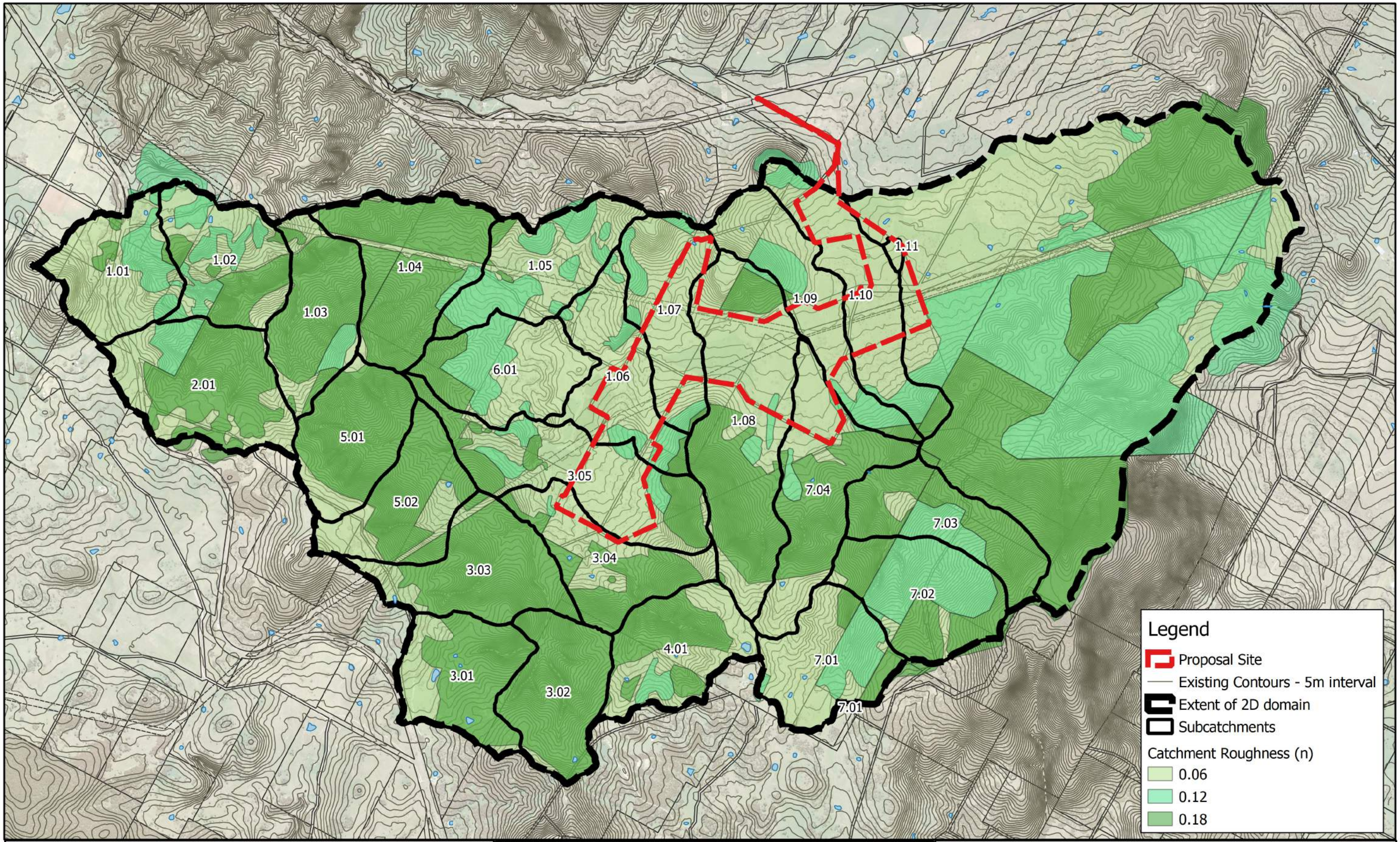


Figure 4: Depth-Duration-Area Curves of Short Duration Rainfall



APPENDIX F

Adopted Manning's Values



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15 meehan drive, kiama downs,
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500 0 500 1000 m

Scale 1:40,000 at A3

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FIGURE 2.1

CATCHMENT ROUGHNESS PLAN

Rev 2 - 21 April 2020

APPENDIX G

Floood Mapping

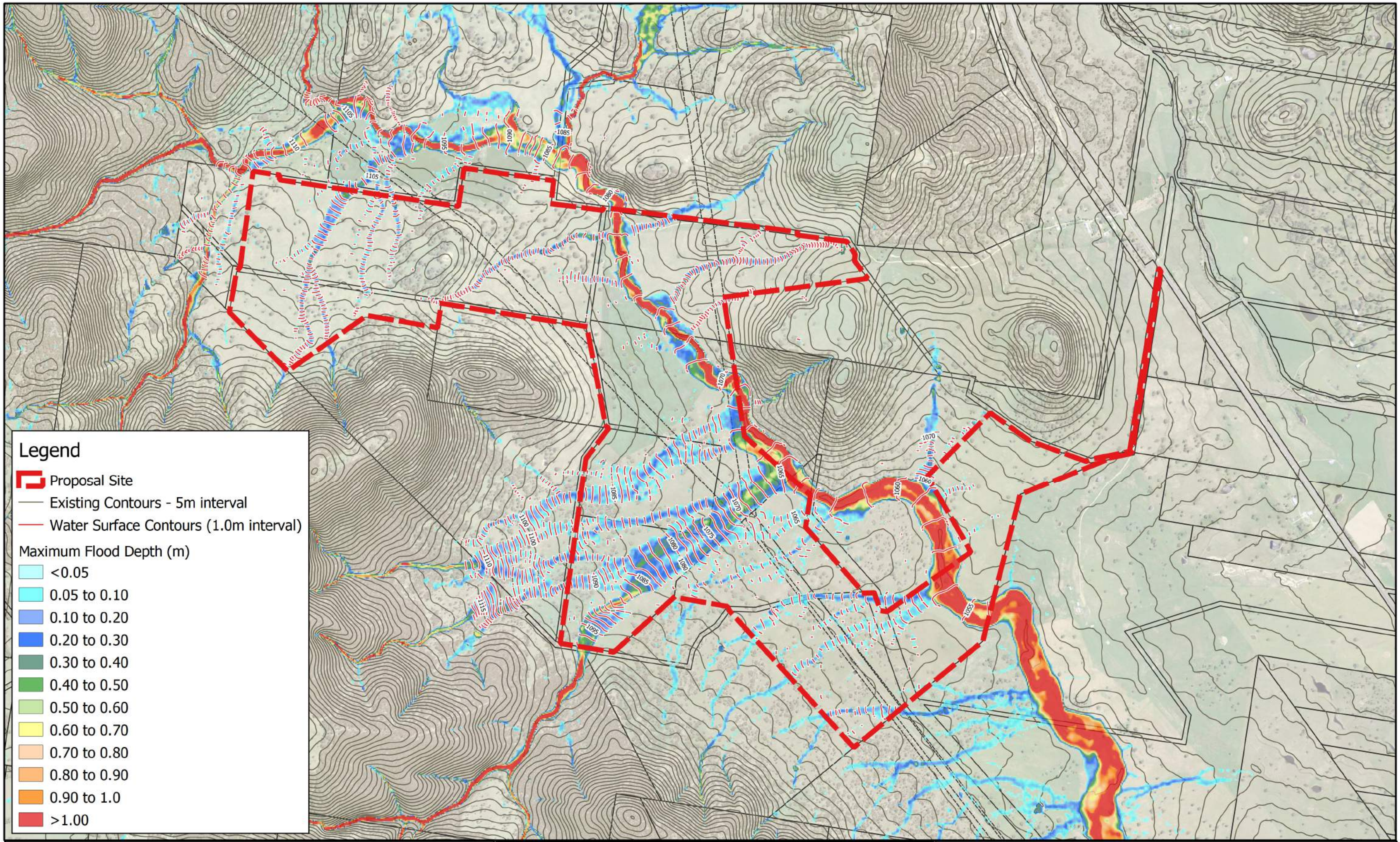

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FIGURE 3.1

PRE-DEVELOPMENT PEAK FLOOD LEVELS AND DEPTHS

5% AEP

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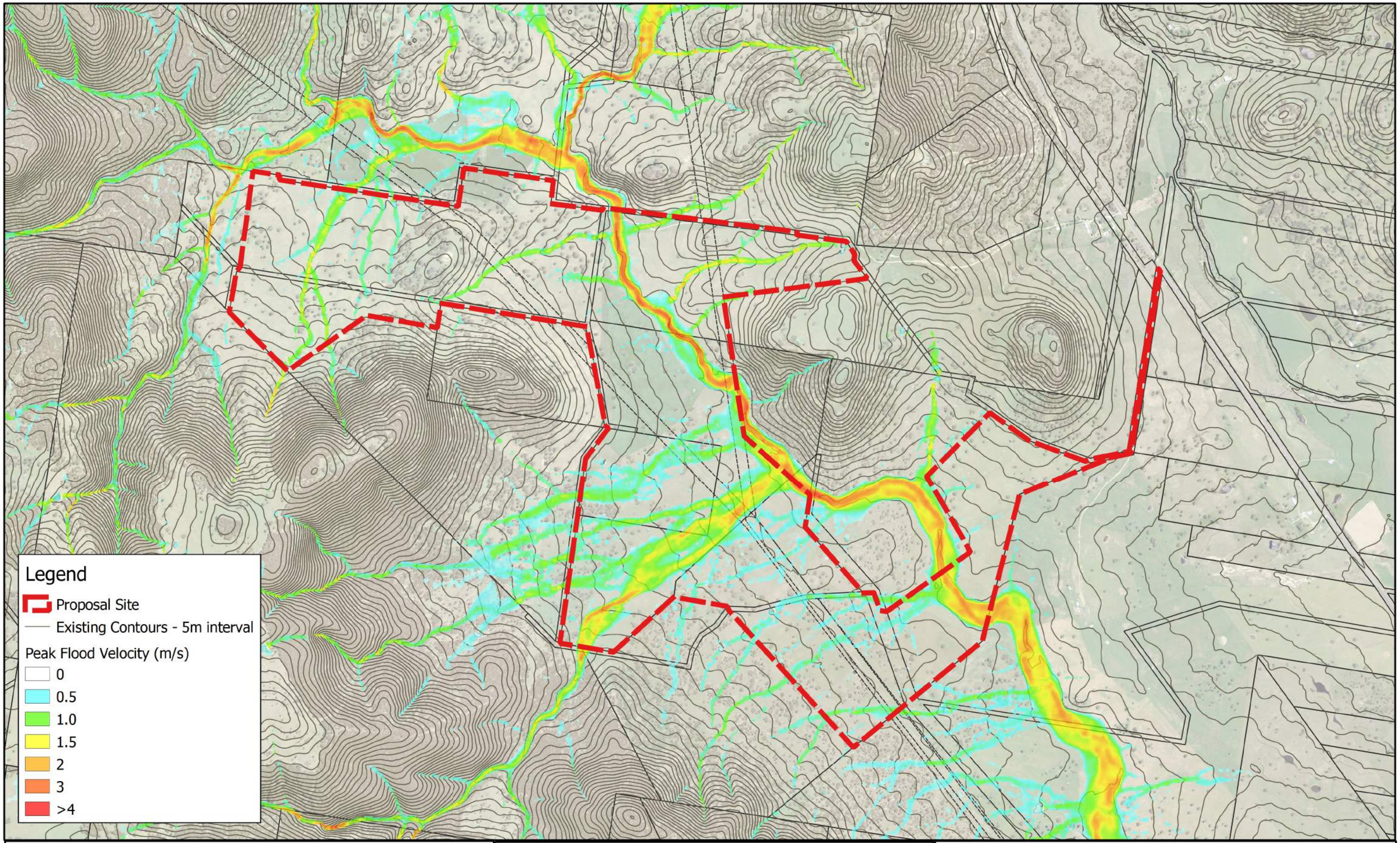

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FIGURE 3.2

PRE-DEVELOPMENT PEAK FLOOD VELOCITIIES

5% AEP

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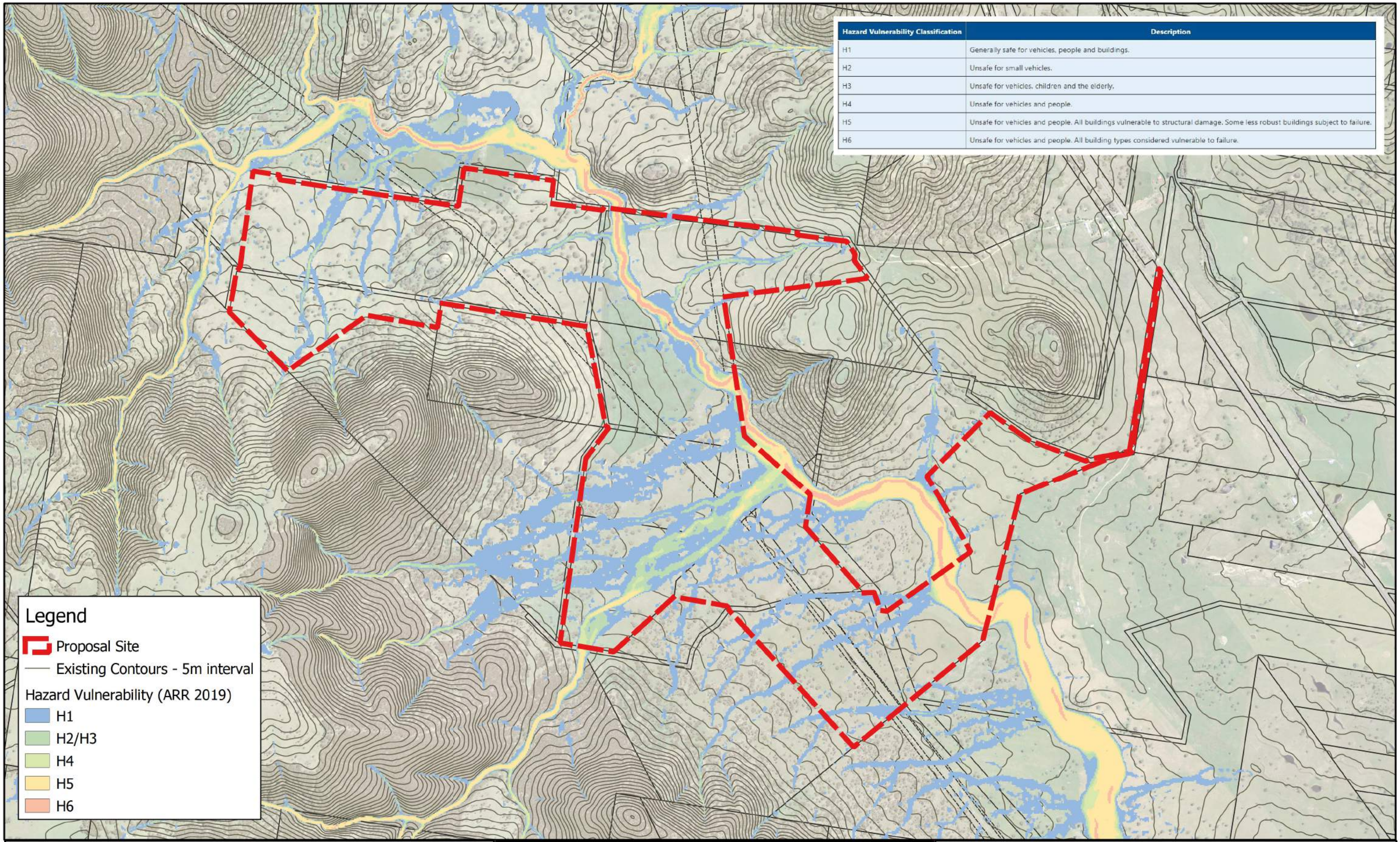

Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles, children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

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200 0 200 400 m
Scale 1:15,000 at A3

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FIGURE 3.3
PRE-DEVELOPMENT HAZARD VULNERABILITY
5% AEP

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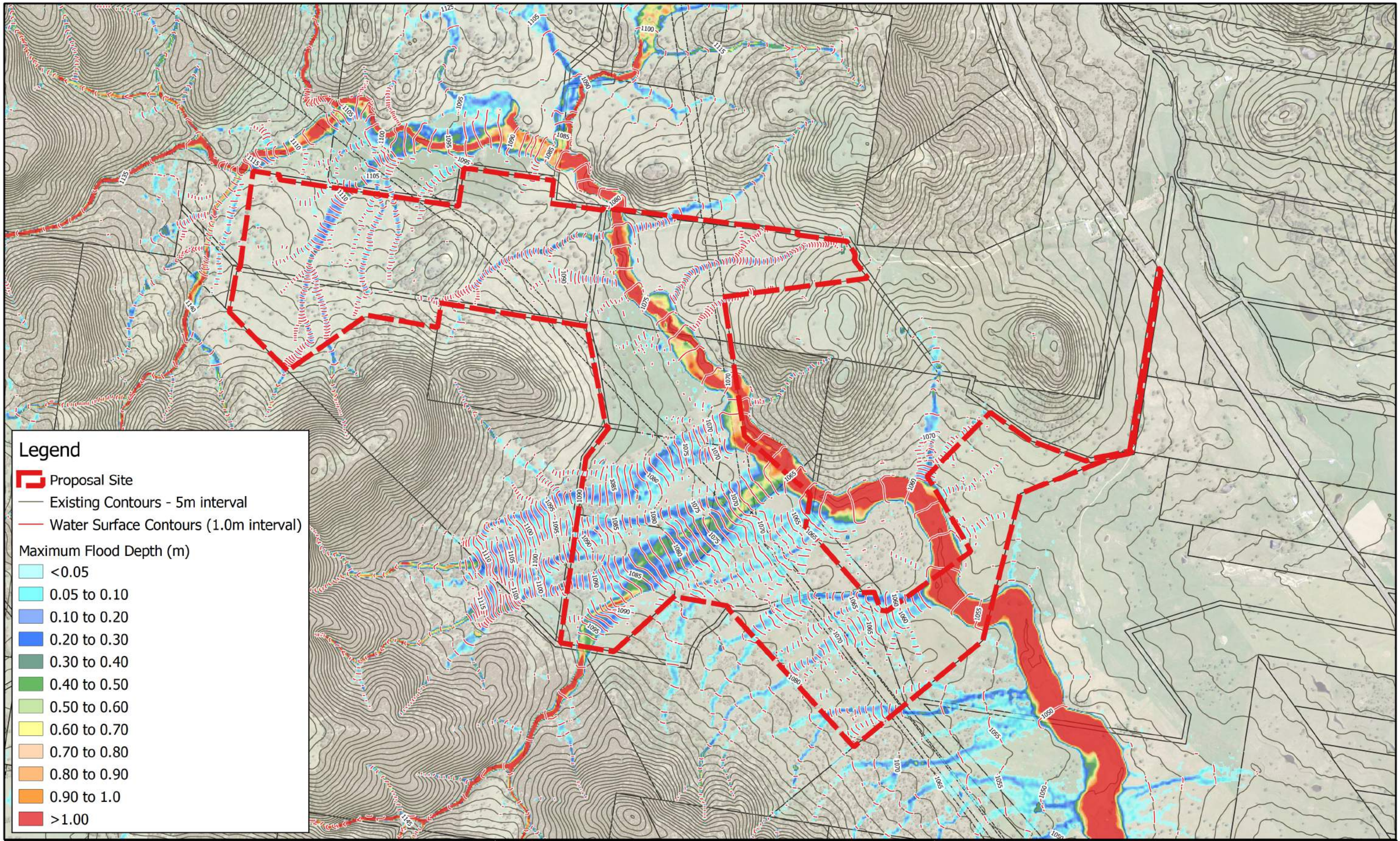

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nsw 2533 p: (02) 4237 6770

200 0 200 400 m

Scale 1:15,000 at A3

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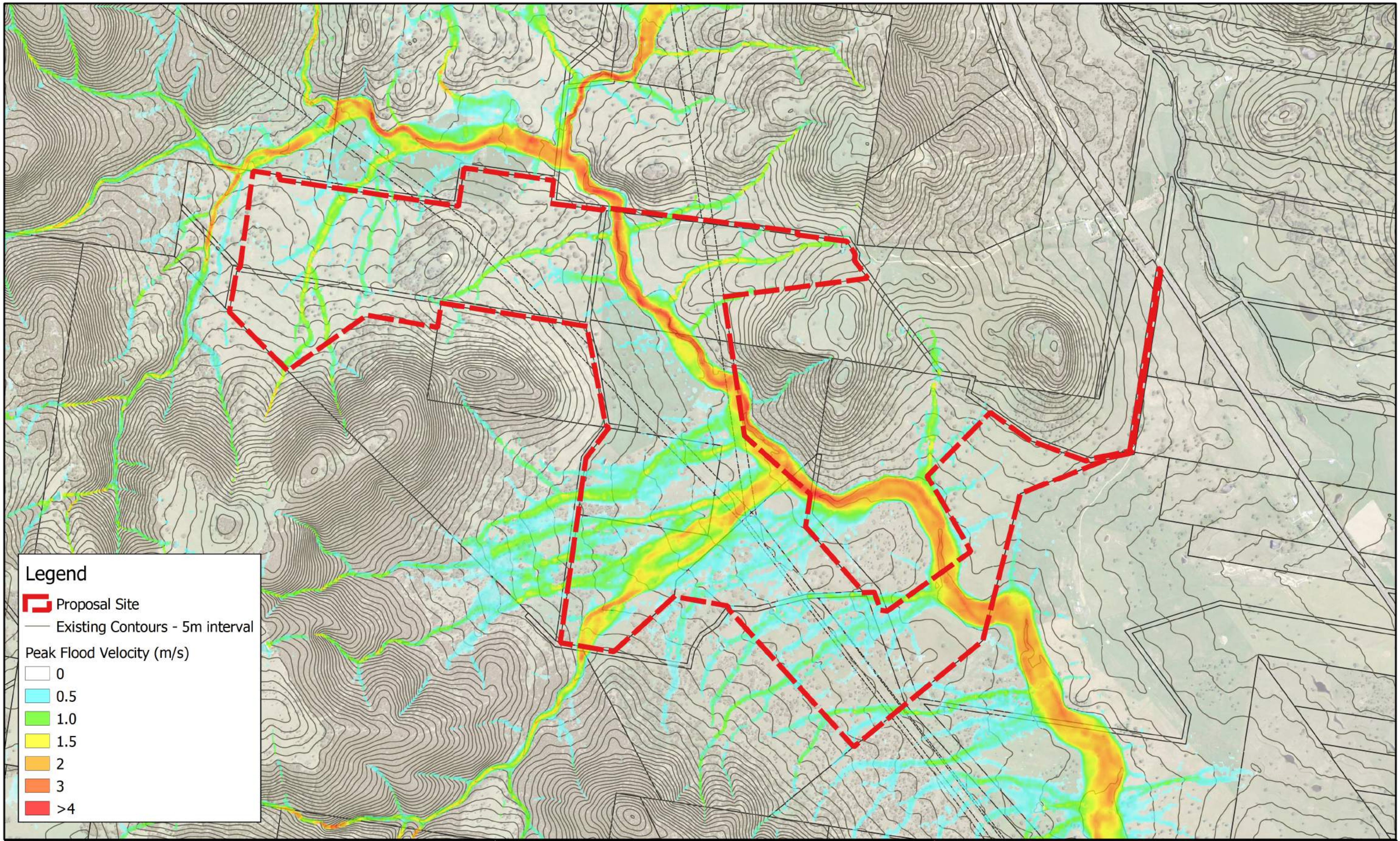
FIGURE 4.1

PRE-DEVELOPMENT PEAK FLOOD LEVELS AND DEPTHS

1% AEP

Rev 2 - 21 April 2020



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200 0 200 400 m

Scale 1:15,000 at A3

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FIGURE 4.2

PRE-DEVELOPMENT PEAK FLOOD VELOCITIIES

1% AEP

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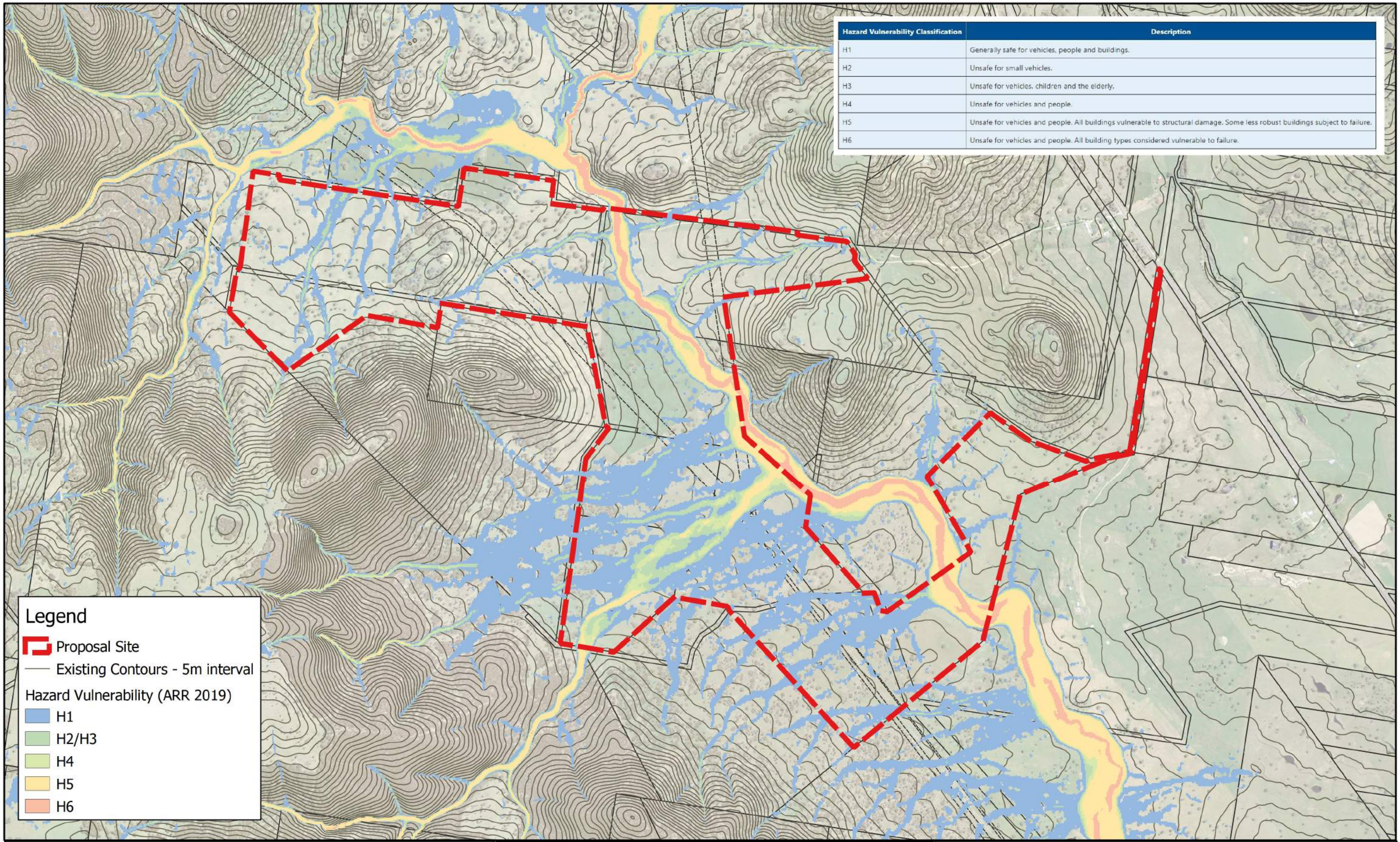

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200 0 200 400 m

Scale 1:15,000 at A3

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FIGURE 4.3
PRE-DEVELOPMENT HAZARD VULNERABILITY
1% AEP

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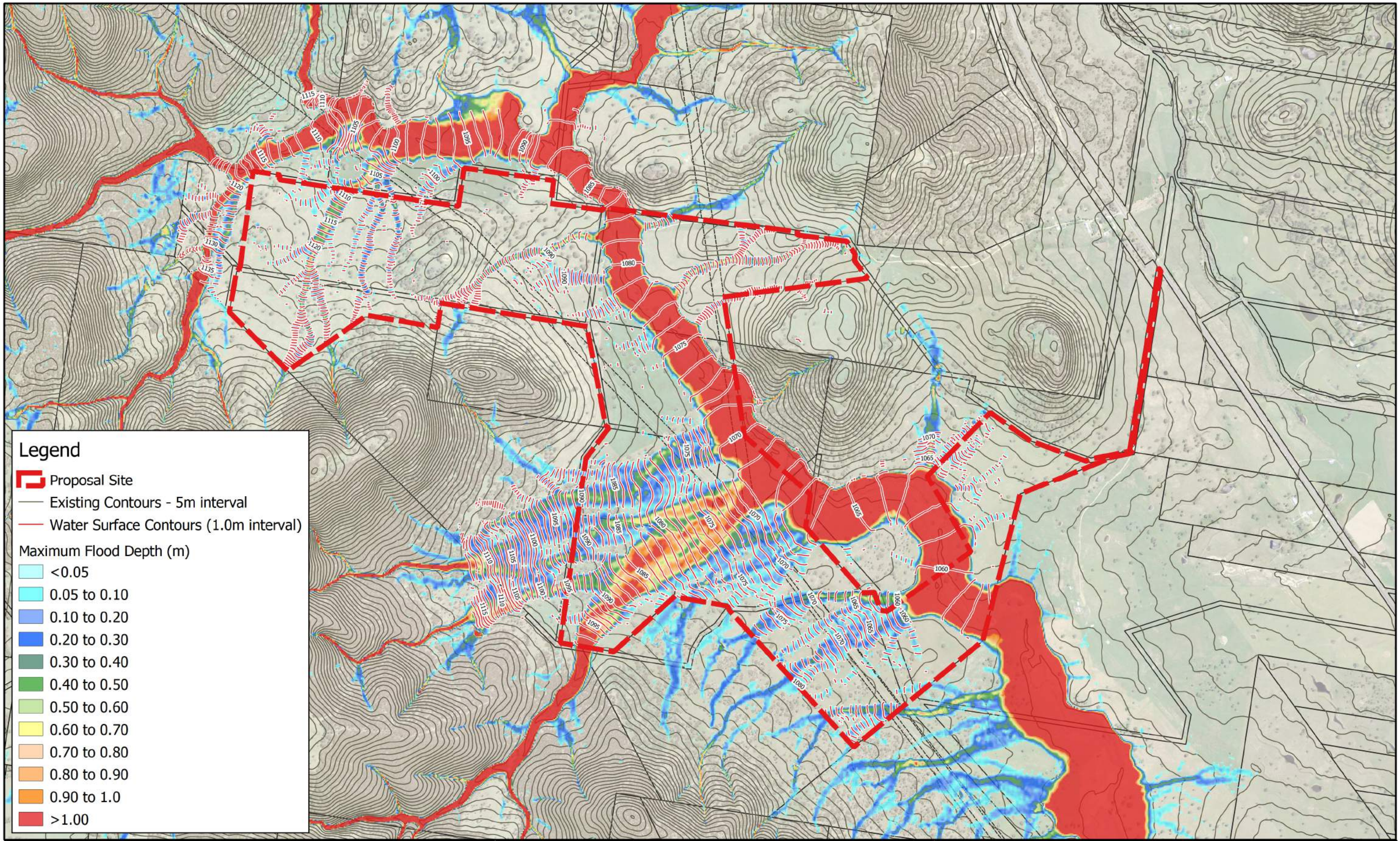

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200 0 200 400 m

Scale 1:15,000 at A3

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FIGURE 5.1

PRE-DEVELOPMENT PEAK FLOOD LEVELS AND DEPTHS

PMF

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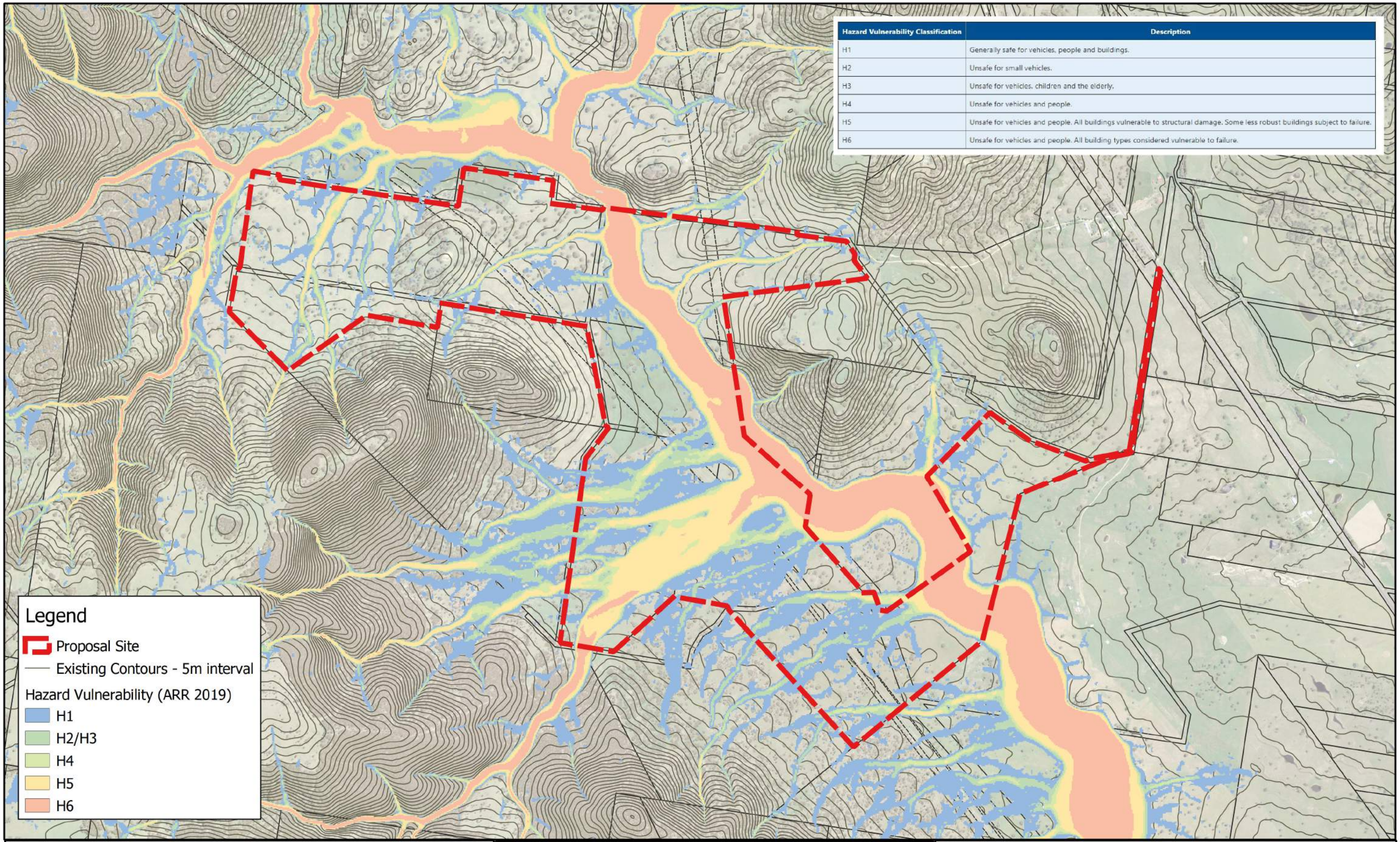
TILBUSTER SOLAR FARM
FIGURE 5.2
PRE-DEVELOPMENT PEAK FLOOD VELOCITIIES
PMF
Rev 2 - 21 April 2020



Hazard Vulnerability Classification	Description
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FIGURE 5.3

PRE-DEVELOPMENT HAZARD VULNERABILITY

PMF

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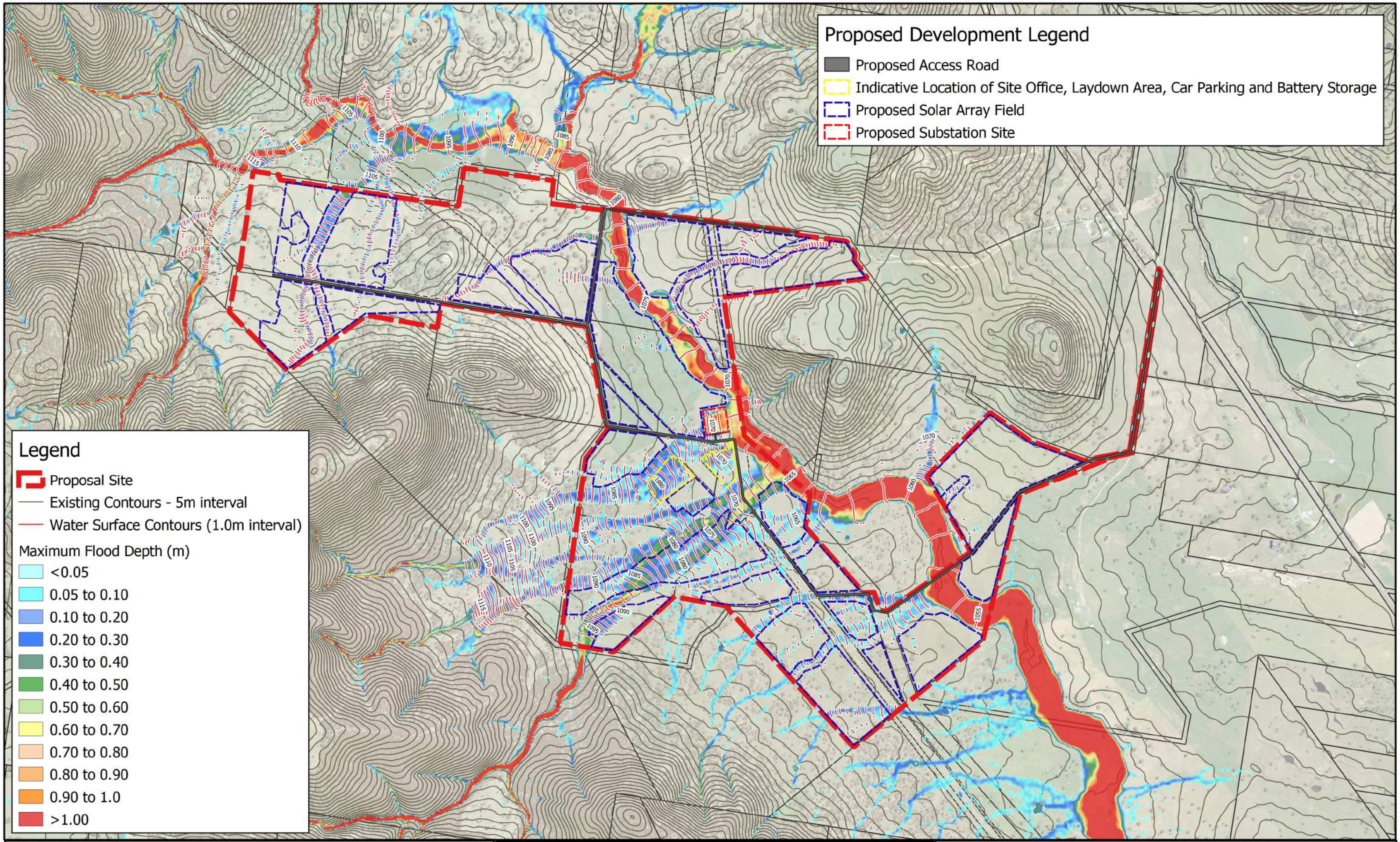

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200 0 200 400 m
Scale 1:15,000 at A3

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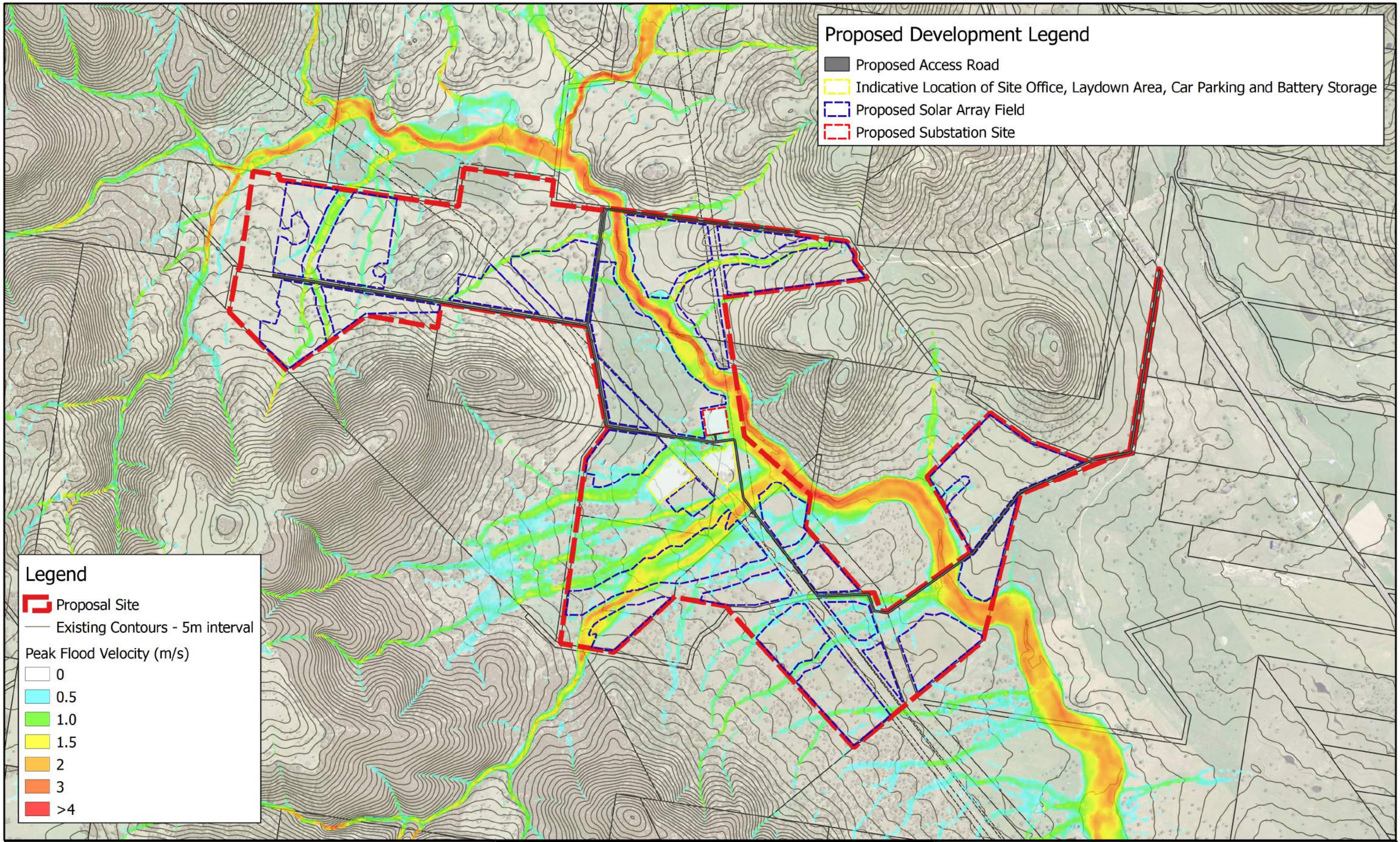
FIGURE 6.1
POST DEVELOPMENT PEAK FLOOD LEVELS AND DEPTHS
1% AEP

Rev 2 - 21 April 2020



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200 0 200 400 m

Scale 1:15,000 at A3

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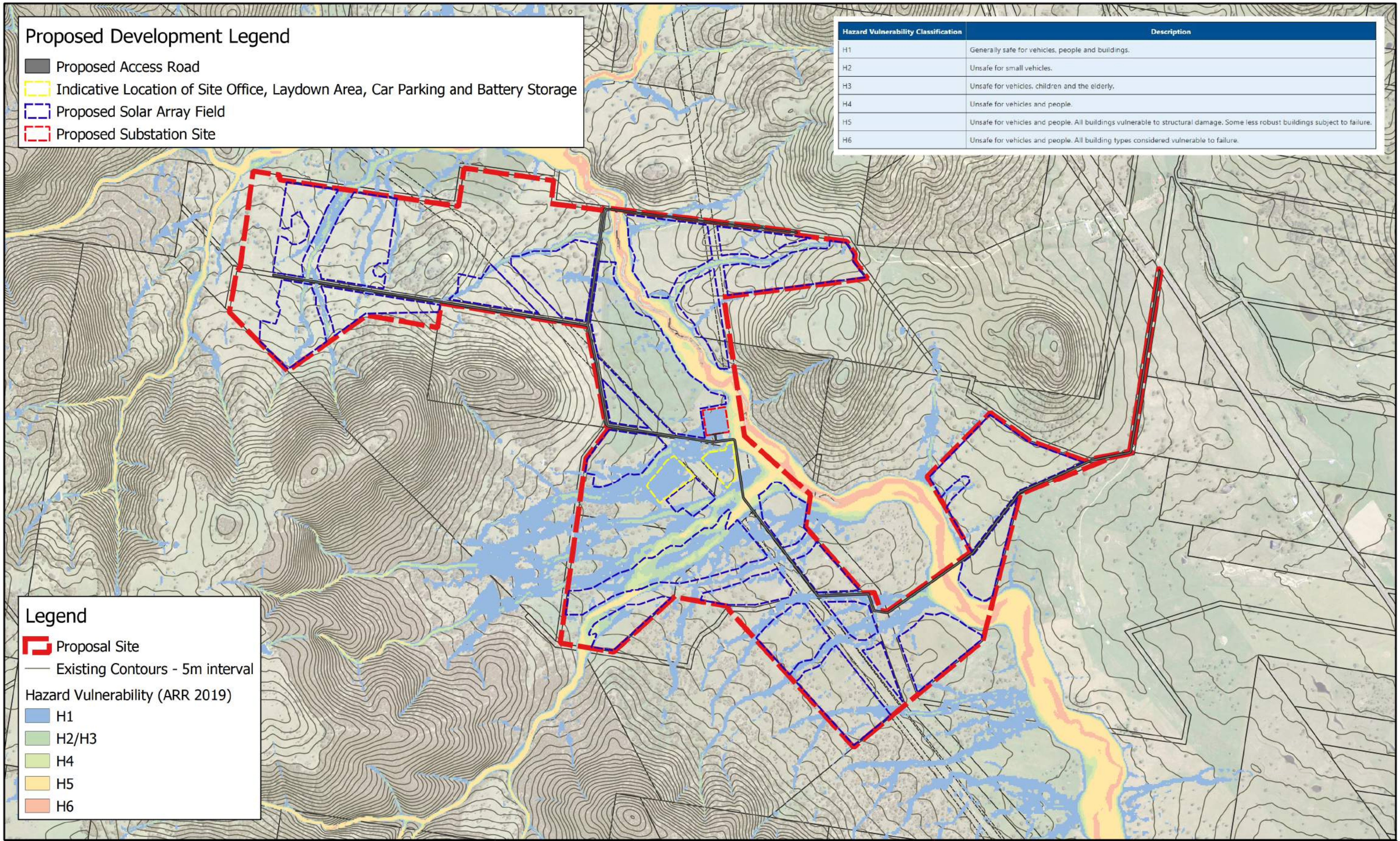
FIGURE 6.2

POST DEVELOPMENT PEAK FLOOD VELOCITIIES

1% AEP

Rev 2 - 21 April 2020



Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
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200 0 200 400 m
Scale 1:15,000 at A3

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FIGURE 6.3
POST DEVELOPMENT HAZARD VULNERABILITY
1% AEP

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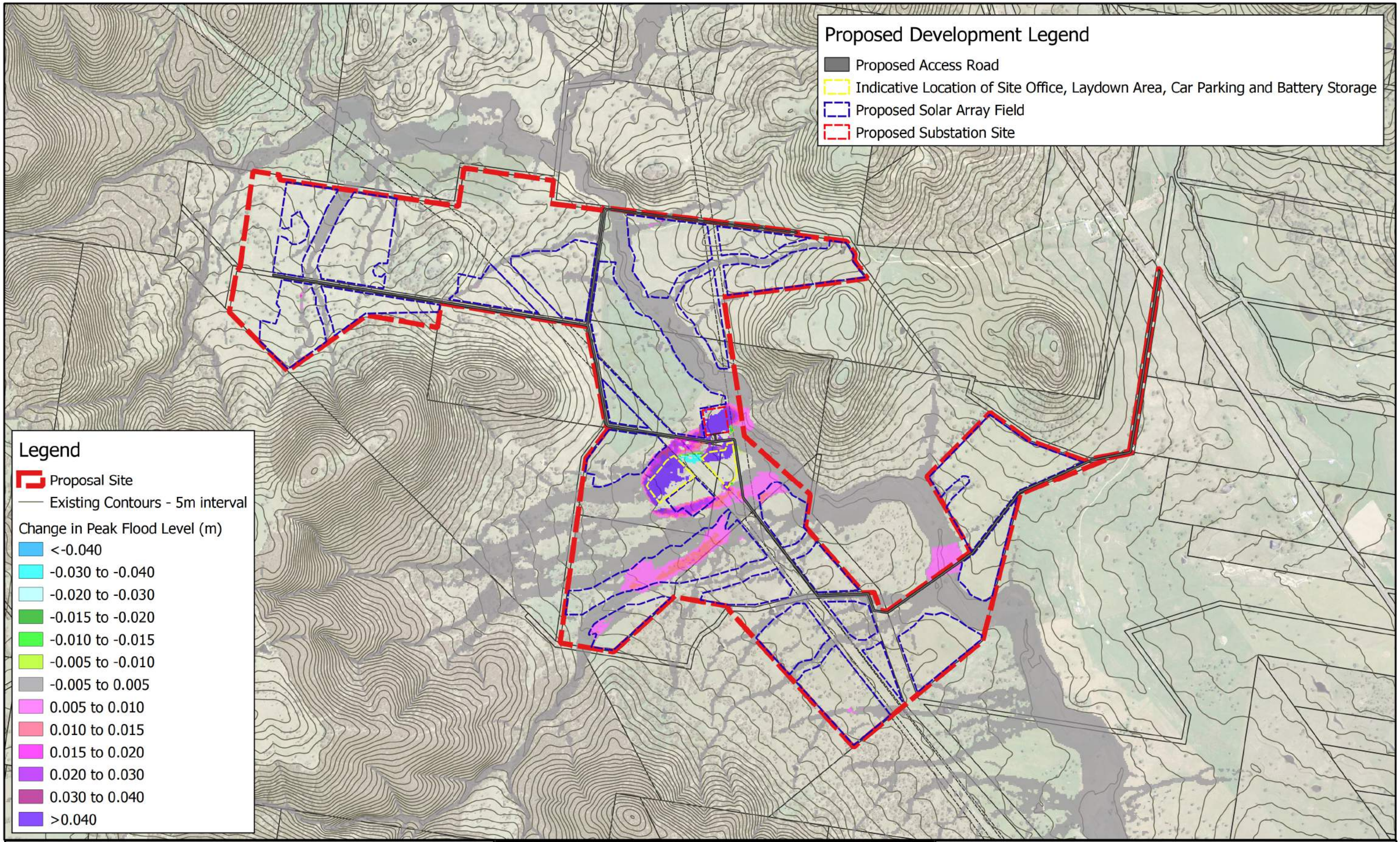

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200 0 200 400 m

Scale 1:15,000 at A3

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FIGURE 7.1

IMPACT OF PROPOSAL ON FLOOD LEVELS

1% AEP

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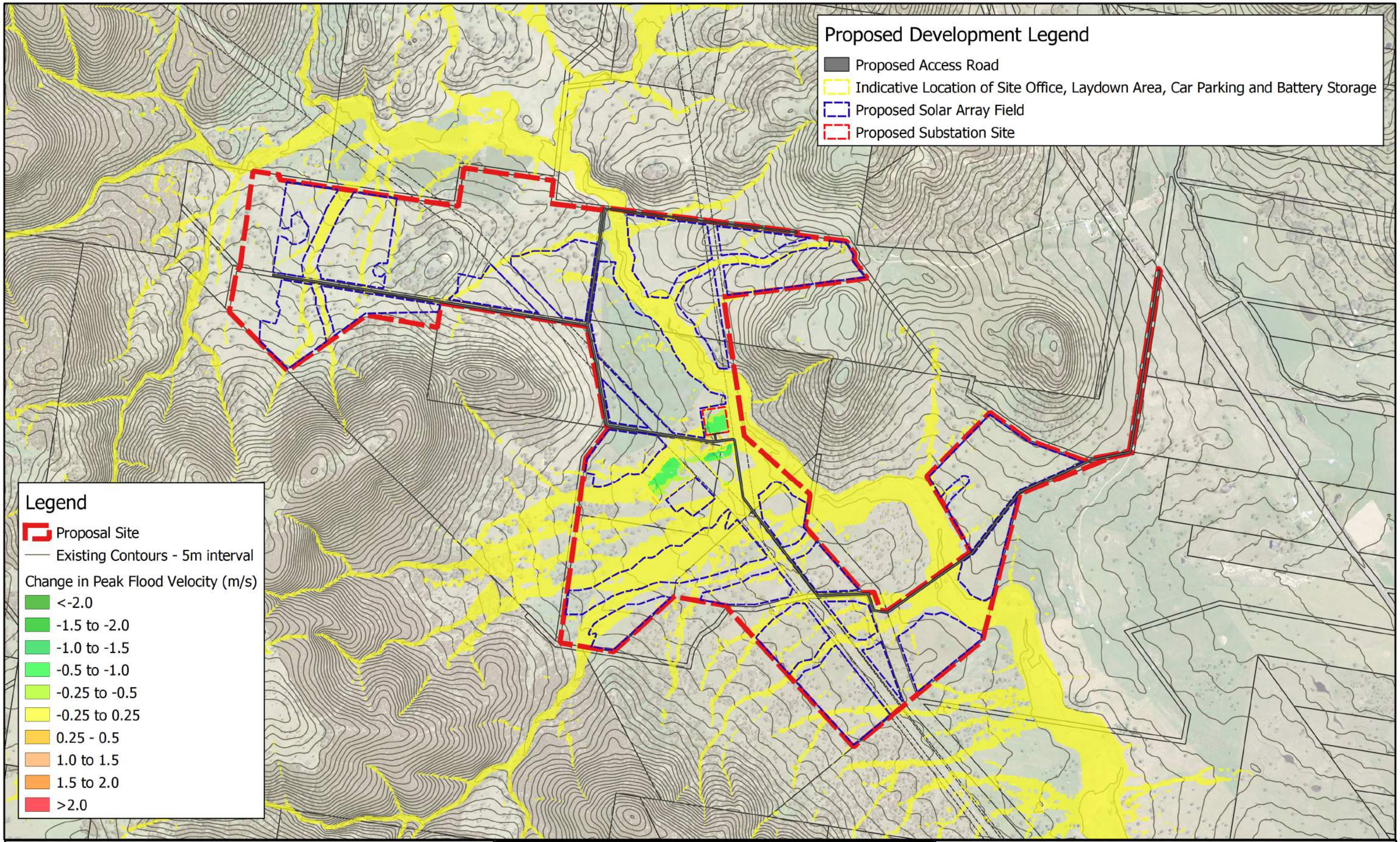

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FIGURE 7.2

IMPACT OF PROPOSAL ON FLOOD VELOCITY

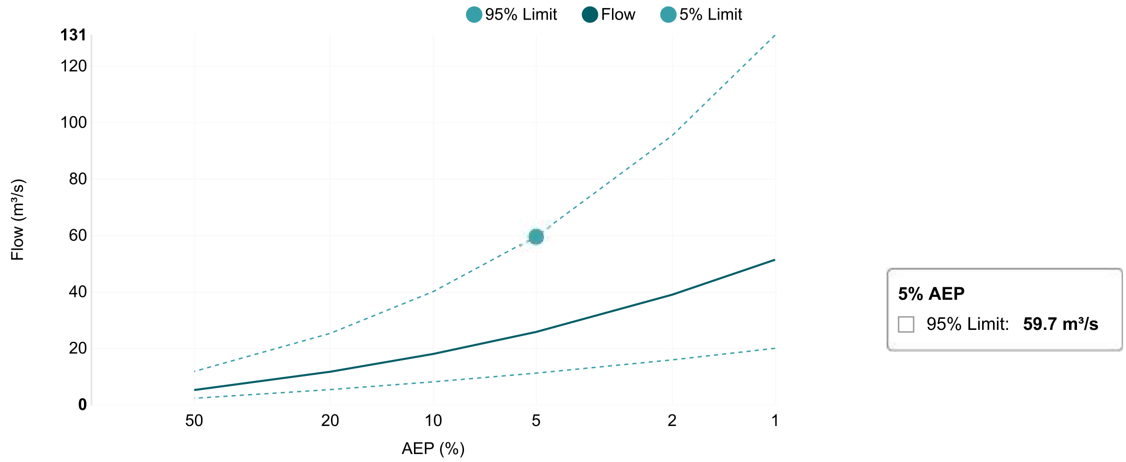
1% AEP

Rev 2 - 21 April 2020

APPENDIX H

RFFE Method Results

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/s)
50	5.21	2.29	11.8
20	11.7	5.37	25.3
10	18.0	8.12	40.1
5	25.8	11.2	59.7
2	39.0	15.9	95.4
1	51.4	20.0	131

Statistics

Variable	Value	Standard Dev
Mean	1.658	0.493
Standard Dev	0.924	0.203
Skew	0.109	0.028

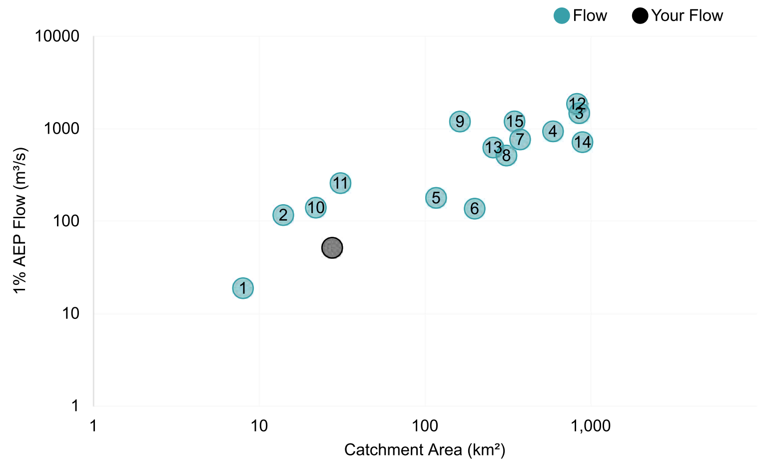
Note: These statistics come from the nearest gauged catchment. Details.

Correlation

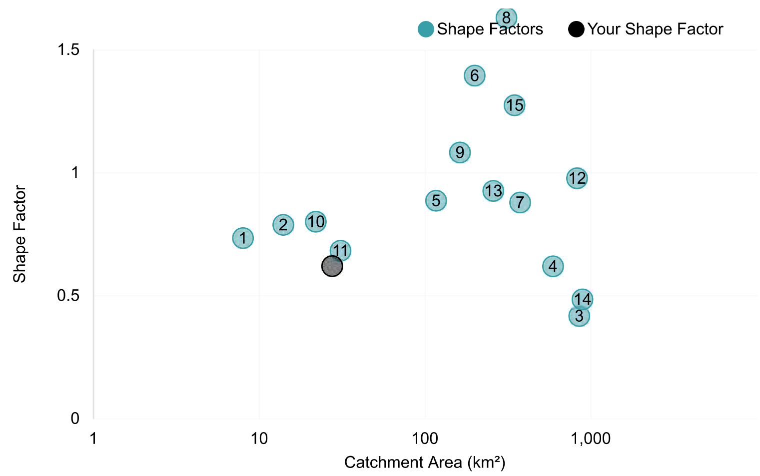
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

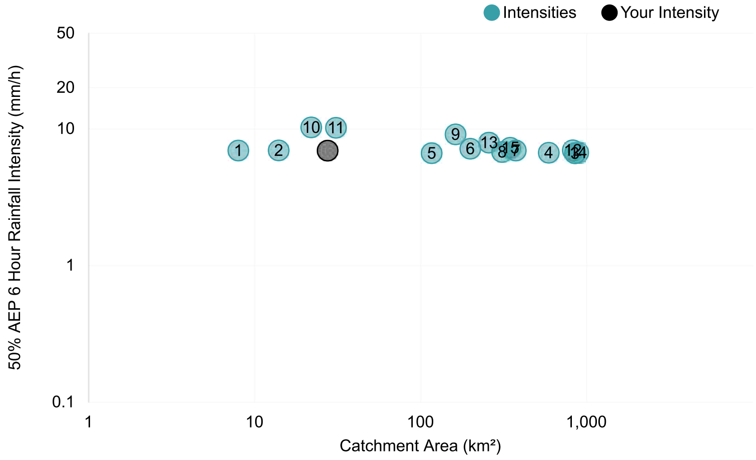
1% AEP Flow vs Catchment Area



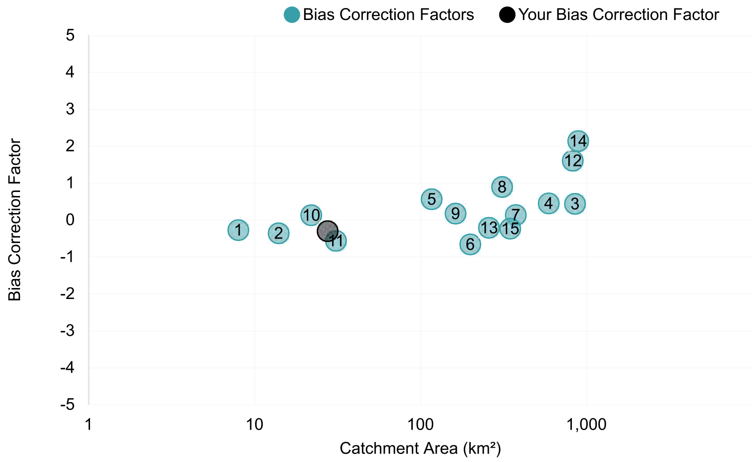
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

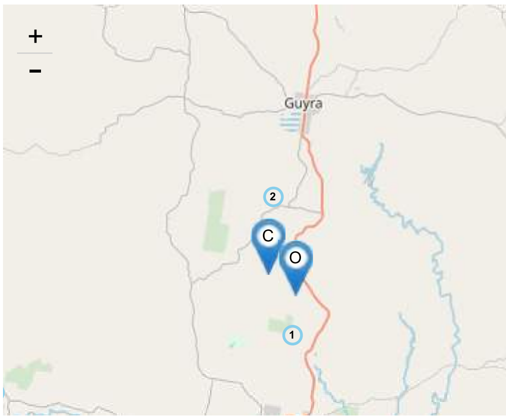
TXT Nearby JSON

Input Data

Date/Time	2019-09-05 20:51

Input Data

Catchment Name	Tilbuster Solar Farm
Latitude (Outlet)	-30.385865
Longitude (Outlet)	151.663032
Latitude (Centroid)	-30.367376
Longitude (Centroid)	151.636454
Catchment Area (km^2)	27.62
Distance to Nearest Gauged Catchment (km)	3.81
50% AEP 6 Hour Rainfall Intensity (mm/h)	6.903713
2% AEP 6 Hour Rainfall Intensity (mm/h)	14.521334
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.62
Interpolation Method	Natural Neighbour
Bias Correction Value	-0.306



Leaflet (http://leafletjs.com) | © OpenStreetMap (http://osm.org/copyright) contributors

Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (http://arr.ga.gov.au/revision-projects/project-list/projects/project-5) on the ARR website. Send any questions regarding the method or project here (mailto:admin@arr-software.org).

(http://www.engineersaustralia.org.au)

(http://www.uws.edu.au)

APPENDIX I

Stream Order

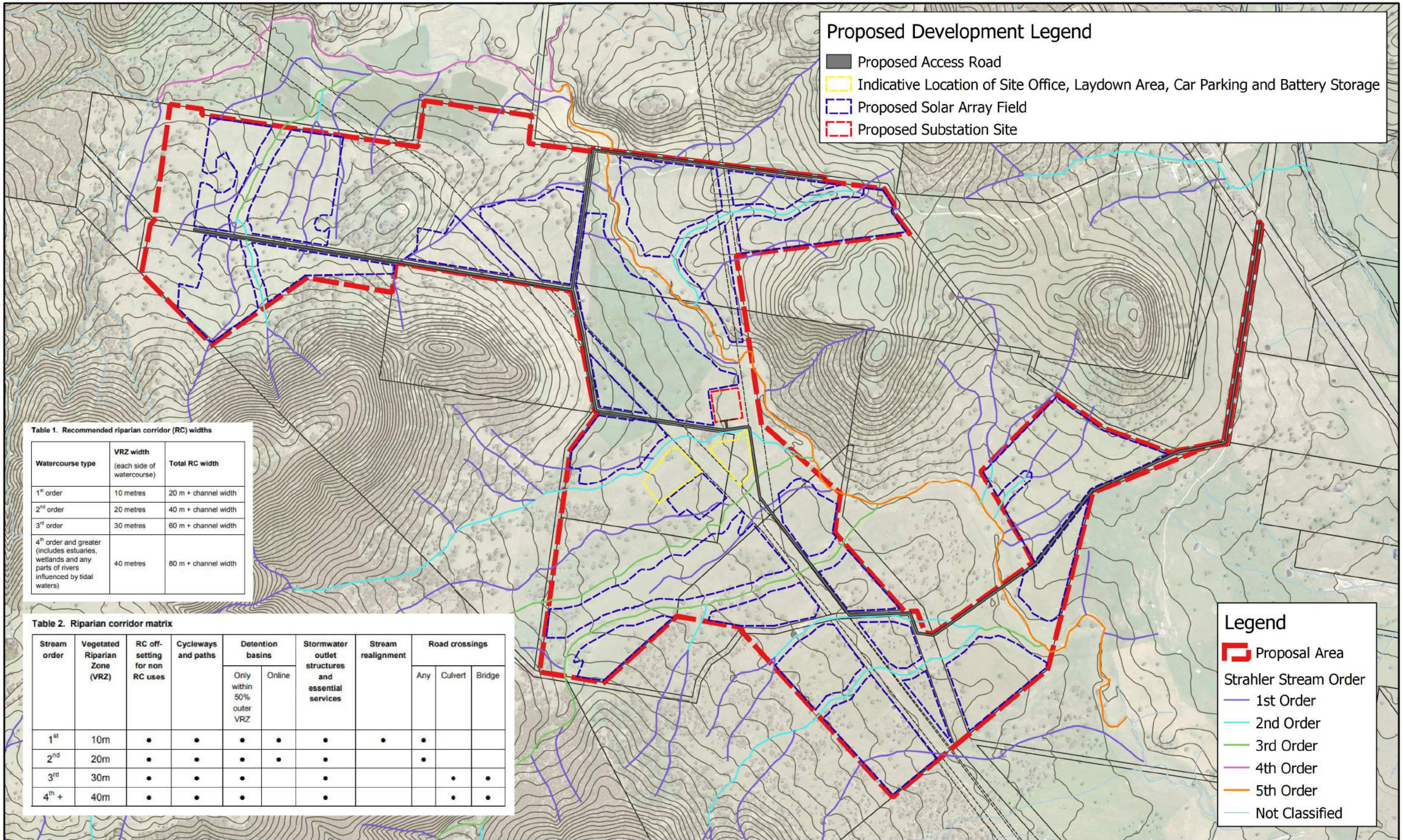


Table 1. Recommended riparian corridor (RC) widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Table 2. Riparian corridor matrix

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

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200 0 200 400 m

Scale 1:12,500 at A3

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FIGURE 8.1

STREAM CLASSIFICATION

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APPENDIX H CONSTRUCTION AND OPERATION NOISE AND VIBRATION ASSESSMENT

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

TILBUSTER SOLAR FARM

Construction & Operational Noise & Vibration Assessment

2 April 2020

NGH

TK911-01F02 Report (r3).docx

Sydney Melbourne Brisbane Gold Coast Kuwait
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

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Attention:	Ms Louiza Romane

Document Control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
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02.04.2020	Final	-	3	W Chan	M Chung	M Chung

Contents

List of Tables

List of Figures

1 Introduction

Renzo Tonin & Associates was engaged to conduct an environmental noise and vibration assessment of the proposed Tilbuster Solar Farm, located approximately 6km northwest of the Tilbuster township in New South Wales (NSW), as part of the Environmental Impact Statement (EIS) for the project. Noise and vibration impacts from the construction and operation phases of the project will be addressed in this report in accordance with relevant Council and EPA requirements and guidelines.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

2.1 Background Information

The Tilbuster Solar Farm project includes the construction and operation of a solar photovoltaic (PV) plant and associated infrastructure, with a capacity of approximately 152 MW. The subject site is located on the western side of the New England Highway, approximately 6km northwest of the Tilbuster township in NSW, within the Armidale Regional Council Local Government Area (LGA).

Key development and infrastructure components would include:

- Installation of approximately 405,888 PV solar modules mounted on either fixed or horizontal single-axis tracking systems
- Steel mounting frames with pile foundation
- Installation of up to 30 Power Conversion Units – totalling 60 inverters, 30 transformers and associated ancillary equipment
- Electrical cabling including overhead lines and underground electrical conduits to connect PV modules to outdoor substation
- Outdoor 330 kV substation including switchgears and ancillary equipment
- Onsite energy storage facility – Storage requirements will be 40 MW/h or less, battery technology is yet to be determined and subject to change based on detail design
- Monitoring container as required for operation and maintenance
- Construction facilities including laydown, parking, site offices and staff facilities
- Storage container (40 ft)
- IB (Combiner) boxes
- Internal access road and upgrades including primary access on New England Highway – up to 6.8km in length
- Perimeter security fencing
- Security camera poles
- Construction of creek crossing as required
- Native vegetative screening as required.

In total, the construction phase of the proposal is expected to take 12 months, and the facility would be expected to operate for around 30 years or extended pending further approvals. Up to five fulltime equivalent operations and maintenance staff and service contractors would operate the facility.

2.2 Regulatory Requirements

Noise and vibration impacts are assessed in accordance with a number of policies, guidelines and standards, including:

- NSW 'Interim Construction Noise Guideline' (ICNG – DECC, 2009)
- NSW 'Noise Policy for Industry' (NPfI – EPA, 2017)
- 'Assessing Vibration: A Technical Guideline' (DECC, 2006)
- NSW 'Road Noise Policy' (RNP – DECCW, 2011).

2.3 Receiver Locations

The nearest affected receivers were identified through aerial maps and are presented in Table 2.1.

Table 2.1 – Receiver Locations

ID	Address	Description
R1	12177 New England Highway	Residential property located approximately 1,250m north of the project area
R2	11853 New England Highway (Snake Gully)	Residential property located approximately 1,880m south east of the project area
R3	11947 New England Highway (Varuna)	Residential property located approximately 900m east of the project area
R4	12248 New England Highway (Lydbrook)	Residential property located approximately 1,970m north of the project area
R5	11966 New England Highway (Tilthorpe)	Residential property located approximately 875m east of the project area
R6	11924 New England Highway (Hillwood)	Residential property located approximately 1,425m east of the project area
R7	12250 New England Highway (Uralba)	Residential property located approximately 2,430m north of the project area
R8	12022 New England Highway	Residential property located approximately 670m north of the project area
R9	12024 New England Highway (Tilbuster North)	Residential property located approximately 305m north east of the project area
R10	12150 New England Highway	Residential property located approximately 1,410m north of the project area
R11	12029 New England Highway, Black Mountan (Tenant)	Residential property located approximately 540m north of the project area
R11A	12029 New England Highway, Black Mountain	Residential property located approximately 280m north of the project area
R12	659 Exmouth Road, Pinaroo	Residential property located approximately 1,590m west of the project area
R13	12173 New England Highway	Residential property located approximately 495m north east of the project area
R14	529 Exmouth Road, Dumaresq (Kestrel)	Residential property located approximately 1,810m west of the project area

ID	Address	Description
R15	11915 New England Highway (Stuart)	Residential property located approximately 380m south east of the project area

Figure 1 provides details of the site, surrounds and receiver locations.

2.4 Hours of Operation

2.4.1 Construction

Construction will occur during the following standard hours of construction:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- No work on Sundays or public holidays

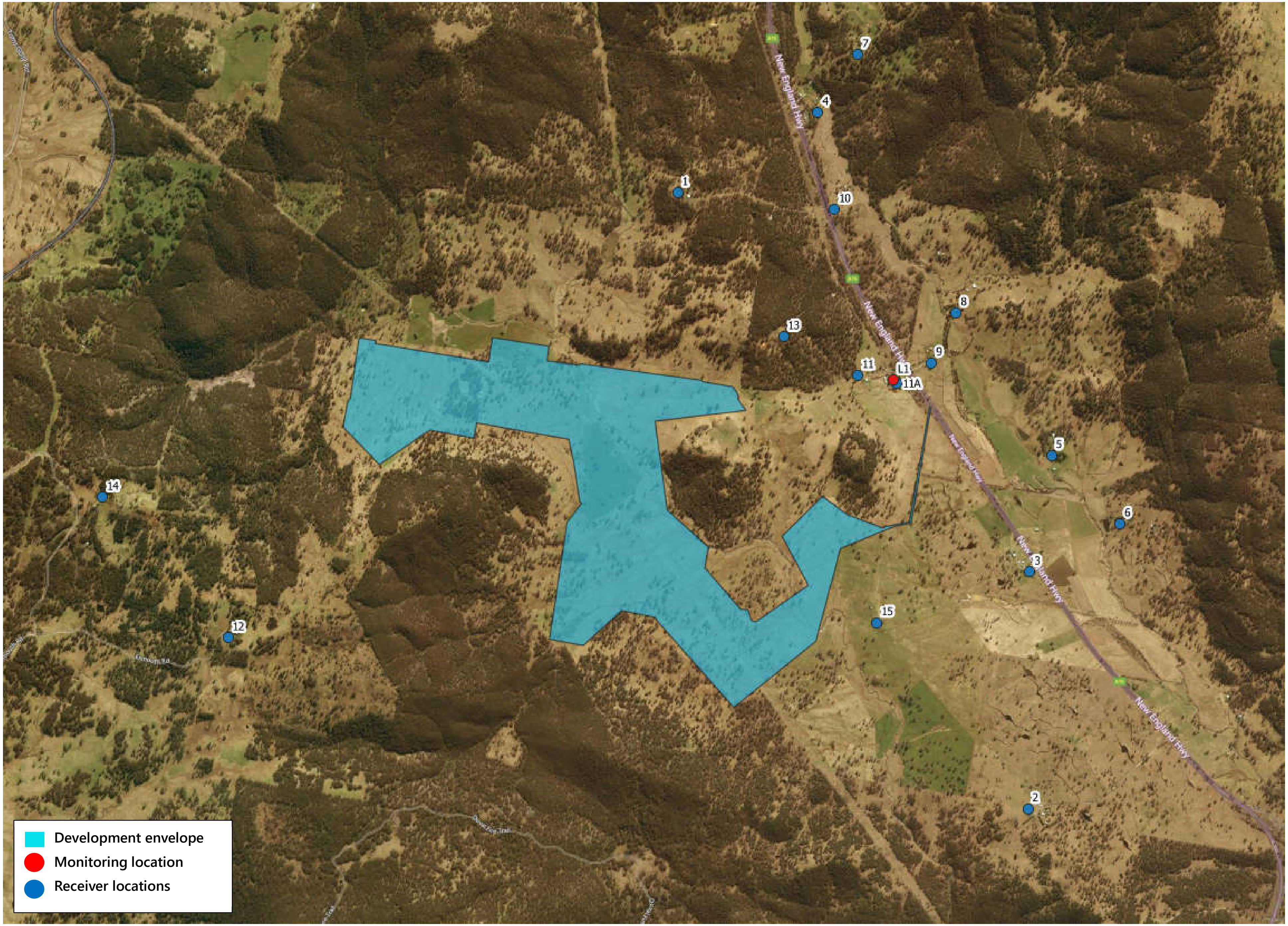
2.4.2 Operation

The solar farm will operate autonomously during times when there is sunlight. This will predominantly be during day and evening periods (7am-6pm and 6pm-10pm, respectively) throughout the year and potentially part of the night time period (prior to 7am) during the summer months.

Furthermore, there will be staff on site during the following standard hours:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm

Figure 1 – Site, Surrounds and Receiver and Noise Monitoring Locations



3 Existing Noise Environment

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NPfI requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The NPfI defines these periods as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

3.1 Noise Monitoring Location

Noise monitoring is to be undertaken at the nearest or potentially most affected receiver locations; or if this is not available, then at a location considered to have a noise environment representative of the nearest or potentially most affected receiver locations. In this case the representative location where noise monitoring was undertaken is presented in Table 3.1.

Table 3.1 – Noise Monitoring Location

ID	Address	Description
L1	12029 New England Highway	Noise monitor was installed in the 'free field' (ie. away from building facades) on the subject site. Noise data represents the background and ambient noise environment for receivers surrounding the project area.

To quantify the existing ambient noise environment, long-term (unattended) noise monitoring was conducted at Location L1 between Tuesday 13th August and Tuesday 20th August 2019.

Appendix A of this report presents a description of noise terms. Appendix B details the noise monitoring methodology and the graphical recorded outputs from long term noise monitoring are included in Appendix C. The graphs in Appendix C were analysed to determine an assessment background level (ABL) for each day, evening and night period in each 24 hour period of noise monitoring, and based on the median of individual ABLs an overall single Rating Background Level (RBL) for the day, evening and night period is determined over the entire monitoring period in accordance with the NPfI.

3.2 Existing Background & Ambient Noise Levels

Existing background and ambient noise levels are presented in Table 2.1 below. The noise monitor was positioned outdoors in the 'free-field' (ie. away from building facades). Construction and operation noise from the site should be assessed in the free-field at the potentially most affected residential boundaries and therefore, the representative noise levels listed in Table 2.1 are directly applicable.

Table 3.2 – Measured Existing Background (L_{90}) & Ambient (L_{eq}) Noise Levels, dB(A)

Location	L_{90} Background Noise Levels			L_{eq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
L1 – 12029 New England Highway	35	23	17	55	43	43

The identified receivers surrounding the subject site are all classified as rural under NPfI guidelines. It was found that the background noise levels were typical for a rural area.

Based on Table 2.1 on page 10 of the NPfI, where background noise levels are less than the minimum assumed RBLs of 35dB(A) during the day period, 30dB(A) during the evening period and 30dB(A) during the night period, the minimum assumed RBL's are adopted instead for all receiver locations nominated in Table 3.2. Therefore, the background noise levels have been set at the levels detailed in the fourth column of Table 3.3 below.

Table 3.3 – Applicable RBL, dB(A)

Time of Day	Measured Existing Background (L_{90}), dB(A)	Minimum RBLs, dB(A)[1]	Applicable RBL, dB(A)
Day	35	35	**35**
Evening	23	30	**30**
Night	17	30	**30**

Notes: 1. In accordance with Table 2.1 of the NSW NPfI

4 Construction Noise Assessment

4.1 Construction Noise Management Levels

The NSW '*Interim Construction Noise Guideline*' (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- *Use of L_{Aeq} as the descriptor for measuring and assessing construction noise*

  NSW noise policies, including the NPfI, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- *Application of reasonable and feasible noise mitigation measures*

  As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.

  Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the length of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 4.1 reproduced from the ICNG, sets out the noise management levels and how they are to be applied for residential receivers.

Table 4.1 – Noise Management Levels (NML) at Residential Receivers, dB(A)

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	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. 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 75dB(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: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Table 4.2 presents the construction noise management levels established for the nearest noise sensitive residential receivers based upon the noise monitoring results presented in Table 2.1, the proposed construction hours and the above ICNG requirements. Given that construction works are to occur during the daytime period as presented in Section 2.4.1, only the daytime period will be assessed.

Table 4.2 – Construction Noise Management Levels (NML) at Residential Receivers, dB(A)

Location Description	Day L_{A90} Background Noise Level (RBL)	Day Noise Management Level $L_{Aeq(15min)}$
All residential receivers	35[1]	**45**

Notes: 1. Construction works occur during the daytime period only; hence, only the day period is assessed

4.2 Construction Noise Sources

The following tables lists typical plant and equipment likely to be used by the contractor to carry out the necessary construction works for the project.

Table 4.3 – Typical Construction Equipment & Sound Power Levels

Plant Item	Plant Description	Number of Items	L_{Aeq} Sound Power Levels, dB(A) re. 1pW (single item)
1	Small pile driving rig	6	114
2	Crane	2	110
3	Drum roller	2	109
4	Padfoot roller	2	109
5	Wheeled loader	2	109
6	Dump truck	4	108
7	30t Excavator	8	107
8	Grader	4	107
9	Chain trencher	2	104
10	Water truck	4	104
11	Telehandler	4	98
12	Forklift	4	90

The sound power levels for the majority of activities presented in the above table are provided by the client, based on maximum levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the ICNG, information from past projects and/or information held in our library files.

4.3 Construction Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2020 MR 1) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations;
- Height of sources and receivers;
- Separation distances between sources and receivers;
- Ground type between sources and receivers (soft); and
- Attenuation from barriers (natural and purpose built).

Noise levels at any receptors resulting from construction would depend on the above and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary substantially over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 4.4 presents construction noise levels likely to be experienced at the nearby affected receivers based on the construction activities and plant and equipment associated with the proposed development site. The noise level ranges represent the noise source being located at the furthest to the closest proximity to each receiver location.

Table 4.4 – Predicted $L_{Aeq,15min}$ Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels															
		R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R11A**	**R12**	**R13**	**R14**	**R15**
Noise Management Level[1]		*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*
1	Small pile driving rig	<20-21	<20-25	<20-29	<20	<20-34	<20-29	<20	<20-37	<20-43	<20-21	<20-37	<20-43	<20	<20-31	<20	<20-42
2	Crane	<20	<20-21	<20-25	<20	<20-30	<20-25	<20	<20-33	<20-39	<20	<20-33	<20-39	<20	<20-27	<20	<20-38
3	Drum roller	<20	<20-20	<20-24	<20	<20-29	<20-24	<20	<20-32	<20-38	<20	<20-32	<20-38	<20	<20-26	<20	<20-37
4	Padfoot roller	<20	<20-20	<20-24	<20	<20-29	<20-24	<20	<20-32	<20-38	<20	<20-32	<20-38	<20	<20-26	<20	<20-37
5	Wheeled loader	<20	<20-20	<20-24	<20	<20-29	<20-24	<20	<20-32	<20-38	<20	<20-32	<20-38	<20	<20-26	<20	<20-37
6	Dump truck	<20	<20	<20-23	<20	<20-28	<20-23	<20	<20-31	<20-37	<20	<20-31	<20-37	<20	<20-25	<20	<20-36
7	30t Excavator	<20	<20	<20-22	<20	<20-27	<20-22	<20	<20-30	<20-36	<20	<20-30	<20-36	<20	<20-24	<20	<20-35
8	Grader	<20	<20	<20-22	<20	<20-27	<20-22	<20	<20-30	<20-36	<20	<20-30	<20-36	<20	<20-24	<20	<20-35
9	Chain trencher	<20	<20	<20	<20	<20-24	<20	<20	<20-27	<20-33	<20	<20-27	<20-33	<20	<20-21	<20	<20-32
10	Water truck	<20	<20	<20	<20	<20-24	<20	<20	<20-27	<20-33	<20	<20-27	<20-33	<20	<20-21	<20	<20-32
11	Telehandler	<20	<20	<20	<20	<20	<20	<20	<20-21	<20-27	<20	<20-21	<20-27	<20	<20	<20	<20-26
12	Forklift	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently		**<20-23**	**<20-27**	**<20-32**	**<20**	**<20-36**	**<20-31**	**<20-21**	**<20-39**	**<20-45**	**<20-23**	**<20-40**	**<20-45**	**<20**	**<20-33**	**<20**	**<20-44**

Notes: 1. Noise Management Levels for day period (ie. standard construction hours)

Based on the construction noise levels presented in the table above, the predicted construction noise levels at all receivers are within the construction noise management levels during standard construction hours. It is noted that construction noise levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A).

Therefore, no further reasonable and feasible noise mitigation measures are required to reduce construction noise impacts.

5 Operational Noise Assessment

5.1 Operational Noise Criteria

Noise impact from the general operation of the proposed solar farm is assessed against the NPfI. The assessment procedure in terms of the NPfI has two components:

- Controlling intrusive noise impacts in the short-term for residences; and
- Maintaining noise level amenity for residences and other land uses.

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level which is the lower value of the project intrusiveness noise levels and project amenity noise levels.

5.1.1 Intrusive Noise Impacts

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

$L_{Aeq,15minute}$ Intrusiveness noise level = Rating Background Level (RBL) plus 5dB(A)

Based on the RBLs set in Table 3.3, the intrusiveness noise level for the residential receivers are determined in Table 5.1.

Table 5.1 – NPfI Intrusive Noise Level at Residential Receivers, dB(A)

Period	RBL, dB(A)	Intrusiveness Noise Level, $L_{Aeq,15min}$, dB(A)
Daytime	35	35+5 = **40**
Evening	30	30+5 = **35**
Night-time	30	30+5 = **35**

5.1.2 Protecting Noise Amenity

The project amenity noise levels for different time periods of a day are determined in accordance with Section 2.4 of the NSW NPfI. The NPfI recommends amenity noise levels ($L_{Aeq, period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These "recommended amenity noise levels" represent the objective for **total** industrial noise experienced at a receiver location. However, when assessing a **single** industrial development and its impact on an area, "project amenity noise levels" apply.

To ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level that applies for each new industrial noise source is determined as follows:

$$L_{Aeq,period} \text{ Project amenity noise level} = L_{Aeq,period} \text{ Recommended amenity noise level} - 5dB(A)$$

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods.

$$L_{Aeq,15min} = L_{Aeq,period} + 3dB(A)$$

The policy, in accordance with the NPfI, applies an adjustment of (+3 dB) to the recommended noise levels ($L_{Aeq,\ period}$) in order to standardise the time periods for the intrusiveness and amenity noise levels. The project amenity noise levels ($L_{Aeq,\ 15min}$) applied for this project are reproduced in Table 5.2.

It is noted that the residential receivers in the vicinity of the site have been categorised as being in a 'rural' area in accordance with Table 2.3 of the NPfI.

Table 5.2 – NPfI Project Amenity Noise Levels, dB(A)

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended Noise Level	
			$L_{Aeq,\ Period}$	$L_{Aeq,\ 15min}$
Residence	Rural	Day	50 – 5 = 45	45 + 3 = **48**
		Evening	45 – 5 = 40	40 + 3 = **43**
		Night	40 – 5 = 35	35 + 3 = **38**

Notes: 1. Monday-Saturday, Day 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 7.00am
2. On Sundays and Public Holidays, Day 8.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 8.00am
3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

5.2 Summary of Project Noise Trigger Levels

In accordance with the NPfI the project noise trigger level, which is the lower (ie. more stringent) value of the project intrusiveness noise level and project amenity noise level, has been determined and reproduced in Table 5.3 below.

Table 5.3 – Project Noise Trigger Levels, dB(A)

Receiver ID	Address	$L_{Aeq,\ 15min}$ Project Noise Trigger Levels		
		Day	Evening	Night
R1	12177 New England Highway	40	35	35
R2	11853 New England Highway (Snake Gully)	40	35	35
R3	11947 New England Highway (Varuna)	40	35	35

Receiver ID	Address	$L_{Aeq, 15min}$ Project Noise Trigger Levels		
		Day	Evening	Night
R4	12248 New England Highway (Lydbrook)	40	35	35
R5	11966 New England Highway (Tilthorpe)	40	35	35
R6	11924 New England Highway (Hillwood)	40	35	35
R7	12250 New England Highway (Uralba)	40	35	35
R8	12022 New England Highway	40	35	35
R9	12024 New England Highway (Tilbuster North)	40	35	35
R10	12150 New England Highway	40	35	35
R11	12029 New England Highway, Black Mountan (Tenant)	40	35	35
R11A	12029 New England Highway, Black Mountain	40	35	35
R12	659 Exmouth Road, Pinaroo	40	35	35
R13	12173 New England Highway	40	35	35
R14	529 Exmouth Road, Dumaresq (Kestrel)	40	35	35
R15	11915 New England Highway (Stuart)	40	35	35

Notes:
1. Monday-Saturday, Day 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 7.00am
2. On Sundays and Public Holidays, Day 8.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 8.00am
3. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period
4. Project Noise Trigger Levels only apply when premises are in use.

5.3 Operational Noise Sources

The proposed solar farm considers two options for the configuration of the PV panels:

1. Fixed configuration, where the panels would be placed on fixed frames running in rows from east to west and tilted to the north; or
2. Single axis tracking, where the panels would be in rows configured in a north to south direction and the panels would track the sun from east to west throughout the day.

The single axis tracking system involves the panels being driven by motors to track the arc of the sun to maximise the solar effect. Hence, the tracking motors are a potential source of mechanical noise and therefore, has been included for a more conservative assessment. Up to a total of 302 tracking motors (ATI DuraTrack Tracker or equivalent) will be employed to drive 6,306 tracker tablers, each holding approximately 84 solar modules, and are to be evenly distributed across the solar farm area.

In addition to the trackers, the site will require the operation of up to 30 PCUs (SMA MV Power Station) with each PCU containing two (2) 3000kW inverters and one (1) transformer, which will be evenly distributed across the solar farm area.

A new substation will also be located in the middle of the site. The dominant noise source from the new substation will be from two (2) 100MVA transformers (generic brand). There will also be 20 battery storage systems (Autarsys Nucleons) located in this area.

During operations, it is assumed that five (5) staff members will attend site daily during the day time period to inspect the equipment. It is also assumed that each staff member will travel around the subject site in a light vehicle.

Based on the above, the following table lists associated plant and equipment likely to be used for the operation of the proposed solar farm and their corresponding sound power levels.

Table 5.4 – Typical Operational Plant and Equipment & Sound Power Levels

Plant Item	Plant Description	L_{Aeq} Sound Power Levels, dB(A) re. 1pW
1	ATI DuraTrack tracker motor (302 in total)	81 (each)[1]
2	SMA MV Power Station 3000 kW inverter (60 in total)	88 (each)[1]
3	SMA MV Power Station transformer (30 in total)	83 (each)[1]
4	100 MVA transformer (2 in total)	96 (each)[1]
5	Battery storage units (20 in total)	87 (each)[2]
6	Light vehicle (5 in total)	88 (each)[1]

Notes: 1. Based on sound power level data from past projects and/or RT&A's acoustic database
2. Based on sound power level data provided by the client

The sound power levels for the plant and equipment presented in the above table are provided by the manufacturer, information from past projects and/or information held in our library files.

5.4 'Modifying Factor' Adjustments

Further to the above and in accordance with the NPfI, where the character of the noise in question is assessed as particularly annoying (ie. if it has an inherently tonal, low frequency, impulsive or intermittent characteristic), then an adjustment of 5dB(A) for each annoyance aspect, up to a total of 10dB(A), is to be added to the predicted value to penalise the noise for its potential increase in annoyance. Table C1 in Fact Sheet C of the NSW NPfI provides definitive procedures for determining whether a penalty or adjustment should be applied from increased annoyance.

For the assessment of the solar farm, the noise from the inverters and transformers are considered to be tonal in nature. Therefore, a 5dB(A) penalty has been applied to the predicted noise contributions from the inverters and transformers.

5.5 Operational Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2020 MR 1) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations;
- Height of sources and receivers;
- Separation distances between sources and receivers;
- Ground type between sources and receivers (soft); and
- Attenuation from barriers (natural and purpose built).

Furthermore, in accordance with the NPfI noise predictions were prepared for each of the following meteorological conditions:

1. Calm & isothermal conditions (acoustically neutral) – no wind and no temperature inversion
2. Slight to gentle breeze – 3m/s wind velocity at 10m from ground level between each noise source and each noise receiver (as per NPfI default wind conditions). Wind direction was based on wind travelling from the source to the receiver.
3. Moderate temperature inversion – applicable for noise predictions during night time periods only

Table 5.5 below present the predicted noise levels for the worst-case scenario based on concurrent operation of all the plant and equipment shown in Table 5.4.

Table 5.5 – Predicted $L_{Aeq,15min}$ Operational Noise Levels at Residential Receiver Locations, dB(A)

Receiver Location	$L_{Aeq, 15min}$ Project Noise Trigger Levels			Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Comply? (Yes/No)
	Day	Evening	Night	Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion[1]	
Receiver R1	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R2	*40*	*35*	*35*	<20	22	22	Yes
Receiver R3	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R4	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R5	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R6	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R7	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R8	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R9	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R10	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R11	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R11A	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R12	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R13	*40*	*35*	*35*	<20	<20	<20	Yes

Receiver Location	$L_{Aeq, 15min}$ Project Noise Trigger Levels			Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Comply? (Yes/No)
	Day	Evening	Night	Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion[1]	
Receiver R12	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R13	*40*	*35*	*35*	26	31	31	Yes

Notes: 1. Applicable for the night time period only

Based on the predicted operational noise levels presented in the table above, predicted noise levels at the nearest receivers comply with the nominated criteria under all scenarios and meteorological conditions.

Therefore, no further reasonable and feasible noise mitigation measures are required to reduce operational noise impacts.

5.6 Sleep Disturbance Assessment

To assess the likelihood of sleep disturbance, the potential of maximum noise level events from premises during the night-time period has been considered in this assessment. In accordance with the NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

Where there are noise events found to exceed the initial screening level, further analysis is undertaken to identify:

- The likely number of events that might occur during the night assessment period,
- The extent to which the maximum noise level exceeds the rating background noise level.

During the night time period, only mechanical plant will be operating, including the tracking motors, inverters and the substations. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the L_{Amax} noise levels experienced at the identified receivers will be similar to the predicted $L_{Aeq,15min}$ noise levels shown in Table 5.5. Hence, it is expected that both the $L_{Aeq,15min}$ and L_{AFmax} will be well below the nominated sleep disturbance criteria of 40dB(A) and 52dB(A), respectively.

6 Vibration Assessment

Vibration generating activities would occur only during the construction phase of the project. There are no vibration generating activities expected during the operational phase. As the nearest identified receivers are in excess of 280m from the subject site, structural damage due to vibration is not expected. Assessment for vibration impact on human comfort is assessed in accordance with EPA requirements.

6.1 Vibration Criteria

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's *'Assessing Vibration; a technical guideline'* (DECC, 2006). The guideline provides criteria which are based on British Standard BS 6472-1992 *'Evaluation of human exposure to vibration in buildings (1-80Hz)'*. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 6.1 provides definitions and examples of each type of vibration.

Table 6.1 – Types of Vibration

Type of Vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

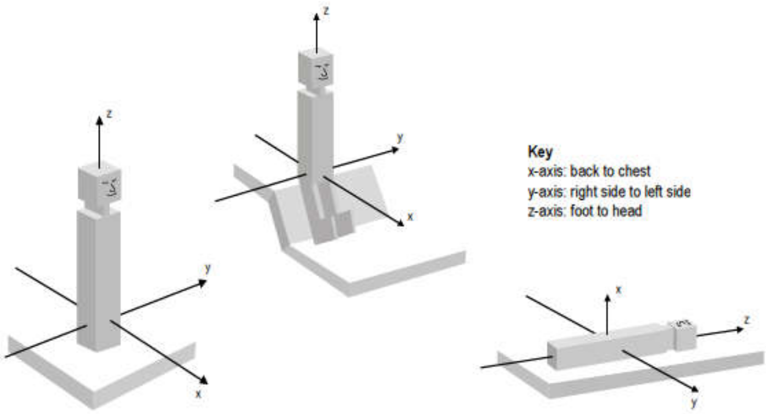
Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *"Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472)."*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore, application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 2. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 2 – Orthogonal Axes for Human Exposure to Vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 6.2 for the applicable receivers.

Table 6.2 – Preferred and Maximum Levels for Human Comfort

Location	Assessment Period[1]	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 6.3 for the applicable receiver type.

Table 6.3 – Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

6.2 Potential Vibration Impacts

Based on the proposed plant items presented in Table 4.3, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 6.4 below. The assessment is relevant to the identified receiver locations.

Table 6.4 – Potential Vibration Impacts for Identified Receivers

Receiver Location	Approx. Distance to Nearest Buildings from Works	Type of Nearest Sensitive Buildings	Assessment on Potential Vibration Impacts	Vibration Monitoring
Receiver R1	1,250m	Residential	Very low risk of adverse comments	Not required
Receiver R2	1,880m	Residential	Very low risk of adverse comments	Not required
Receiver R3	900m	Residential	Very low risk of adverse comments	Not required
Receiver R4	1,970m	Residential	Very low risk of adverse comments	Not required
Receiver R5	875m	Residential	Very low risk of adverse comments	Not required
Receiver R6	1,425m	Residential	Very low risk of adverse comments	Not required
Receiver R7	2,430m	Residential	Very low risk of adverse comments	Not required
Receiver R8	670m	Residential	Very low risk of adverse comments	Not required
Receiver R9	305m	Residential	Very low risk of adverse comments	Not required
Receiver R10	1,410m	Residential	Very low risk of adverse comments	Not required
Receiver R11	540m	Residential	Very low risk of adverse comments	Not required
Receiver R11A	280m	Residential	Very low risk of adverse comments	Not required
Receiver R12	1,590m	Residential	Very low risk of adverse comments	Not required
Receiver R13	495m	Residential	Very low risk of adverse comments	Not required
Receiver R14	1,810m	Residential	Very low risk of adverse comments	Not required
Receiver R15	380m	Residential	Very low risk of adverse comments	Not required

The potential for adverse comments to vibration impacts during the construction works was determined to be very low due to the large distances between the receiver locations and the construction activities. Therefore, additional vibration mitigation measures and vibration monitoring are not required at the identified receiver locations during construction works associated with the project.

7 Road Traffic Noise Assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

Vehicle access to the subject site will be via the New England Highway. Based on information provided by the client, the peak vehicle movements during the construction stage of the project are presented in the following table. Furthermore, vehicle movements will only occur during the day time period when construction works occur.

Table 7.1 – Summary of the Estimated Construction Traffic Volumes During Peak Construction

Vehicle Type	Vehicle Movements Per Day
Light Vehicle (car / 4WD)	58
Shuttle Bus	8
MRV / HRV	22
AV / B-Double	14
Total	**102**

During the operational stage, vehicle access to the site will be maintenance vans or delivery trucks which would occur on an irregular basis. Traffic noise impacts during the operational stage of the project would be minimal and insignificant and will not be assessed further.

7.1 Road Traffic Noise Criteria

Based on functionality, the New England Highway is categorised as an arterial road. For existing residences affected by additional traffic on existing arterial roads generated by land use developments, the following RNP road traffic noise criteria apply.

Table 7.2 – RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15 hour)}$ 60 (external)	$L_{Aeq,(9 hour)}$ 55 (external)

Further to the above, the RNP states the following for land use developments generating additional traffic:

*"For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use development**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."*

7.2 Predicted Road Traffic Noise

Results of the road traffic noise predictions are presented in the table below. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels due to existing general traffic flows as existing traffic volumes along the New England Highway are unknown.

Table 7.3 – Predicted Road Traffic Noise Contribution Levels Along Public Roads, dB(A) $L_{Aeq(15\ Hour)}$

Receiver	Criteria	Traffic Movements	Speed (km/h)[1]	Distance to Road[2]	Predicted Noise Level	Exceed?
Residences on New England Highway	$L_{Aeq,\ (15\ hour)}$ 60	As per Table 7.1	100	20m	50	No

Notes: 1. Based on posted speed limit
2. Based on closest typical distance from facade of dwelling to the road

From the above table, it can be seen that road traffic noise level contributions from the vehicle movements associated with the construction works are at least 10dB(A) below the applicable noise criterion based on dwellings being 20m from the road. Given that residences are located within a rural environment, distances between the road and the dwellings would likely be significantly greater than 20m.

Furthermore, as the predicted levels are 10dB(A) less than the traffic noise criterion, it is not expected that the traffic noise contribution from the construction vehicles would result in an exceedance of the traffic noise criterion and/or increase the existing traffic noise levels by more then 2dB.

Therefore, traffic noise levels as a result of the construction works for the solar farm would not adversely contribute to the existing traffic noise levels at the most affected residences along the surrounding roads.

8 Conclusion

Renzo Tonin and Associates has completed an environmental noise and vibration assessment of the proposed Tilbuster Solar Farm.

Noise emissions from the construction phase of the project were predicted to comply with the construction noise management levels at the nearest affected receivers.

Noise emissions from the operational phase of the project were predicted to comply with the nominated criteria at the nearest affected receivers.

Given the large separation distance between the nearest affected receivers and the subject site, vibration impacts resulting in structural damage to buildings at the nearest affected receivers are determined to be negligible and there is very low risk of adverse comments from occupants of dwellings due to construction vibration.

Road traffic noise impacts on residential properties along the access route were found to comply with the relevant RNP criteria.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 110dB Operating a chainsaw or jackhammer 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Long Term Noise Monitoring Methodology

B.1 Noise Monitoring Equipment

A long-term unattended noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave Band Data	Logger Location(s)
RTA04 (CESVA SC310)	Type 1	1/1	L1

Notes: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

B.2 Meteorology During Monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the NSW INP. Determination of extraneous meteorological conditions was based on data provided by the Bureau of Meteorology (BOM), for a location considered representative of the noise monitoring location(s). However, the data was adjusted to account for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is typically 1.5m above ground level (and less than 3m). The correction factor applied to the data is based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'.

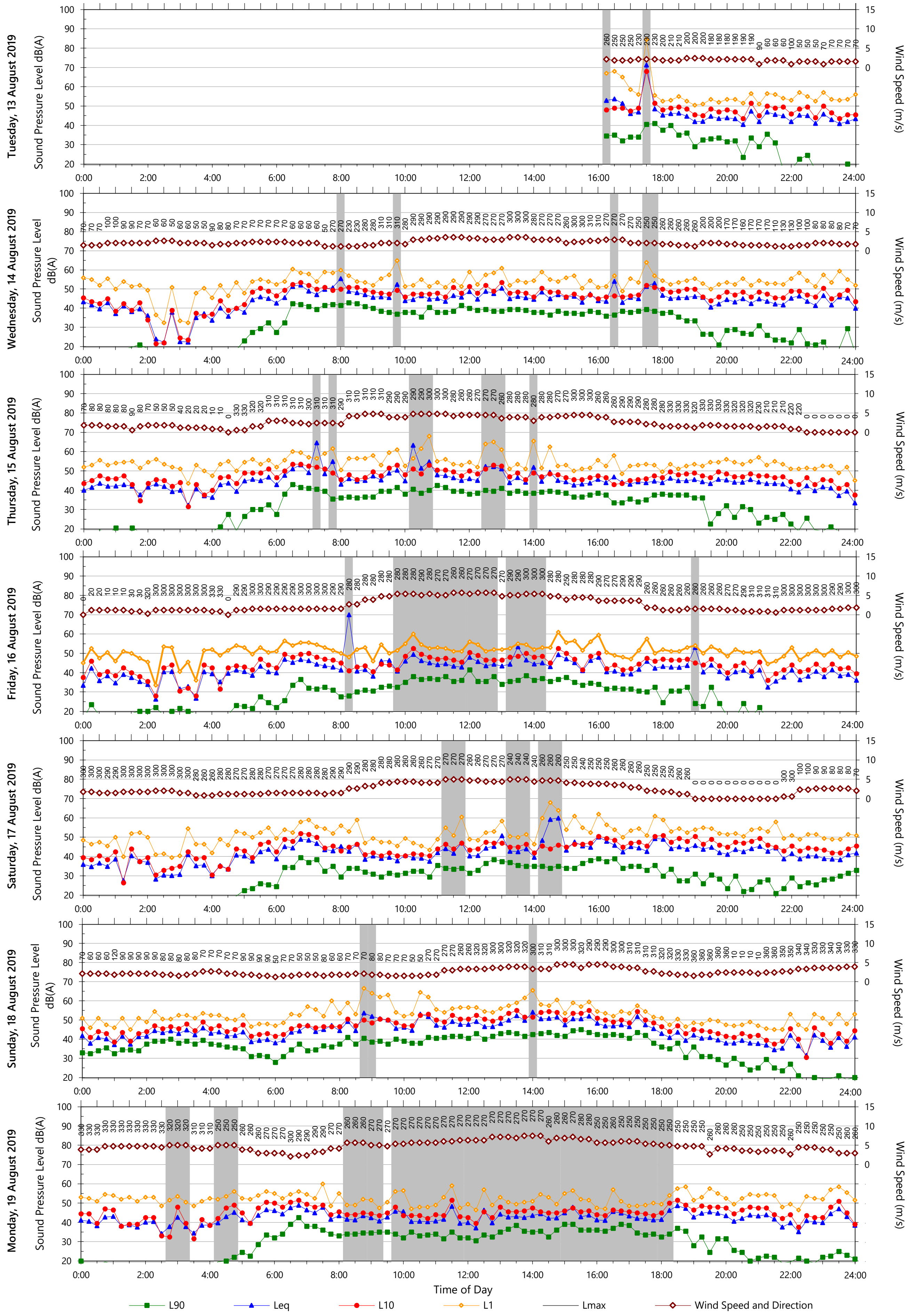
B.3 Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10}, L_{90}, and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels, as presented in this report, illustrate these concepts for the broadband dB(A) results.

APPENDIX C Long Term Noise Monitoring Results

Unattended Monitoring Results

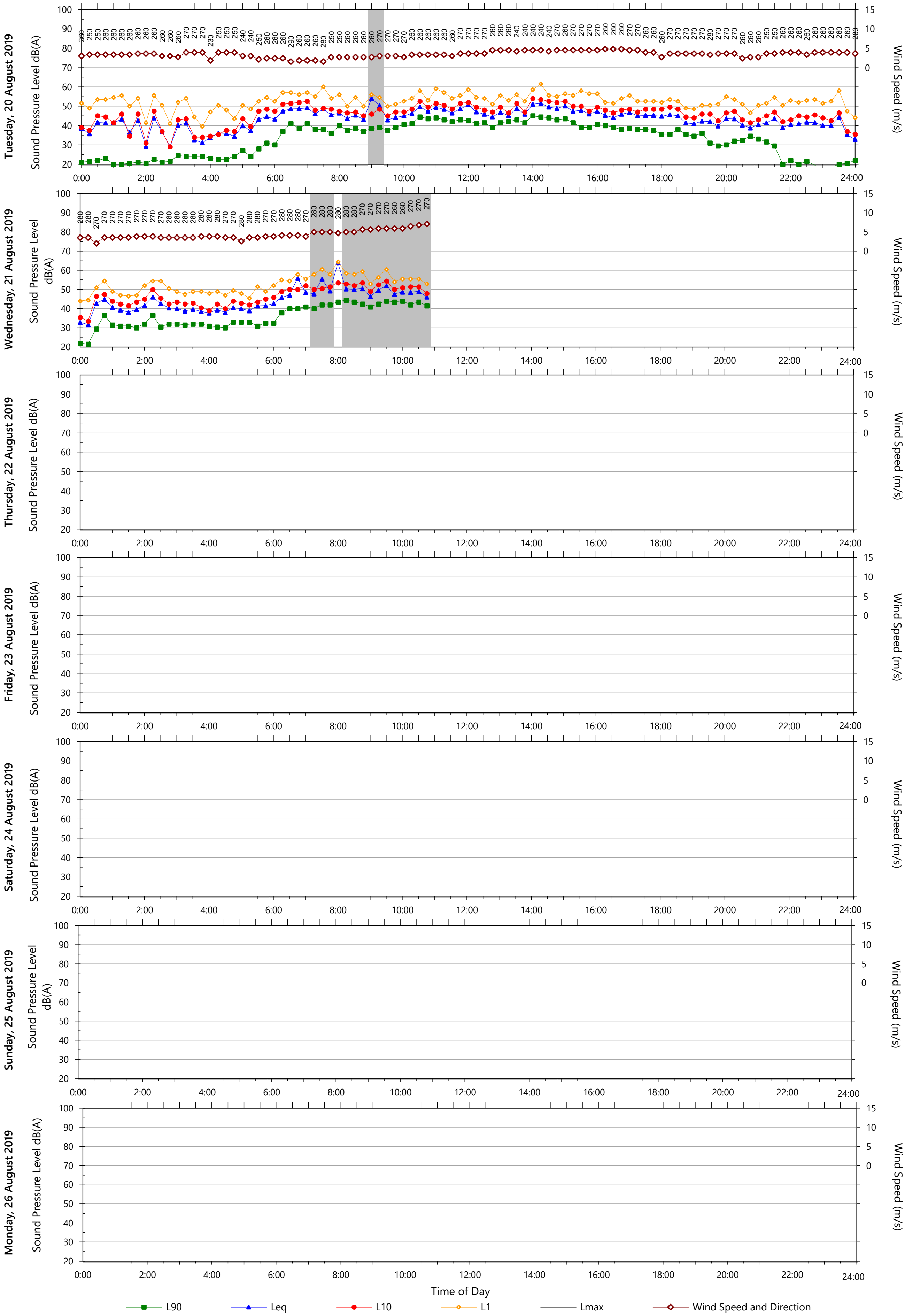
Location: 12029 New England Highway, Black Mountain



Data File: R:\AssocSydProjects\TK901-TK950\TK911 wc Tilbuster Solar Farm\4 Field Work\Logger\2019-08-13_16-00-00_002_RTA.xls

Template: QTE-26 Logger Graphs Program (r29)

Unattended Monitoring Results **Location: 12029 New England Highway, Black Mountain**



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Template: QTE-26 Logger Graphs Program (r29)

APPENDIX I TRAFFIC IMPACT ASSESSMENT (TIA)

Amber Organisation

www.amber.org.au

+61 432 022 363

Byron Heffernan
Environmental Consultant
NGH Consulting
Suite 11, 89-91 Auckland Street
Bega NSW 2550

Ref: 045
20 April 2020

Issued via email: byron.h@nghconsulting.com.au

Dear Byron

Tilbuster Solar Farm – Traffic Impact Assessment

Amber has been asked to assess the traffic matters of the proposed solar farm located approximately 6km northwest of Tilbuster, New South Wales. Access to the site will be provided via the existing driveway that connects to the western side of New England Highway, which is proposed to be widened and realigned to accommodate simultaneous truck movements. Staff will be located within the nearby regional towns, with all plant expected to be delivered from the south along New England Highway. An assessment of the traffic impacts of the solar farm is provided below.

1. Existing Conditions

1.1 Road Network

New England Highway is a State Arterial Road under the care and management of RMS. It runs in a northwest-southeast alignment from Newcastle to Muswellbrook, before running in a northern alignment to its termination at the Queensland Border. Within the vicinity of the site, it typically accommodates one lane of traffic in each direction and has a sealed width of approximately 7 metres, with gravel shoulders provided on both sides of the road. It has a speed limit of 100km/hr.

1.2 Traffic Volumes

Traffic volume data for New England Highway was obtained from the RMS traffic volume viewer. The closest available data was located just north of Puddledock Road, where the 2013 data recorded an average daily traffic count of 2,143 vehicles per day (vpd). The traffic count data also indicates that 17% of all traffic is heavy vehicles. Applying a 1% growth factor to the 2013 traffic count, New England Highway is estimated to currently be accommodating 2,298 vehicles per day.

2. Traffic Assessment

2.1 Traffic Generation

The solar farm construction is expected to take approximately 12 months, with the peak construction period expected to take 3-4 months. Construction activities would be undertaken during standard daytime construction hours (7:00am to 6:00pm Monday to Friday, and 8:00am to 1:00pm on

Saturdays). Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

A maximum of 125 staff will be on-site during peak construction periods. It is understood that 4 shuttle buses will be provided that can accommodate approximately 85 staff. The remaining 40 staff will access the site using private vehicles. Assuming a conservative vehicle occupancy rate of 1.35 for workers, the site is expected to generate 33 light/shuttle bus vehicle movements during each of the peak periods.

Approximately 18 trucks will access the site per day during peak construction periods. The delivery trucks will predominantly be Medium and Heavy Rigid Trucks (MRV and HRV as defined within AS 2890.2:2009). Articulated Vehicles (AV as defined within AS 2890.2:2009) will occasionally be used to transport larger plant such as the PV panels.

Therefore, it is anticipated that during peak construction the site could generate up to 36 heavy and 66 light vehicle movements per day. Table 1 summarises the traffic movements generate during the peak construction period of the solar farm.

Table 1: Traffic Generation During Peak Construction Periods

Vehicle Type	Vehicle Movements per Day
Light Vehicle (car / 4WD)	58
Shuttle Bus	8
MRV/HRV	22
AV/B-Double	14
Total	**102**

Accordingly, the site is expected to generate approximately 102 vehicle movements per day during peak periods. During operation, the solar farm is expected to generate a maximum of 6 light vehicle movements per day.

2.2 Traffic Distribution

Traffic accessing the site will do so via the single access point to/from New England Highway. The following provides a breakdown of the access distribution for each of the vehicle classifications outlined within Table 1:

- Light Vehicles: It is anticipated that most staff will be local to the New England region (in any direction). For the purposes of this assessment it is estimated that 75% of staff will be travelling from the south and the remaining 25% will travel from the north.

- Shuttle Bus: It has been assumed that all shuttle buses will travel to/from the south.

- MRV/HRV: These vehicles will predominantly be water trucks and vehicles transporting materials such as concrete and fencing supplies. These materials will be sourced within the surrounding area and as such, it has been assumed that 75% of these vehicles will be travelling from the south and the remaining 25% will travel from the north.

- AV: Plant will be transported via Sydney to/from the south.

The peak hour for the solar farm will occur at the start and end of the day when staff are transported to/from the site. During the morning peak all vehicle movements will be towards the site and in the evening peak all vehicle movements will be away from the site. Heavy vehicle movements will be distributed throughout the day and will be split evenly between inbound and outbound movements.

2.3 Traffic Assessment

The site is expected to generate approximately 33 light vehicle movements associated with staff during each of the morning and evening peak periods. Outside of these times the site will generate approximately 3-4 heavy vehicle movements per hour.

New England Highway is estimated to currently be accommodating 2,298 vehicles per day based on the 2013 traffic volume count data. Assuming 10% of these trips are generated during peak periods, the peak hour traffic volume is 230 vehicles per hour. Therefore, during the peak hours New England Highway would accommodate approximately 263 vehicles per hour with the development traffic, which is well within the capacity of the road network. Outside of these times, the increase in traffic of 3-4 vehicle movements per hour would result in a negligible change to the traffic environment.

Accordingly, the road network is able to accommodate the traffic generated by the development during the construction and operational period.

It is noted that the following major projects are occurring in the surrounding area:

- Salisbury Solar Farm (700 MW), proposed by Walcha Energy would be located approximately 41km southwest of the proposal site.

- New England Solar Farm (720 MW), proposed by UPC Renewables, would be located approximately 26km southwest of the proposal site.

- Oxley Solar Farm, proposed by Oxley Solar Development, would be located approximately 24km southeast of the proposal site.

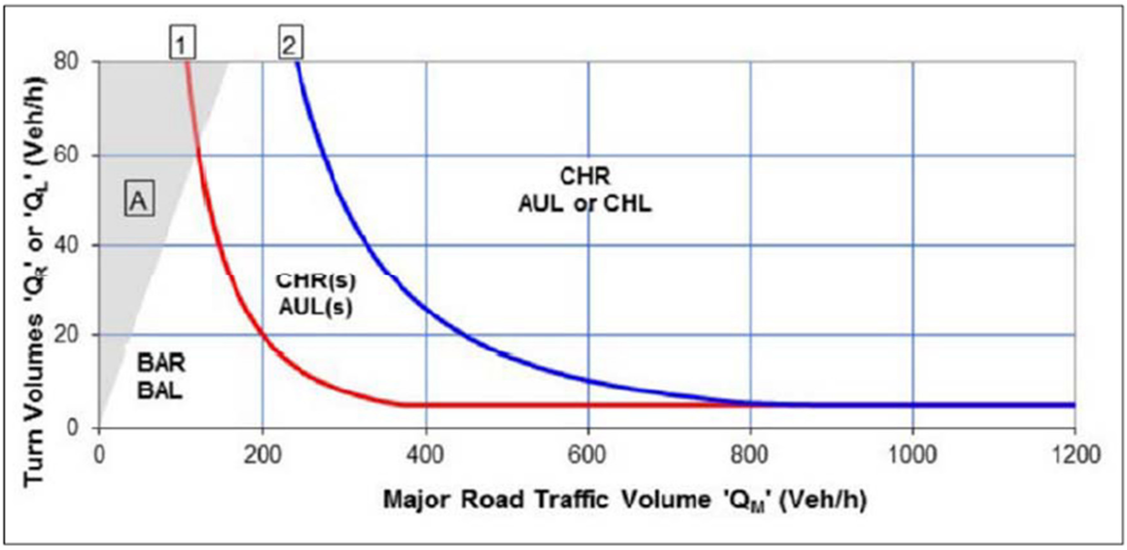
Each of the above projects will generate peak hour movements associated with staff, similar to the proposed solar farm. However, given their locations these traffic movements are likely to be generated from towns south of the site such as Armidale and Uralla. As such, the peak hour traffic generated by these projects is unlikely to be located on the same sections of the road network as the proposed solar farm and the cumulative impact of the projects will have a minimal impact on the road network. Given the minimal increase in truck traffic generated by the site, the cumulative impact on the road network outside of peak times is also expected to be minimal.

3. Intersection Assessment

3.1 Turning Treatments

Austroads Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings specifies the turning treatments required at intersections. Figure 2.26 of the guide, shown below in Figure 1, specifies the required turn treatments on the major road at unsignalised intersections, and is provided below for a design speed of greater than or equal to 100km/hr.

Figure 1: Figure 2.26 of Austroads Guide to Traffic Management Part 6



The peak hour turning volumes will be generated by staff accessing the site in the morning. Based on the traffic distribution described above the site will generate 26 left turn movements from the south, and 7 right turn movements from the north. Based on these volumes and New England Highway having a Major Road Traffic Volume of 230 vehicles per hour, the intersection would require an Auxiliary Left Turn Lane (AUL) and a Basic Right Turn (BAR) turn treatment.

It is proposed to provide a BAR in accordance with the Austroads Guideline. However, it is proposed to only provide a Basic Left Turn (BAL) for the left turn treatment. The justification for the adoption of the reduced turning treatment is provided below:

- The 26 vehicles turning left into the site will only occur once throughout the day during the morning peak. The movements will only be generated by light vehicles associated with staff accessing the site. Left turn movements during other times of the day will be larger vehicles, which will generate approximately 1-2 vehicle movements per hour.

- The solar farm construction is expected to take approximately 12 months, with the peak construction period expected to take 3-4 months. During operation the site is expected to generate a total of 6 vehicle movements per day, or approximately 3 left turn movements per day.

- The site is located within the middle of a long straight and has excellent sight distance for vehicles travelling along New England Highway to see turning vehicles.

- The access will be realigned to be perpendicular to New England Highway to ensure easy vehicle access and clear sight lines for vehicles exiting the site. The access has also been widened and will be sealed for the initial section to allow easy entry for both light and heavy vehicles.

- A Construction Traffic Management Plan (CTMP) will be prepared prior to construction of the site. It is recommended that the CTMP consider the use of signage to enforce a lower travel speed at the site access and/or advise drivers of turning vehicles on New England Highway. It is also recommended that the CTMP include measures to inform staff of the reduced left turn treatment and to encourage suitable safety initiatives.

Accordingly, it is concluded that the provision of a BAL treatment at the site access is suitable and will provide a safe road environment including the incorporations of the above recommendations.

The *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* specifies the requirements for the design of turn treatments. The proposed design for the site access is provided within Appendix A, based on an AV design vehicle, which is the largest vehicle expected to access the site. A swept path assessment has been prepared for the access design using the software package 'AutoTurn'. The swept path assessment is shown within Appendix B and shows that the vehicle is able to access the site in a suitable manner.

Accordingly, the proposed intersection turning treatment has been appropriately designed and in accordance with the Austroads dimensional requirements.

3.2 Sight Distance Assessment

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections specifies the Safe Intersection Sight Distance (SISD) as the minimum sight distance which should be provided along the major road at any intersection. Table 3.1 of the guide specifies the SISD required for various design speeds. Given New England Highway has a speed limit of 100km/hr, a design speed of 110km/hr has been adopted, which requires a SISD of 285 metres. The available sight distance at the access greatly exceeds the Austroads requirements.

4. Conclusions

Amber has assessed the traffic impacts of the solar farm located approximately 6km northwest of Tilbuster, New South Wales. Access to the site will be provided via the existing driveway that connects to the western side of New England Highway, which is proposed to be widened and realigned to accommodate simultaneous truck movements. Staff will be located within the nearby regional towns, with all plant expected to be delivered from the south along New England Highway. The above assessment determined the following:

- The site will generate up to 102 vehicle movements per day during peak construction times, including 36 truck movements;
- The road network is able to accommodate the traffic generated by the development during the construction and operational period. Further, the cumulative impact of the site traffic with nearby developments is expected to be minimal;
- The design provided within Appendix A, for the intersection of the site access with New England Highway, will ensure the access will operate in a safe manner and will be able to accommodate the maximum design vehicle expected to access the site.

Accordingly, based on the assessment above, it is concluded that the proposed access arrangements for the solar farm are suitable to accommodate the expected construction vehicle types and traffic volumes during the construction and operation phase of the project.

If you have any questions please feel free to contact the undersigned.

Yours sincerely
Amber Organisation

Michael Willson
Director

Appendix A

Access Design

The following design details have been taken from Austroads Guide to Road Design Part 4A:

Rural Basic Right-turn Treatment (BAR) Section 7.5.1.

1: Design speed of 100km/h.
2: 3.2m Lane widths have been used.
3: Taper lengths calculate to 46m.
4: Formation/carriageway widening is 3.2m.
5: Storage length is 22.5m for one 19m design vehicle.

Rural Left-turn Treatment (BAL) Section 8.2.1.

1: Design speed of 100km/h.
2: Lane widths of 3.5m have been used.
3: Taper length calculates to 42m.
4: Formation/carriageway widening is 2.5m.
5: Minimum length of parallel widened shoulder used from Table 8.1 is 35m

Tilbuster Solar Farm

New England Highway / Site Access Intersection

Access Design

DRAWN: MW
DATE: 11/09/2019
SCALE: NTS
DWG NO: 045-S01B

Amber

1

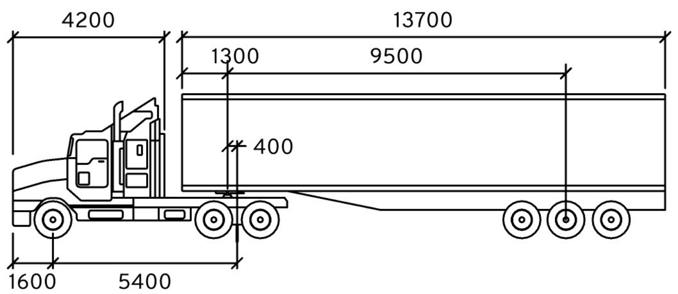
Appendix B

Swept Path Assessment

Vehicle Envelope

300mm Clearance

AV



	mm
Tractor Width	: 2500
Trailer Width	: 2500
Tractor Track	: 2500
Trailer Track	: 2500
Lock to Lock	: 6.0s
Steering Angle	: 28.3
Articulating Angle	: 70.0

Tilbuster Solar Farm

New England Highway / Site Access Intersection

Swept Path Assessment

DRAWN: MW

DATE: 11/09/2019

SCALE: NTS

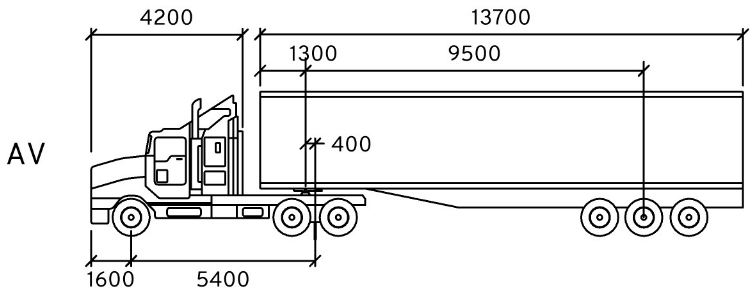
DWG NO: 045-S01B

Amber

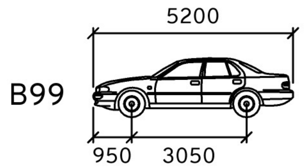
2

Vehicle Envelope

300mm Clearance



		mm
Tractor Width	:	2500
Trailer Width	:	2500
Tractor Track	:	2500
Trailer Track	:	2500
Lock to Lock	:	6.0s
Steering Angle	:	28.3
Articulating Angle	:	70.0



		mm
Width	:	1940
Track	:	1840
Lock to Lock	:	6.0s
Steering Angle	:	33.9

Tilbuster Solar Farm

New England Highway / Site Access Intersection

Swept Path Assessment

DRAWN: MW
DATE: 11/09/2019
SCALE: NTS
DWG NO: 045-S01B

Amber

3

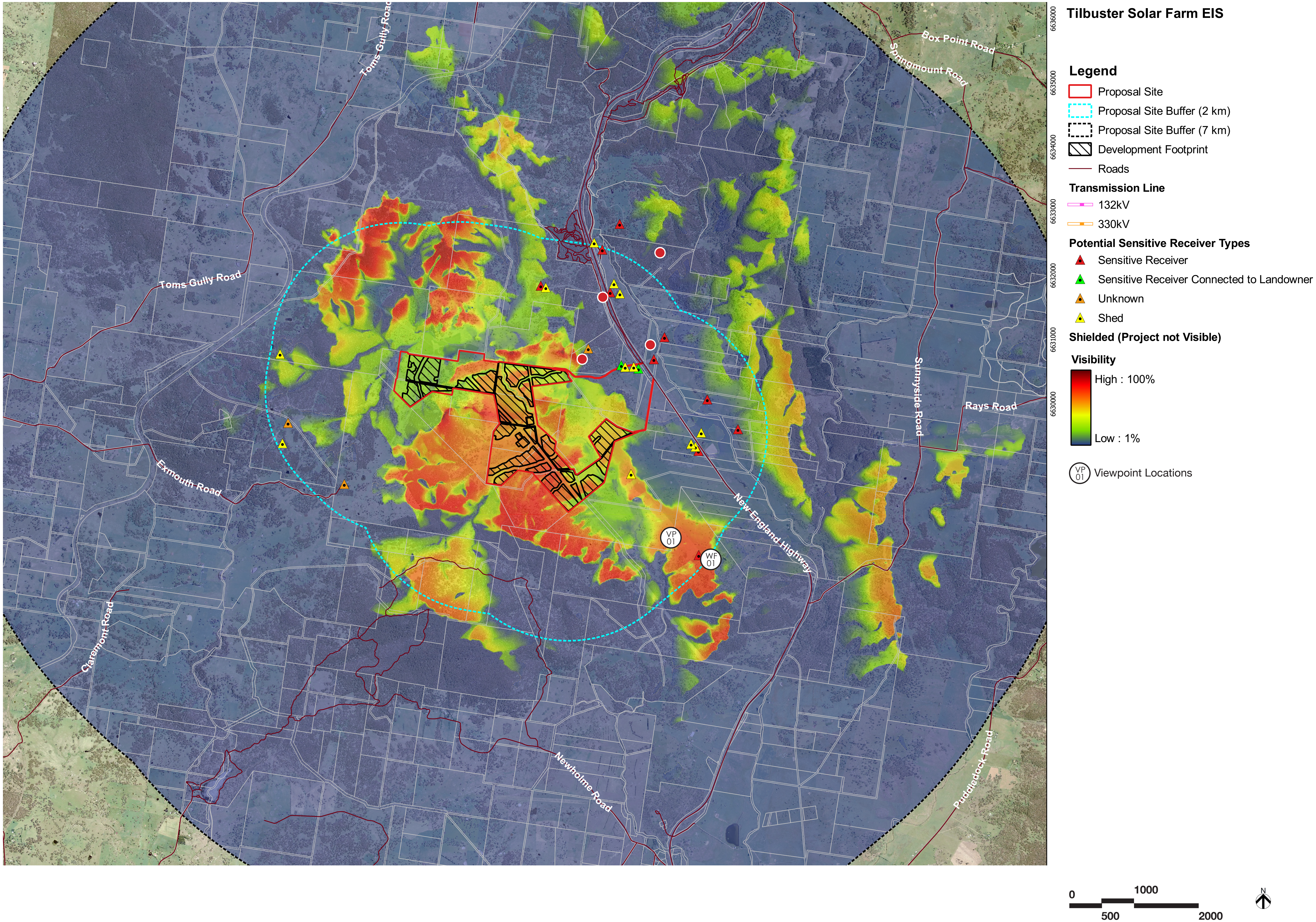
APPENDIX J PHOTOMONTAGE

Tilbuster Photomontage & Wireframes

Prepared for: NGH

Project No: 1800 Issue: A Date: 03 December 2019

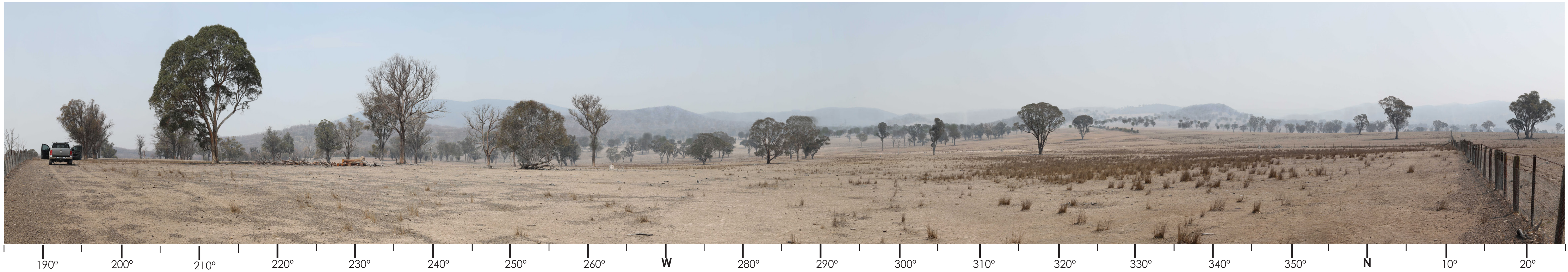
Tilbuster Solar Farm EIS



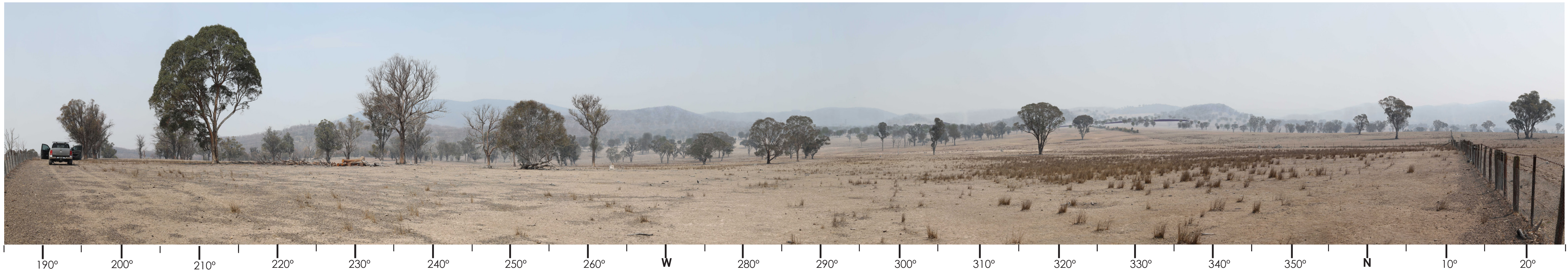
*Note: Map adapted from Tilbuster EIS by NGH

Viewpoint 01

Existing view from VP01



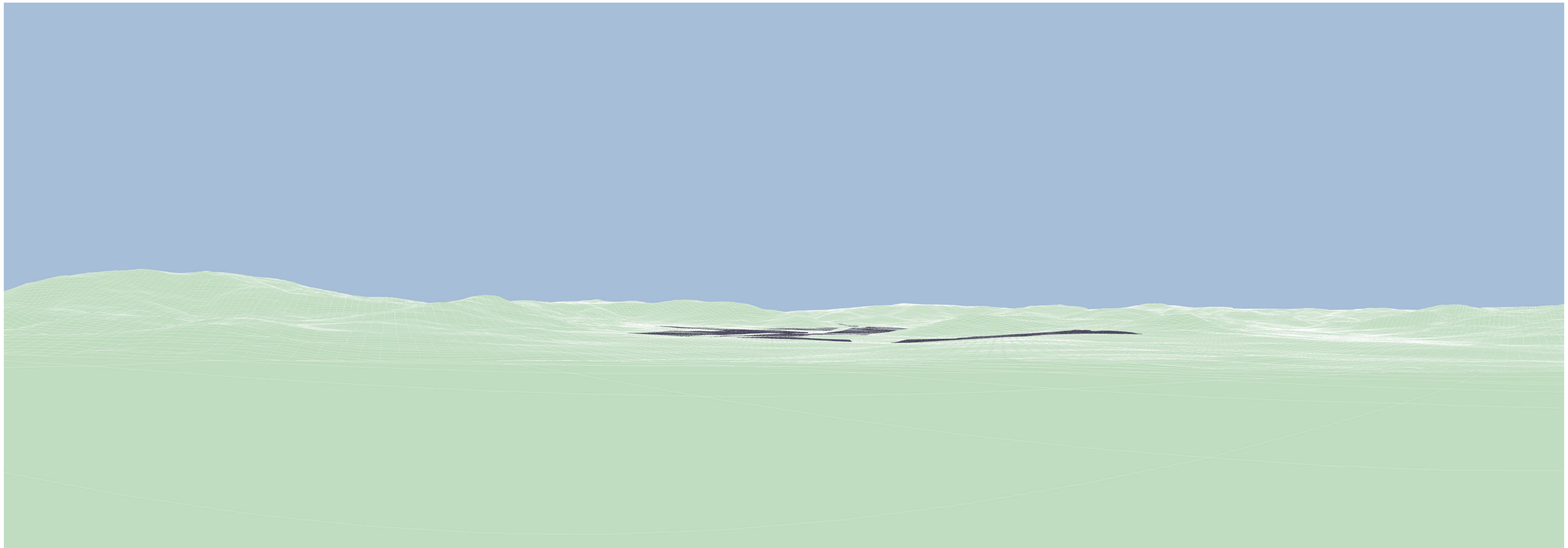
Proposed view from VP01



Location map

Wireframe 01

Proposed view from sensitive receiver



*Note: Wireframe does not take into account vegetation, structures or other items that could fragment the view.

Location map